



Abstract Book

JMIH 2013

JMIH



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**Abstracts for the 2013
Joint Meeting of Ichthyologists and Herpetologists**

**AES - American Elasmobranch Society
ASIH - American Society of Ichthyologists and
Herpetologists
HL - Herpetologists' League
SSAR - Society for the Study of Amphibians and Reptiles**

**Albuquerque, New Mexico
10-15 July 2013**

**Edited by
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3 May 2013**

0731 HL Detectability Symposium, Brazos, Friday 12 July 2013

Amy Yackel Adams¹, Robert Reed¹, Gordon Rodda¹, Bjorn Lardner², Julie Savidge², Shane Siers²

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Modeling Visual Detection Probabilities of an Invasive Snake: What have we Learned and What Insights do we Gain from Study Replication?

Detection probability is typically a nuisance variable that must be estimated to obtain the state variable of interest (survival, abundance, or occupancy). However, when optimizing control strategies for invasive species, the rate of detection and removal is the variable of primary interest. We evaluated visual searching for populations of the invasive Brown Treesnake *Boiga irregularis* on Guam using a temporally replicated mark-recapture study to evaluate visual detection probability as a function of a large suite of covariates. Sampling occurred in a 5-ha geographically closed entirely marked population of snakes. Overall snake detection rate was 0.07 per search occasion. Although effect magnitudes differed between studies, the second study replicated all of the major factors seen in the previous study of visual searching. Individual periodic changes in detectability of a few days duration (study 1) increased to almost a week during study 2. Latent heterogeneity was relatively minor in searches in study 1 but significant in study 2. Nights with no moonlight, low wind, and recent rainfall yielded moderate increases in detection probabilities. As predicted, small snake detectability was positively associated with increased gecko sightings while large snakes were positively associated with increased rat sightings. The strong and consistent combination of sex and size effects on detection indicates that the control challenge will be most severe for females of very small and large body sizes. Improved understanding of detectability has a role in improving not only invasive species management but any activity sensitive to detectability, including estimation of survival, abundance and occupancy.

0287 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Cory Adams, Daniel Saenz

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Calling Habits of the Introduced Rio Grande Chirping Frog (*Eleutherodactylus cystignathoides*) - Preliminary Results

The Rio Grande Chirping Frog's (*Eleutherodactylus cystignathoides*) native range stretches from northeastern Mexico to extreme southern Texas; however, it has been rapidly

expanding into other parts of Texas presumably by way of accidental human transport, primarily the potted plant trade. Very little information is known about this introduced anuran across most of its introduced range. The purpose of this study is to determine the calling habits of the introduced Rio Grande Chirping Frog. We surveyed for calling Rio Grande Chirping Frogs at three study sites using automated recording devices set to record for the first minute of every hour each day. We detected frogs calling at all three of our survey sites. Preliminary results indicated that the Rio Grande Chirping frogs can call any month, with calling mainly occurring during the warmer months. Frogs called primarily during dark hours but did occasionally call during the day. The mild climate of eastern Texas appears to be suitable to support an established population of Rio Grande Chirping Frogs.

0196 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

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Rates of morphological evolution in European *Hydromantes* salamanders

Characterizing the pace of evolutionary change is essential for understanding how morphological diversity is generated and maintained. Recent years have seen a renaissance in the study of the tempo of evolution, where rates of phenotypic evolution are estimated in a phylogenetic context, and compared among clades and among traits. This approach allows long-standing evolutionary hypotheses to be quantified and evaluated empirically. In this study we compare rates of morphological evolution in European plethodontid salamanders (genus *Hydromantes*) to test predictions stemming from their interesting natural history. Species in this lineage frequently inhabit caves and crevices, where they cling to the walls and ceilings. They display substantial webbing on their hands and feet, an adaptation for climbing which is presumably under considerable selection. If correct, this generates the prediction that macroevolutionary rates of change in foot webbing would be lower than evolutionary rates for other phenotypic traits. To test this prediction we measured several phenotypic traits from 198 adults from all European species, and estimated rates of phenotypic evolution using a time-calibrated multi-gene molecular phylogeny for the group. We found that the rate of evolution of foot webbing was significantly lower than evolutionary rates for other phenotypic traits, in accord with our prediction. This pattern is consistent with the hypothesis of strong stabilizing selection on foot webbing, perhaps as a result from the functional constraints of climbing. Overall our data lend support to the hypothesis that foot shape in European *Hydromantes* is an adaptation for the climbing behavior these species exhibit.

0604 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Anne Elizabeth Adelson, Francesco Ferretti, Fiorenza Micheli

Stanford University, California, USA

Changing abundances of white sharks (*Carcharodon carcharias*) in the Mediterranean Sea

A major challenge to shark conservation efforts is the lack of estimates of shark removal rates and abundances in the world's oceans. White sharks (*Carcharodon carcharias*) are rare worldwide, but are important apex predators. Many hypotheses have been posed about the history of white sharks in the Mediterranean Sea, but because white sharks are observed infrequently, we must rely on historical and anecdotal data to understand patterns of white shark abundance. After an extensive bibliographical search we built a data set from existing scientific literature, which included catch records, museum catalogs, and historical reports from 1554 to the present. We combined and integrated these data with generalized linear models and their extensions to model the abundance of white sharks through time and space, controlling for factors affecting the probability of reporting a catch, and then standardized the data to obtain a reliable index of population abundance. We tested previous hypotheses that sought to understand spatial and temporal patterns of abundance and distribution of white shark in the Mediterranean Sea. This study is more comprehensive than previous attempts to explore the ecology of white sharks in the Mediterranean Sea. We found that the history of fishing exploitation, prey abundance, and seasonal environmental regimes were good predictors of white shark distribution. This study aims to elucidate the population structure of white sharks in the Mediterranean Sea and enable us to evaluate conservation efforts, estimate baseline abundance, and assess changes in the status of white sharks.

0779 Fish Conservation, San Miguel, Sunday 14 July 2013

Mia Adreani, Mark Steele

California State University, Northridge, CA, USA

Estimating fecundity, spawning frequency and growth rates of temperate reef fish; a comparison of natural and artificial rocky reefs

The reproductive output of fishes is often used as a measure of the health and productivity of a given population. This measure may be of particular importance when habitat is altered in some way. Artificial reefs may provide new space for fishes to inhabit, but it is unclear whether fishes reproduce and grow at the same rate on natural and artificial reefs. We tested whether the overall reproductive output and growth rates

on a large artificial reef was similar to nearby natural reefs using five of the most abundant species on rocky reefs in the Southern California Bight. Fish were collected during their reproductive season and we measured a range of reproductive and growth parameters using visual assessments, gonad histology, egg counts and otolith analyses. While there was some variation in the specific measures, our estimates for each of the species were similar across all of the reefs. These results, along with additional estimates of overall reef productivity, suggest that artificial reefs have the potential to mitigate damages incurred to natural reefs and give us additional insight into the reproductive ecology of these ecologically important species.

0640 Reptile Ecology, Mesilla, Monday 15 July 2013

Christopher Agard, George Middendorf

Howard University, Washington, DC, USA

The Impact of Caudal Autotomy on Growth in *Sceloporus jarrovi* (Phrynosomatidae)

Despite known autotomy effects on lizard reproduction, locomotion and survival, few studies have examined the degree naturally occurring autotomy or subsequent effects on growth. We examined both in a population of Yarrow's spiny lizard (*Sceloporus jarrovi*) and found that approximately 30% of individuals in the population showed evidence of autotomy with a typical degree of tail loss between 17-37% (median=27%). However, if survivorship is affected by the amount of loss, animals with more extensive loss may be underrepresented in the population and the actual average tail loss greater. We estimated effects on growth by comparing the SVL, total length (TL), non-regrown tail length (NTL), and regrown tail length (RTL) of animals with intact tails to animals exhibiting autotomy. We found that growth rate for SVL to be unaffected by autotomy ($p=0.085$; $t=1.40$; $d.f.=40$), but TL to be greater for intact animals ($p=0.038$; $t=1.82$; $d.f.=32$) and NTL to be significantly greater ($p=0.009$; $t=2.81$; $d.f.=27$) for intact ($24.3\pm 19.0\text{mm}$) than for autotomized lizards ($5.0\pm 4.0\text{mm}$). Because the severity of natural tail loss appears to be considerably less than the usual degree of autotomy experimentally applied, we suggest that studies examining the influence of tail loss may need to be adjusted.

Joseph Agugliaro¹, Steven J. Beaupre²

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Temperature-dependent Metabolic Rate Depression in Timber Rattlesnakes (*Crotalus horridus*) during Artificial Hibernation

A hallmark feature of many dormant animals is the ability to reduce metabolism to levels below that anticipated based on temperature effects alone (i.e., metabolic rate depression). In northwest Arkansas, Timber Rattlesnakes (*Crotalus horridus*) exhibit a continuous hibernation period of nearly six months. However, as for most snakes, it is unknown if the behavioral inactivity characteristic of hibernation is also accompanied by intrinsic adjustments of metabolic rate. In the laboratory, 20 male *C. horridus* were acclimated to monthly thermocycles and daily photocycles designed to simulate active season conditions experienced in northwest Arkansas, followed by acclimation to artificial hibernation conditions from mid-October to mid-April. Measurements of resting metabolic rate (CO₂ production) were made in late summer and late winter across the range of temperatures experienced during natural hibernation. Using a repeated-measures design, we tested for the effects of laboratory acclimation treatment (simulated summer and artificial hibernation), acute temperature, time of day, and body mass on resting metabolic rate. A significant temperature-dependent metabolic rate depression was observed during artificial hibernation. Mass-adjusted metabolic rate measured at 5 and 9°C during artificial hibernation was depressed to approximately 45% of that measured at the same temperatures during summer acclimation, but no difference between acclimation treatments was detectable at 13 or 17°C. Low but statistically significant diel variation in metabolic rate was detected (independent of temperature and acclimation treatment), suggesting the persistence of an endogenous rhythm during artificial hibernation. The potential mechanisms underlying metabolic rate depression and endogenous rhythmicity during hibernation in reptiles merit further attention.

0509 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Alejandra Aguirre, Victor Torres, Ana Gatica

Universidad Autonoma de Ciudad Juarez, Juarez, Chihuahua, Mexico

Lung flukes associated with *Lithobates catesbeianus* in Janos, Chihuahua, Mexico

The lungs of 20 *Lithobates catesbeianus* from Janos, Chihuahua, Mexico were examined for helminthes. The frogs were infected with two species of trematodes, *Haematoloechus longiplexus* and *H. floedae*. There was no difference in length between female and male individuals of host species. *H. longiplexus* showed the highest prevalence (60 %), mean intensity (37.42) and mean abundance (22.45), while for *H. floedae* the prevalence was 50 %, the mean intensity 18.80 and the mean abundance 9.4.. An effect of sex and length with parasite load was not found. Both species had an overdispersed distribution.

0705 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Cassandra Aguirre, J. Tomasz Giermakowski

The University of New Mexico, Albuquerque, USA

The effect of imprecise localities on modeling species distribution: a case study of the Plateau Striped Whiptail (*Aspidoscelis velox*)

The amount of data on distribution of species that is readily available from online databases is staggering. Their abundance is likely linked to increased usage of species distribution models (SDMs) by ecologists and conservation managers alike. One obstacle to the use of these data is that locality descriptions of specimens or observations often lack precise geographic coordinates. Our aim was to determine whether the locality descriptions affect outcomes in modeling distribution of species. We calculated weights for each locality based on the interpretation of its uncertainty and then examined how this weighting scheme affected the predictions of SDMs at coarse scales. Specifically, using the Plateau Striped Whiptail (*Aspidoscelis velox*) as a case study, we used the same locality data set to run models with different weighting schemes. We then evaluated the effects of this variation on predicted areas of occurrence as well as the accuracy of each model outcome. We found that representing imprecise localities with a radial-bias weighting scheme significantly alters the fit of a SDM and, as a result, the area calculated as suitable. Thus the use of imprecise locality descriptions in SDMs without accounting for the bias it introduces is likely to yield unreliable models and many modeled outputs, such as calculation of areas predicted as suitable. We therefore caution users of species distribution models to approach analysis of imprecise locality data very cautiously. This is especially a concern when management decisions rely on modeled outputs.

0323 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

Bonnie Ahr, Michael Farris, Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Movement behavior and habitat selection of white croaker (*Genyonemus lineatus*) in the Los Angeles and Long Beach Harbors

Sediment contamination within the Los Angeles-Long Beach Harbors has been an environmental concern since pollutants entered the harbors through historical wastewater discharge. Contaminants such as DDT and PCBs are of particular concern in the harbors as it negatively affects marine organisms and can be harmful to humans if consumed. White croaker (*Genyonemus lineatus*) are a sentinel fish species for contamination because of their susceptibility to pollutants and their direct interaction with contaminated sediments through their benthic foraging behavior. Acoustic telemetry was utilized to determine fine and coarse scale movements of white croaker within the LA-LB Harbors in order to determine habitat preference and utilization. Benthic infauna data (provided by the ports) was coupled with fish movement data. Preliminary data suggests prey density is not the sole driver for habitat selection for white croaker. White croaker spent relatively equal amounts of time in each one of the four prey density categories (ranging from lowest to highest concentrations in the harbors). White croakers spent 20% in the highest tier (47.5-59 benthic individuals/0.1 m²) and spent the most time (32%) in the second highest tier (35.9-47.4 benthic individuals/0.1 m²) of benthic infauna. White croaker exhibit a diel shift in depth distribution, occupying deeper depths and a wider range of depths during the day than during the night. This study will continue to investigate the relationship of white croaker movements and prey density and depth. This study will also continue to determine which abiotic and biotic factors are drivers for white croaker habitat selection.

0065 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Matthew J. Ajemian¹, Julie A. Neer²

¹Texas A&M University, Harte Research Institute, Corpus Christit, TX, USA, ²SEDAR, North Charleston, SC, USA

A multi-decade review of durophagous stingray research: from eradication to conservation

Known for their large-scale migrations, surface schooling behaviors and impressive durophagy, the myliobatid and rhinopterid stingrays have long fascinated naturalists

and researchers worldwide. However, studies of the biology and ecology of these animals have considerably lagged behind other groups of marine fishes, including sharks. The low commercial value of these animals has likely impeded the development of management measures despite recently increased exploitation of rays by artisanal fisheries and the rising number of kill tournaments targeting these animals in the USA. These culling programs developed due to the purported impact of some species (e.g., *Rhinoptera bonasus*) on commercial shellfish, yet a concrete understanding of the range of resources these animals exploit is severely lacking. Though life history data are not extensive for this group, the few studies of rhinopterid and myliobatid ray reproductive biology suggest some species have among the lowest fecundity of all marine vertebrates. Given this extremely low reproductive output, any eradication procedures could have rapid and devastating impacts on populations of durophagous rays, as already evidenced by artisanal fishing fleets. This symposium will review the current state of knowledge of durophagous stingray biology and ecology. In this process, we will highlight the potential importance of this group in marine ecosystems and provide timely life history data critically needed by managers to better sustain these species, many of which are experiencing heavy anthropogenic pressure around the world.

0434 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Matthew Ajemian¹, Sean Powers^{2 3}

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SPOT on at the largest of scales: use of towed-float satellite telemetry to track movements and migrations of myliobatid and rhinopterid stingrays

Despite a preponderance of studies using satellite telemetry to track the migratory behavior of marine megafauna, attempts to use this technology on batoids remain limited. Many researchers elect pop-up satellite archival tags (PSATs) for large-scale movement studies, yet PSATs are costly and rarely produce precise position estimates. Smart Positioning or Temperature (SPOT) transmitters allow for precise, multi-scale tracking of species that regularly use surface waters. To date, SPOTs have been predominantly used on sharks and a variety of air-breathing marine vertebrates, with only one application to a batoid ray. Given the epipelagic nature of myliobatid and rhinopterid stingrays, we examined the potential for Wildlife Computers towed-float SPOT tags to monitor large and meso-scale movements of two representative species: the cownose ray (*Rhinoptera* sp.; n = 15) and spotted eagle ray (*Aetobatus narinari*; n = 8). Over the course of the study we explored multiple techniques to tether SPOT tags to rays, including dart tags, tail sutures, and spiracular harnesses, all with varying levels of success. Tag retention ranged between 1 and an estimated 155 days with multiple cases of tag scavenging evident from recovered units. Despite these limitations, we report on several consistent outmigration patterns of cownose rays in the northern Gulf of Mexico

and inshore-offshore movements of spotted eagle rays along the Bermuda platform. Reductions in tag size and improved tethering techniques would undoubtedly broaden the applicability of this technology to monitor habitat use of medium-bodied stingrays and other marine vertebrates.

0314 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Christina M. Akins, Thomas R. Jones

Arizona Game and Fish Department, Phoenix, AZ, USA

Invasive Bullfrog Removal in the American Southwest: A Case Study from the Pajarito/Atascosa Mountains, Arizona

Invasive American Bullfrogs (*Lithobates catesbeianus*) are one of the single greatest impediments to successful conservation of native aquatic wildlife in Arizona, including federally listed Chiricahua Leopard Frogs (*L. chiricahuensis*). Peña Blanca Lake, an 18 ha lake ca. 24 km W of Nogales, provided secure Bullfrog habitat for decades, and was a source for a widespread bullfrog metapopulation in the Atascosa and Pajarito mountains. Stock tanks, seeps and springs became additional Bullfrog sources and sinks, or stepping stones facilitating wider dispersal. In Fall and Winter 2008 - 2009, U.S. Forest Service drained the lake to remove mercury-contaminated sediments. Temporary loss of Bullfrog habitat in the lake provided an opportunity to systematically attack the remaining metapopulation, and to remove completely all Bullfrogs from within a minimum of a ca. 8 km radius of the lake, and from additional sites outside of the 8 km radius critical to Chiricahua Leopard Frog recovery. Working with partners we surveyed nearly 100 sites and identified bullfrogs at 8 sites within and 5 sites outside of the 8 km radius. We completely removed bullfrogs from all sites by Summer 2010.

Chiricahua Leopard Frogs have since occupied several sites that previously supported Bullfrogs. We continue to monitor likely Bullfrog dispersal corridors and remove individuals that immigrate into the area. We have demonstrated that a landscape approach to Bullfrog removal can be successful, and has great potential to contribute to regional conservation of native riparian herpetofauna in the American Southwest.

0628 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Kristin Albert, Mickey Parker, Matt Goode

University of Arizona, Tucson, AZ, USA

Snake community dynamics in a Southern Arizona urbanizing landscape

Habitat loss and degradation are increasingly threatening snake populations worldwide, and are largely a result of encroachment into previously undisturbed regions and the expansion of metropolitan areas. Although urbanization is usually associated with a loss of biodiversity, some studies have documented an actual increase in species richness, especially when the intensity of urbanization remains moderate, and effective mitigation measures are put in place. We present findings on snake community dynamics from our long-term study site at Stone Canyon, a high-end residential development and golf community near Oro Valley, Arizona, USA. Stone Canyon has experienced a dramatic increase in development over the past decade, allowing us to examine spatial and temporal changes in snake community structure. We recorded live and DOR snakes encountered during road surveys on paved roads, dirt roads, and a golf cart path. We also recorded all snakes encountered incidentally during telemetry efforts. We recorded nearly four thousand captures and over nine hundred recaptures, and documented a total of twenty-one species. Although Stone Canyon has steadily become more urbanized, species diversity has not decreased, perhaps due to a combination of factors, including, presence of relatively large, intact habitat patches, low-density housing, and increased productivity from the heavily irrigated golf course. In areas where continued population growth and urbanization are a constant concern, tracking potential changes in snake community structure over time is crucial, and long-term research is an essential conservation tool for preserving biodiversity in a human dominated landscape.

0788 Fish Conservation, San Miguel, Sunday 14 July 2013

Mark A. Albins, Stephen Szedlmayer

Auburn University, Department of Fisheries and Allied Aquacultures, Marine Fish Laboratory, Gulf Coast Research and Extension Center, Fairhope, Alabama, USA

Age-1 Red Snapper (*Lutjanus campechanus*) Exclude Age-0 Red Snapper From High-Quality Recruitment Habitat

Current evidence suggests that juvenile mortality rates of red snapper *Lutjanus campechanus* are density dependent, with year-class mortality varying inversely with year-class strength in both age-0 and age-1 fish. Such compensatory effects often arise in early post-settlement reef fishes as a result of high levels of predation when refuge space is limiting. Here we present results of an observational study which suggests that (1) high-quality settlement habitat is a limiting resource for early post-settlement age-0 red

snapper, and (2) age-1 red snapper displace age-0 red snapper from high-quality refuge habitat. Visual surveys of fish communities on small artificial reefs off the coast of Alabama during the red snapper recruitment season (August 2012) demonstrated that abundance of age-0 red snapper was 6.7 times greater (95% C.I. from 3.0 to 15.2) on recently deployed reefs lacking potential competitors, compared to one-year-old reefs with high densities of potential intra- and interspecific refuge competitors ($p < 0.0001$). After accounting for this reef-age effect, the abundance of age-0 snapper was negatively correlated with the abundance of age-1 snapper ($p = 0.036$). Reductions in age-0 snapper abundance of 29.8% (95% C.I. from 2.4 to 49.6%) were associated with every doubling in the abundance of age-1 red snapper. This study suggests a potential mechanism by which early post-settlement mortality in red snapper may be a function of predation, habitat availability, and the density of the previous snapper year class. These results have important implications for constructing accurate fisheries models for this important Gulf of Mexico fishery species.

0030 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Robert Aldridge¹, Chad Montgomery², Lynnette McGuire³, Matthew Graves⁴

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Amphibian Pond Selection: An Inquiry Based Study for Rural High School Students

This project is to provide high school students with hands on experiences applying concepts learned in the classroom to real world situations by engaging students in inquiry based study. Students were presented with a situation in which nine experimental ponds received one of three treatments (control, competitor, predator and competitor) in a randomized fashion. The study was designed to determine if amphibians choose to lay eggs in ponds that have fewer competitors and predators than in adjacent ponds that have neither. Based on the design students, with assistance from researchers, developed hypotheses related to the type of strategy they would expect amphibians to follow. Students then designed a data collection protocol to test their hypotheses concerning amphibian oviposition site strategy. Following implementation of their data collection protocols and data analysis, students used the results to draw conclusions directly related to their a priori hypotheses. Here we present results from student data collection as well as student evaluations of the learning outcomes of the project.

0420 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Karen Alofs, Donald Jackson

University of Toronto, Toronto, ON, Canada

Range shifts and their impacts on Ontario Freshwater Fish Communities

With changes in climate, the range limits of many species are shifting north, however, very few studies have empirically investigated changes in the distribution of freshwater fish. Using contemporary and historical survey data we measured the magnitude and direction of range shifts in a suite of freshwater fish species in more than 1500 lakes across Ontario. Warm and coolwater sportfishes have significantly shifted their distributions northward by approximately half a degree latitude over nearly 30 years. We then examined both the biotic and abiotic factors that control the introduction of these fish at the northern edge of their distribution. While controlling for environmental factors related to lake morphometry and location, we tested whether changes in community composition differ between lakes where species introductions have and have not occurred. We find that sportfish introductions appear to negatively impact both native top predators and their prey.

0077 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Melanie Altner, Bettina Reichenbacher

LMU, Munich, Germany

An enigmatic aplocheiloid killifish from the Upper Miocene

Morphological analysis is essential for the interpretation of fossils. Moreover, the fossil record can directly decipher the evolution of morphological characters. Here we present exceptionally well-preserved fish fossils from the Upper Miocene Lukeino Formation, located in the Central Kenya Rift Valley (East Africa). A total of 192 specimens were studied based on morphometric, meristic and osteological analyses. The fossils clearly represent a member of the Cyprinodontiformes based on the first rib originating on the second vertebra and the symmetry of the caudal skeletal elements, amongst others. In addition, they reveal three synapomorphies for the Aplocheiloidei (Aplocheilidae, Nothobranchiidae, Rivulidae), i.e. short dorsal maxillary process, reduced coronoid process of the anguloarticular, and a short median process of the pelvic girdle. However, they do not possess the complete suite of derived characters that define the aplocheiloid families. In particular, they lack bifid epipleural ribs (synapomorphy for Nothobranchiidae), a posteriorly tapered premaxillary ascending process (synapomorphy for Aplocheilidae sensu Costa 1998), and a gap between quadrate and palatine (synapomorphy for Rivulidae). Moreover, they show a widened haemal spine of the preural vertebra 2, a condition that is not developed in Nothobranchiidae and

Rivulidae, but in Aplocheilidae and Cyprinodontoidei. Another interesting character is the high number of preural vertebrae (5-6), which makes them clearly different from all Aplocheiloidei, but similar to some Cyprinodontoidei such as *Fundulus* (Fundulidae), *Anableps* (Anablepididae) and *Orestias* (Cyprinodontidae). The phylogenetic analyses reveal that the fossil can be a stem taxon to the [Nothobranchiidae + Rivulidae] or [Aplocheilidae + Nothobranchiidae + Rivulidae].

0108 AES Reproduction, Mesilla, Sunday 14 July 2013

Brenda Anderson¹, Jim Gelsleichter¹, Bryan Frazier², Carolyn Belcher³

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Non-lethal Characterization of the Reproductive Cycle of the Blacknose Shark (*Carcharhinus acronotus*) Using Circulating Levels of Gonadal Steroid Hormones

Characterization of shark reproductive cycles has historically involved culling individuals to examine gonad morphology to determine reproductive status. This practice, while necessary at first, is counterproductive to the conservation of shark populations. Measuring plasma steroids to characterize reproductive cycles has been used extensively with elasmobranchs. Chemiluminescence immunoassays (CLIA) have been validated for use with bonnethead shark (*Sphyrna tiburo*) plasma and correlate with cycles derived from RIA-measured plasma steroid concentrations and gonad morphological assessments. In this study, we used both CLIA and RIA to examine plasma steroid (17 β -estradiol and testosterone) concentrations in the blacknose shark (*Carcharhinus acronotus*) to characterize their reproductive cycle. Steroid concentrations were compared to morphological assessments of reproductive status from culled specimens. CLIA-derived measurements were generally higher than those measured using RIA. However, seasonal changes in CLIA-determined plasma concentrations were consistent with those determined using RIA. Males exhibited higher levels of testosterone, indicative of spermatogenesis, in May when peak testis width was observed. In females, 17 β -estradiol concentrations measured using CLIA and RIA did not correlate well with maximum follicular development. Therefore, circulating steroid levels appear to be a reliable method for characterizing reproductive status in male blacknose but not females. This may be associated with significant variability in female reproductive modes exhibited by this species. This raises concern about the use of this approach as a non-lethal surrogate for animal dissection when the species in question does not exhibit a highly synchronized reproductive cycle, especially when follicular development and gestation may occur concurrently.

0103 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Brenda Anderson¹, Julie Richmond¹, Tom Pitchford², Jim Gelsleichter¹

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Observations of Shark Scavenging on North Atlantic Right Whale (*Eubalaena glacialis*) Carcass in Northeast Florida

The IUCN listed the North Atlantic Right Whale (*Eubalaena glacialis*) as endangered in 1996. The current population is estimated at fewer than 400 individuals in the western Atlantic. Current sources of mortality include entanglement, vessel strikes, and predation. However, carcass scavenging and predation has not been well documented. On December 18, 2012, a deceased yearling with substantial post-mortem shark scavenging was necropsied on Flagler Beach, Florida. Our objective was to document and confirm bite wounds to implicate large pelagic sharks as scavengers of juvenile whales. Bite wound measurements were recorded to the nearest cm. Where the complete bite wound was discernible, maximum height of the upper and lower jaws was recorded. A total of 22 full and partial bite wounds were measured. Average bite wound width was 28 cm. Two were complete bite wounds (30 x 38 cm and 36 x 44 cm, width by height). Two bite wounds located on the dorsal surface of the right tail fluke were 39 and 32 cm wide, the latter being a partial bite wound that removed a significant portion of the tail fluke. Discrimination of bite marks on the ventral abdomen was not possible due to substantial scavenging in this region. Average bite diameter and morphology of bite wounds correlate with studies that observed white shark (*Carcharodon carcharias*) scavenging. White sharks migrate to whale calving grounds and represent the only species large enough to produce the widest wounds seen in this study. Smaller bite wounds likely represent carcharhinids that scavenged opportunistically.

0365 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Katie Anderson, Jerry Johnson

University of Texas El Paso, El Paso, TX, USA

The call characteristics of *Spea bombifrons* X *Spea multiplicata* hybrids in Doña Ana County, New Mexico

Hybridization events between members of Scaphiropodidae are well documented and several studies have examined mate choice between *Spea bombifrons* and *S. multiplicata*, hybrid larval offspring survivorship and feeding habits. However, no study to date has investigated calling characteristics of adult hybrids. Hybrids were identified by call at a

site in southeastern Doña Ana County, New Mexico, and calls were recorded on site. Call characteristics were analyzed using Raven Pro software. Preliminary results indicate adult hybrids produce calls that are intermediate between *S. bombifrons* and *S. multiplicata*. Analysis of variance recovered significant differences among all three groups with respect to length of pulse, peak frequency, and pulses per second. Significant differences were found when comparing interpulse length of hybrids to *S. multiplicata* and high and low frequency of hybrids compared to *S. bombifrons*. Examination of principal component loadings obtained from log-transformed data indicated component one was significantly influenced by pulse length, high, low, and peak frequency, and pulses per second, whereas component two was influenced by interpulse duration. Specimens will be collected and molecular methods implemented to determine parent lineage, potential fertility of hybrids and their impact on the population.

0488 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Paul J Anderson¹, Katherine R Greenwald¹, H Lisle Gibbs²

¹Eastern Michigan University, Ypsilanti, Michigan, USA, ²Ohio State University, Columbus, Ohio, USA

Confronting Models with Data: Using Environmental DNA for the Verification of Niche Models

This study assessed distribution of *Ambystoma laterale* using both traditional trapping methods and environmental DNA (eDNA) analysis, with a goal of developing a habitat model to predict species presence for conservation efforts. Though common in much of its range, *A. laterale* is endangered in four U.S. states at the southern edge of its distribution. These states include Ohio, where the only known populations (n=3) exist in a single small physiographic remnant within the Maumee Lake Plain: the Oak Openings region. Delimiting the distribution of these salamanders is further complicated by their association with sympatric and morphologically indistinguishable, but genetically distinct, unisexual ambystomatid salamanders. Our goal was to locate and genetically confirm pure *A. laterale* in this region in order to better understand their distribution and habitat associations. Data collection and analysis was conducted in four stages: (1) salamander sampling via traditional methods; (2) microsatellite analysis; (3) creation of an ecological niche model; and (4) environmental DNA analysis of water samples taken from predicted sites to verify the model. Preliminary results suggest that remnant populations along the edge of the species' range occupy a separate niche and may be more strongly affected by habitat degradation than populations at the core of the species' range. This model will be used by state agencies to target conservation efforts for *A. laterale* in this region, and may have further implications for delimiting of the species' range across the southern edge of its distribution.

**0360 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER
HERPETOLOGY AWARD**

Thomas Anderson, Raymond Semlitsch

University of Missouri, Columbia, MO, USA

Nonlinear density-dependent competition in a predator alters prey size and survival within a larval salamander guild

Intraguild predator density can alter its effects on intraguild prey populations through several mechanisms. One such way is through density-dependent processes that affect predator traits such as size or growth, which can enhance or limit its abilities as a predator. We examined these potential effects of predator density-dependence within a larval salamander guild. Specifically, we tested whether predator density altered its own growth, size and survival, as well as predator density effects on the same response variables of its intraguild prey. Four densities of ringed salamanders (*Ambystoma annulatum*), the IG predator, were combined with the presence/absence of spotted salamanders (*A. maculatum*), the IG prey, within experimental mesocosms. Nonlinear effects of *A. annulatum* density were modeled for both species, in addition to the interspecific effects of *A. maculatum* on *A. annulatum*. We found that intraspecific density had subtle nonlinear effects on growth rate, days to metamorphosis and size at metamorphosis but not survival of *A. annulatum*. No interspecific effects of *A. maculatum* on *A. annulatum* were observed. Intraguild predator density also showed nonlinear relationships for growth, size and survival of *A. maculatum*, but in an opposite, saturating relationship. Density-dependent thinning effects from *A. annulatum* were present, as survival and size of *A. maculatum* were inversely related. Overall, this study shows that density-dependence within an intraguild predator has the potential to determine its relationship with its intraguild prey by affecting the size ratio between the two species which ultimately can shift whether competition or predation ensues.

0516 Reptile Ecology, Mesilla, Monday 15 July 2013

Paul T. Andreadis¹, Robert N. Reed², Ray W. Snow³, Frank J. Mazzotti⁴, Kristen M. Hart⁵

¹*Denison University, Biology Dept., Granville, OH, USA*, ²*USGS, Ft. Collins Science Center, Ft. Collins, CO, USA*, ³*Everglades National Park, Homestead, FL, USA*, ⁴*University of Florida, FLREC, Davie, FL, USA*, ⁵*USGS, Southeast Ecological Science Center, Davie, FL, USA*

Neonate demography of Burmese Pythons in southern Florida, USA

Our understanding of neonatal snake biology is limited, but the young of large-bodied species are more readily studied. We analyzed records (mainly from driving surveys on paved roads) of small Burmese Pythons from the exotic population in southern Florida. Neonates are a distinct size class first appearing in July (mean 56 cm SVL, 115 g mass), remaining distinct until November. Hatching appears to occur in July and August, suggesting fertilization in March-April. The July-August sample was female biased, but not significantly ($p=0.14$). Body condition declined initially, suggesting neonates are generally not feeding during the first six weeks of the hatching season. During this time, they appeared to be preferentially directing maternal provisions to increases in length rather than mass. In November, mean size had increased to 91 cm and 660 g. To date, the northern limit of neonate records is US Highway 41, but unpaved roads and more restricted access have limited surveys north of Everglades National Park (ENP). Longitudinally, hatchlings have been found across the peninsula, with the main concentration in ENP and areas immediately east; records also exist for Big Cypress National Preserve and southwestern Collier County. The shortage of records in between these concentrations may reflect lack of survey effort, or distinct population segments. Records outside of ENP indicate that suitable incubation habitat exists in agricultural areas. The natal dispersal of a python clutch is a detectable demographic event, and neonate surveys are an effective tool to delineate the geographic limits of reproduction in this invasive population.

0055 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Whitney Anthonysamy¹, Michael Dreslik¹, David Mauger², Christopher Phillips¹

¹Illinois Natural History Survey, Prairie Research Institute, University of Illinois Urbana Champaign, Champaign, IL, USA, ²Forest Preserve District of Will County, Joliet, IL, USA

Habitat Partitioning in a Midwest Turtle Assemblage

Understanding species-habitat relationships is important for conservation efforts of species vulnerable to habitat loss such as turtles. From May-September 2006, we conducted a radio-telemetry study to determine differences in macro- and micro-habitat use, niche breadth, and niche overlap of 50 turtles representing rare (*Emydoidea blandingii*, *Clemmys guttata*) and common species (*Chrysemys picta*, *Chelydra serpentina*, *Sternotherus odoratus*). Both levels of habitat analysis showed strong partitioning between *C. guttata* and the common species as well as marked overlap in habitat use for *E. blandingii* and *C. serpentina*. Use of mesic prairie, sedge meadow, river, and pond macro-habitats differed between rare and common species. Only micro-habitat use differed within the rare and common species groups, suggesting that coarse macro-habitat classification obscured subtle variation in habitat use. Patterns of macro- and micro-habitat use and measures of niche breadth and niche overlap suggest that *E. blandingii* and *C. serpentina* are habitat generalists whereas *C. guttata* is a habitat specialist. Our findings suggest that *C. guttata* is most vulnerable to habitat degradation and that broad variation in water and vegetation micro-habitat characteristics is necessary to support a diverse freshwater turtle community.

0379 NIA BEST STUDENT PAPER, NIA Oral Papers, Doña Ana/Cimarron, Monday 15 July 2013

Jessica Arbour¹, Hernán López-Fernández²

¹University of Toronto, ON, Canada, ²Royal Ontario Museum, ON, Canada

Patterns of Morphological Evolution Support an Ancient Adaptive Radiation in Geophagine Cichlids

Cichlids are among the most species rich families of fishes in the Neotropics and also exhibit high morphological, ecological and behavioural diversity. Recent phylogenetic analyses combining molecular and fossil data have support a Cretaceous origin for Neotropical cichlids and diversity-dependent lineage diversification rates in some clades. Patterns of morphological and functional diversification were examined in Geophagini, the largest tribe of Cichlinae. Geophagini morphospace was characterized using principal component analysis of several morphological variables and

biomechanics indices associated with feeding function. The rate and mode of evolution in several morphological and functional traits were examined using disparity-through-time analyses and maximum likelihood model fitting approaches. Additionally, a model fitting approach was used to differentiate between patterns of Brownian motion and adaptive morphological evolution. The majority of morphological and biomechanical variation was associated with a trade-off between benthivorous species and pursuit-predators feeding on fish and other evasive prey. Along these axes of variation, Geophagini illustrated patterns of decreasing rates of morphological diversification through time. Early colonization of a novel adaptive peak for velocity-optimized feeding biomechanics by a clade of ram-feeding predators appears to have limited subsequent diversification in other Geophagine taxa. Morphological evolution in Geophagini is consistent with a pattern of adaptive radiation and suggests that ecological variation in Neotropical cichlids could have a relatively ancient origin.

**0162 NIA BEST STUDENT PAPER, NIA Oral Papers, Doña Ana/Cimarron,
Monday 15 July 2013**

Mariangeles Arce H.

The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA

Anatomical Variation of Cranial and Pectoral Muscles of the Thorny Catfishes (Doradidae, Siluriformes)

The work presents results of an anatomical study of the cranial and pectoral musculature of the Doradidae showing interesting findings about the composition and structure of the muscles. Doradidae is a monophyletic catfish family endemic to South America composed by 92 extant and one fossil species grouped into 31 genera. Information about the anatomy of the Doradidae is restricted to morphological characters related to the external morphology, osteology, gonads, and gasbladder. In order to understand the function, position, shape, and development of doradids' muscular system, I dissected and examined 61 species representing 31 doradids genera. As a result, I was able to establish homologies within catfishes and established variations in the composition and structure of the muscles. The *adductor mandibulae* and the *protractor hyoidei* exhibit simplification in the amount of portions that are present in species of Doradidae when compared with species of Bagridae, Siluridae and Pimelodidae. The *levator arcus palatini* exhibit a posterior dislocation in species of Doradidae when compared with species of Pimelodidae, Claridae, Bagridae, Siluridae and Ictaluridae. Members of the *Rhinodoras* clade (*Orinocodoras*, *Rhinodoras* and *Rhynchodoras*) exhibit a ventral insertion of the fibers of the *extensor tentaculi* on the distal end of the palatine. This is a unique characteristic among doradids. The presence of an extra muscle in the pectoral spine. This muscle apparently works together with the *arrector dorsalis* and *arrector ventralis* to produce the locking of the pectoral fin.

0344 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Dahiana Arcila¹, Richard P. Vari², Naércio A. Menezes³

¹The George Washington University, Washington, DC, USA, ²National Museum of Natural History, Smithsonian, Washington, DC, USA, ³Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil

Revision of the Neotropical genus *Acrobrycon* (Ostariophysi: Characiformes; Characidae) with description of two new species

Acrobrycon, a genus of Neotropical freshwater fishes from the western Amazon and northwestern portions of the La Plata basin is revised. The genus is found to include three species, two of which are new to science. *Acrobrycon ipanquianus* is distributed from the western portions of the Río Amazonas through to the northwestern region of the Río de La Plata basin; *A. starnesi*, new species, in the southwestern portion of the Amazon basin in Bolivia; and *A. ortii*, new species, in the northwestern Río de La Plata basin in Argentina. Members of the genus are distinguished from each other on the basis of the depth at dorsal fin origin, the horizontal eye diameter, the least interorbital width, and the numbers of perforated lateral-line scales, anal fin rays and horizontal scales around the caudal peduncle. The analysis found that *A. tarijae*, described from the Río Lipeo in Bolivia cannot be distinguished morphologically from *A. ipanquianus*; thus, *A. tarijae* is placed into the synonymy of *A. ipanquianus*.

0603 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Rachel Arnold

University of Washington, Seattle, Washington, USA

Evolutionary Relationships of the Enigmatic Anglerfishes (Order Lophiiformes): Preliminary Evidence from Nuclear Loci

Anglerfishes, Order Lophiiformes, are a morphologically diverse group of teleost fishes found world-wide from tropical near-shore habitats to the deep ocean. Previous studies examining evolutionary relationships within the Lophiiformes using morphological and mitochondrial data are incongruent, especially within the deep-sea ceratioid anglerfishes and the sister group to them. In this study, I use mitochondrial sequences and five newly added nuclear loci in order to test these novel relationships. The use of Bayesian and maximum likelihood phylogenetic analyses of concatenated datasets is examined and compared to a species tree approach that accounts for heterogeneity among gene trees. Preliminary evidence suggests that the genus *Lasiognathus* belongs within the family Oneirodidae rather than the Thaumatiichthyidae, and that the Melanocetidae and

Diceratiidae are sisters, with the Himantolophidae as sister to them, as reported in the mitogenomic study. Interestingly, phylogenetic analyses of the nuclear loci sequenced thus far indicate that the handfishes, family Brachionichthyidae, are deeply nested within the frogfish family Antennariidae. Within the Antennariidae, the subfamily Histiophryninae appears to be more closely related to the handfishes than to members of the subfamily Antennariinae. Both the family Brachionichthyidae and the subfamily Histiophryninae are confined to the Indo-Pacific archipelago and have similar life history traits, while the Antennariinae are widely distributed and have contrasting life history characteristics, lending some additional support for this novel relationship. Reproductive modes, including male parasitism within deep-sea ceratioids, ovarian morphology, and life history, are mapped onto the phylogeny resulting from the nuclear loci analyzed using a coalescent-based approach.

0090 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Gloria Arratia

Biodiversity Institute, University of Kansas, Lawrence, Kansas, USA

Teleostean Morphology in a Temporal Dimension: Reflections on the Evolution of Selected Characters

Today, teleosts comprise the largest group of vertebrates and represent a group that has undergone monumental morphological diversification. This fact is reflected in a complex evolutionary history that according to the fossil record would have arisen about 212 million years ago (about 155 My for the crown group). Based on the controversial idea that living forms are basic for our understanding of extant groups, 27 synapomorphies were proposed for crown Teleostei. When fossils are added, all osteological synapomorphies can be traced back to 199 My, which demonstrates the conservatism of the characters supporting the teleostean monophyly. This conservatism contradicts the immense plasticity and genetic potential that Teleostei display. Furthermore, elopomorph (leptocephalous) or ostarioclupeomorph (chondral pleurostyle) or euteleost (stegural) synapomorphies can be traced back 155 My. Further transformations, e.g., dermal pleurostyle or reduced stegural are apparently recently acquired novelties. The long teleostean history reveals modifications of structures, gains, losses or fusions of others; any of which is easily interpreted in one time dimension. Parallel to the evolution of a group in geological time is the evolution of individuals throughout ontogeny. It is expected that the sum of both these processes will increase our knowledge of taxa, especially our understanding of homologies and homoplasies. This has important consequences for systematic and phylogenetic interpretations. Unfortunately, both processes are still incompletely known for many groups. Selected characters will be analyzed to illustrate these claims, and new synapomorphies for osteoglossocephalans and euteleosts will be introduced.

**0687 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Jairo Arroyave

American Museum of Natural History, New York, NY, USA

**Molecular phylogeny of the Loricariinae (Siluriformes: Loricariidae):
congruence and conflict with previous hypotheses of intergeneric
relationships**

With more than 200 species arrayed in over 30 genera, suckermouth armoured catfishes of the subfamily Loricariinae constitute the second-most speciose subfamilial clade within the Loricariidae. Partially because of this tremendous diversity, the very few phylogenetic studies of the Loricariinae have been primarily hampered by limited taxon sampling. To further investigate loricariin interrelationships, DNA sequence data (3471 bp; four genes) from 111 specimens representing 22 loricariin genera were used to infer the most comprehensive phylogeny of the Loricariinae to date. Although derived from only a partially overlapping taxon sampling, the results of this study are in general agreement with the most recently published molecular-based phylogeny of the group (e.g., support for the monophyly of the Loricariini and the paraphyly of the Harttiini). Whereas the results presented herein offer the fundamental phylogenetic framework for testing previous hypotheses of relationships and assessing the adequacy of current classifications, expanded taxonomic coverage is necessary to provide a more complete and accurate picture of loricariin evolution. Likewise, the analysis of a combined morphological and molecular dataset may provide a more resolved and better-supported hypothesis of loricariin relationships.

0176 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Jairo Arroyave^{1,2}, John S. S. Denton¹, Melanie Stiassny¹

¹*American Museum of Natural History, New York, NY, USA*, ²*City University of New York, New York, NY, USA*

**A reappraisal of the phylogenetic relationships of the Distichodontidae
(Ostariophysi: Characiformes) and the timing of citharinoid diversification:
Implications for characiform biogeography**

Prior to the present study, the only comprehensive phylogenetic treatment of the African characiform family Distichodontidae had been a morphology-based analysis published over three decades ago. To further investigate distichodontid interrelationships, we inferred a phylogeny of the family based on DNA sequence data and established the temporal context of citharinoid diversification using a Bayesian

approach to divergence time estimation. Additionally, variation in divergence-time estimates resulting from different calibration strategies was explored via sensitivity analysis. Our results corroborate the monophyly of the Citharinoidei, the Distichodontidae, and most distichodontid genera. The resultant phylogeny also provides support for the recognition of morphologically distinct suprageneric assemblages represented by well-supported clades. The inferred chronogram is robust to changes in calibration priors and indicates that the origins of citharinoids and distichodontids date back to the Late- (*ca.* 90 Ma) and Mid-Cretaceous (*ca.* 67 Ma), respectively. Most modern distichodontid genera, however, appear to have originated and diversified much more recently, mainly during the Miocene. By reconciling molecular-clock- with fossil-based estimates for the origins of the Characiformes, our results provide further support for the hypothesis that attributes the disjunct distribution of the order to the mid-Cretaceous fragmentation of Gondwana. Moreover, the striking overlap in tempo of diversification and biogeographic patterns between distichodontids and another African-endemic characiform family – the Alestidae, suggests that their evolutionary histories were strongly and similarly influenced by Miocene geotectonic events that modified the landscape and produced the drainage pattern of Central Africa seen today.

0085 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Neil Aschliman

St. Ambrose University, Davenport, IA, USA

Evolution of the durophagous stingrays (Batoidea: Myliobatidae)

In the last few years, estimates of the patterns and timing of the evolution of the durophagous pelagic stingrays (Myliobatidae) have been improved through new comparative data from morphology, the fossil record and DNA sequences. These recent studies are here briefly reviewed and a conservative summary of myliobatid diversification and origins is presented. The interrelationships and morphological evolution of the durophagous stingrays are discussed, including the nature of mobulids as derived myliobatids. An exploration of myliobatid origins includes estimates of the timing of their diversification and an assessment of gymnurids as a possible sister group. Finally, alternative taxonomic schemes currently in use are evaluated and the validity of the genus *Pteromylaeus* Garman 1913 is called into question.

0208 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Kimberly Atwater¹, Andrea Bernard¹, Jennifer Hester¹, Malcom Francis², Mauvis Gore³, Catherine Jones⁴, Les Noble⁴, Rupert Ormond³, Gregory Skomal⁵, Mahmood Shivji¹

¹Save Our Seas Shark Center, Nova Southeastern University, Dania Beach, FL, USA, ²National Institute of Water and Atmospheric Research Ltd, Wellington, New Zealand, ³Marine Conservation International, South Queensferry, UK, ⁴Institute of Biological & Environmental Sciences, University of Aberdeen, Aberdeen, UK, ⁵MA Marine Fisheries Shark Research Program, New Bedford, MA, USA

A mitogenomics view of the genetic status and population history of the basking shark, *Cetorhinus maximus*

The basking shark, *Cetorhinus maximus*, has historically been a target of fisheries exploitation, leading to well-documented declines in parts of its range. Little is known about the genetic status and population history of this CITES Appendix II listed species. Prior analysis of basking sharks based on a single, non-coding, mitochondrial locus (control region (CR); 1,085bp), has suggested an absence of population structure and very low levels of genetic diversity ($\pi = 0.0013$) globally. In the present study, we assessed population genetic parameters by completing the first whole mitochondrial genome (~16,669 bp) survey of basking sharks sampled from three widespread geographic regions: the western North Atlantic (n=10), the eastern North Atlantic (n=10) and western South Pacific (n=10). Concordant with CR locus findings, whole mitogenome analyses (despite 15X more sequence data) showed no evidence of population differentiation and even lower genetic diversity ($\pi = 0.0005$). However, comparative analyses of individual loci revealed unexpected evolutionary dynamics: the protein coding genes ATP8, CO2, and ND3 contained the highest nucleotide diversity, while commonly utilized loci for population genetic studies (CR, ND2 and Cytb) showed an order of magnitude lower diversity. Bayesian Skyline Plot analyses of mitogenomes indicated a largely stable effective population size with limited growth. Demographic tests for population expansion produced non-significant values. Whole mitogenome findings of exceptionally low genetic diversity and results from population demographic analyses are consistent with a hypothesis of a historical bottleneck with limited population expansion thereafter, adding to conservation concerns for this regionally Endangered (IUCN Red List) species.

0470 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Lyndell M. Bade, Christopher N. Balakrishnan, Susan B. McRae, Joseph J. Luczkovich

East Carolina University, Greenville, NC, USA

A Genetic Technique to Identify the Diet of Cownose Rays, *Rhinoptera bonasus*: Analysis of Shellfish Prey Items from North Carolina and Virginia

Cownose rays are blamed for consumption of commercially important species of shellfish on the East Coast. We tested this assumption by developing a molecular technique for species identification from cownose ray gut contents. Digestive tracts sampled from 32 rays in Pamlico Sound, NC and Chesapeake Bay, VA contained pieces of partially-digested tissue, sludge, and minute shell fragments which made visual identification to the species level nearly impossible. We sequenced the cytochrome oxidase subunit I (COI) for a variety of locally acquired bivalve species of commercial and ecological importance in NC and Chesapeake Bay: Atlantic bay scallop, Eastern oyster, Baltic macoma, cross-barred venus, hard, soft shell, and stout razor clams.

Sequences were then used to design unique species-specific primers for each bivalve species to amplify polymerase chain reaction (PCR) products. We designed primers such that PCR products were sufficiently different in size to be distinguishable from one another when resolved on an agarose gel. Based on the primer design, multiplexing of several species in one reaction was possible. Tests of sample types from digestive tracts revealed that cownose rays in Virginia ate stout razor clams and soft shell clams. There was no evidence of commercially important bivalves like oysters and bay scallops being consumed by the rays in this study. Further sampling over an extended period of time and at additional locations is required to confirm these results. Best practices of tissue manipulation and handling techniques will be discussed to help inform methodologies for forensic testing on marine species.

0505 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Justin Bagley, Jerald Johnson

Brigham Young University, Provo, UT, USA

Phylogeography and Biogeography of the Lower Central American Neotropics: Diversification Between Two Continents, Between Two Seas

Lower Central America (LCA) provides a geologically dynamic, richly biodiverse model for studying the recent assembly and diversification of a Neotropical biota. Here, we

review the growing literature of LCA phylogeography studies and their contribution to understanding the origins, assembly, and diversification of LCA biota against the backdrop of regional geologic and climatic history, and previous biogeographical inquiry. Studies to date reveal that phylogeographical signal within taxa of differing distributions reflects a diversity of patterns and processes rivaling the complexities of LCA landscapes, themselves. Even so, phylogeography is providing novel insights into regional diversification (e.g. cryptic lineage divergences), and general evolutionary patterns are emerging. Congruent multi-taxon phylogeographic breaks are found across the Nicaraguan depression, Chorotega volcanic front, western and central Panama, and the Darién isthmus, indicating a potentially shared history of responses to regional-scale geological processes has shaped the genetic diversity of LCA communities. In contrast, other species show unique demographic histories in response to overriding historical events, including no phylogeographic structure at all, suggesting a role of local, ecological factors (e.g. long-distance dispersal) in shaping LCA communities. Temporally, comparative phylogeographical structuring reflects Pliocene–Pleistocene diversification consistent with emergence of the LCA isthmus and its major physiographic features, e.g. cordilleras. We emphasize the need to improve biogeographic inferences in LCA through in-depth comparative phylogeography projects capitalizing on the latest statistical phylogeographical methods. We also urge phylogeographers to take up the critical service to society of applying their work to the conservation of its fascinating biodiversity.

0308 HL Detectability Symposium, Brazos, Friday 12 July 2013

Larissa Bailey

Colorado State University, Fort Collins, CO, USA

Estimating population vital rates: insights from species with complex life histories

Species exhibiting complex life-history behaviors present unique challenges in estimating vital rates within and across populations. Such species may have life stages that are undetectable, but important to our understanding of population dynamics. Additionally, these species may be observed by actively sampling the observable component of the population or passively sampling individuals as they transition between states. The ability to estimate population vital rates (e.g. survival, breeding, and movement probabilities) for these species using mark-recapture methods requires explicit consideration of the species biology, study objectives, and appropriate sampling designs. Using case studies, I will demonstrate both design and model based strategies for accommodating unobservable states, while emphasizing important assumptions of the estimation methods.

0216 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Carole Baldwin

Smithsonian Institution, Washington, DC, USA

The Phylogenetic Significance of Color Patterns in Marine Teleost Larvae

The pelagic larval stages of marine fishes exhibit subtle to striking, ephemeral patterns of chromatophores that have not been investigated phylogenetically. Color patterns in larvae of over 200 species of marine teleosts, primarily from the western Caribbean, were examined from digital color photographs. Larvae of relatively few basal marine teleosts exhibit erythrophores, xanthophores, or iridophores (i.e., non-melanistic chromatophores), but one or more of those types of chromatophores are visible in larvae of many basal marine neoteleosts and nearly all marine percomorphs. Whether or not the presence of non-melanistic chromatophores in pelagic marine larvae diagnoses any major teleost taxonomic group cannot be determined based on the preliminary survey conducted, but there is a trend toward increased color from elopomorphs to percomorphs. Within percomorphs, patterns of non-melanistic chromatophores may help resolve or contribute evidence to existing hypotheses of relationships at multiple levels of classification. Mugilid and some beloniform larvae share a unique ontogenetic transformation of color pattern that lends support to the hypothesis of a close relationship between them. Larvae of some tetraodontiforms and lophiiforms are strikingly similar in having the trunk enclosed in an inflated sac covered with xanthophores. Color patterns in percomorph larvae also appear to diagnose certain groups at the interfamilial, familial, intergeneric, and generic levels. Slight differences in generic color patterns, including whether the pattern comprises xanthophores or erythrophores, often distinguish species. Considerably more investigation of larval color patterns in marine teleosts is needed to fully assess their value in phylogenetic reconstruction.

0654 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Meghan Balk¹, Catalina Pimiento²

¹*Department of Biology, University of New Mexico, Albuquerque, NM, USA,* ²*Florida Museum of Natural History, University of Florida, Gainesville, FL, USA*

Paleoecology of *Carcharocles megalodon*, the Megatooth Shark

Predator-prey interactions structure communities and can direct evolution. Previous scientists have hypothesized that change in body size can be an evolutionary strategy to escape predation. However, this hypothesis has yet to be thoroughly tested. The megatooth shark, *Carcharocles megalodon*, provides an ideal study system to test this hypothesis. *C. megalodon* went extinct 2 mya, coinciding with the increase in body size of

Cetacea, which are suspected prey of *C. megalodon*. We ask, does *C. megalodon* change body size through time, and does the body size change correlate with and mimic the change seen in marine mammals? We compared body size estimates of *C. megalodon* to a dataset of marine mammal body sizes through time. We find that *C. megalodon* increases in body size over time, and predict that it will correlate with the body size change in marine mammals.

0123 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Charles Bangle, Roger Rulifson

Institute for Coastal Science and Policy, East Carolina University, Greenville, NC, USA

Gastric evacuation, feeding ration, and potential predatory impact of spiny dogfish (*Squalus acanthias*) in the Northwest Atlantic

Spiny dogfish (*Squalus acanthias*) have long been suspected of damaging more valuable fish stocks by directly consuming or outcompeting those species. Despite much research interest in the trophic dynamics of this shark, currently no estimate of its food ration requirements exists for the Northwest Atlantic population. To assess food requirements of dogfish on the U.S. east coast, adult spiny dogfish were captured in the vicinity of Atlantic Beach, NC and transported to the Carteret Community College aquaculture facility in Morehead City, NC. While kept in captivity, dogfish were allowed to feed voluntarily on pre-weighed portions of frozen fish. After a pre-determined digestion period, remaining food was recovered from the stomach using nonlethal stomach tube gastric lavage and weighed. Regression analysis was used to estimate gastric evacuation rate, and both linear and exponential models fit the data well ($R^2 > 0.6$). Daily ration was determined using models for both linear and exponential evacuation curves, and incorporated the Diana (1979) model to account for intermittent feeding. Using daily ration estimates and the proportion of key prey species in the dogfish diet from previous studies, the predatory impact of spiny dogfish relative to prey stock biomass was estimated.

0473 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Max Bangs¹, Marlis Douglas², Michael Douglas¹

¹University of Arkansas, Arkansas, USA, ²Illinois Natural History Survey - University of Illinois, Illinois, USA

Utilization of Molecular Markers to Examine Potential Hybridization in Bluehead Suckers (*Catostomus discobolus*) in the Weber River, UT

Fishes of the desert Southwest face numerous anthropogenic threats including introduction of invasive species, habitat modifications, and recent climate change driven drought. Continuous, long-term monitoring (to include genetic evaluation) of threatened taxa provides important baseline data to develop management plans. However, accurate assessments can be inhibited if species identifications are ambiguous due to hybridization. Level of admixture (e.g., hybridization or introgression) is generally difficult to quantify without employing molecular genetic techniques. The Bluehead Sucker (*Catostomus discobolus*), endemic to the Colorado River, Upper Snake, and Bonneville basins, has experienced drastic declines throughout its range. In addition, hybridization with both native and introduced species may further jeopardize persistence of locally adapted lineages. One such example is Bluehead Sucker in the Weber River, UT (Bonneville Basin), where the species is of conservation concern and hybridization has been recognized as an issue. We tested 50 samples phenotypically identified as either pure or introgressed Bluehead Sucker for admixed ancestry by sequencing several bi-allelic nuclear (nDNA) loci and one mitochondrial (mtDNA) locus. We were able to not only confirm introgression, but also characterize parental species involved in the admixture. Our results have important management implications and will help in the development of conservation plan for the species.

0549 Reptile Ecology, Mesilla, Monday 15 July 2013

Jeff Bardwell, Richard Duhrkopf

Baylor University, Waco, TX, USA

Basking turtle assemblage demographics within a central Texas creek community

This study examined the demographic composition of a central Texas emydid assemblage from 2010 to 2012 using basking traps. Species proportions included *Trachemys scripta elegans* (46%), *Pseudemys texana* (32%), and *Graptemys pseudogeographica kohnii* (23%). Larger males and females were conspicuously absent, *T. scripta* and *P. texana* male:female ratios were significantly male skewed, although none of the species' gender proportions shifted significantly from year to year. Comparing ontogenous

variation among annual samples, only *T. scripta* (all and male) and *P. texana* (all) demographics showed significant plastron length change from year to year. Male activity showed few consistent annual seasonal trends, female activity was typically minimal and absent during summer 2011, and juvenile activity rose in August to September. Some results statistically varied between analyzing individuals and capture events per demographic.

0768 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

Amanda Barker, Andrew Nosal, Ron Burton

Scripps Institution of Oceanography, La Jolla, CA, USA

Genetic Structure of Leopard Shark Populations along the Pacific Coast of North America

The leopard shark (*Triakis semifasciata*) is a common nearshore benthic elasmobranch endemic to the Pacific coast of North America, from Washington, USA to Mazatlan, Mexico. Leopard sharks aggregate at specific coastal locations in the spring and summer, but little is known about leopard shark movement patterns once aggregations disperse. As a result, the extent of potential gene flow remains to be fully elucidated. While the leopard shark is not currently a threatened species, understanding gene flow throughout the species' range may provide insight into the population structure of similar species. Five microsatellite markers were used to analyze the genetic population structure of *T. semifasciata* throughout much of its range. Fin clips were collected from five locations in California and one location in Mexico (total N= 339). Our data show significant structuring among several locations. Evidence of gene flow between Santa Catalina Island and mainland populations is consistent with acoustic tracking data showing that leopard sharks occasionally cross the deep-water channel between Santa Catalina Island and the mainland, a minimum distance of 32 km. This provides an interesting contrast to leopard sharks' generally benthic lifestyle. We conclude that *T. semifasciata* does not form one panmictic population and significant population structure is present.

0498 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Judith Barkstedt, Jennifer Hester, Michael Farrington

American Southwest Ichthyological Researchers, Albuquerque, NM, USA

Determining the Frequency of Opercular Deformities in Age-0 Native Catostomids from the San Juan River (NM, CO, UT)

The San Juan River is a major tributary of the Colorado River and supports native populations of *Catostomus latipinnis*, flannelmouth sucker, *Catostomus discobolus*, bluehead sucker, and federally endangered *Xyrauchen texanus*, razorback sucker. From 1998 to present, monthly surveys (April – September) of the larval fish community were conducted in a 200 km+ reach of the San Juan River between Shiprock, NM and Lake Powell, UT. Of the approximately 170,000 age-0 native catostomids collected during the tenure of this study, *Catostomus latipinnis* was the numerically dominant species (66%), followed by *Catostomus discobolus* (30%), and *Xyrauchen texanus* (4%). The high prevalence of opercular deformities noted in 2011 San Juan River samples of age-0 catostomids resulted in re-examination of the study material in an attempt to determine annual species-specific frequencies of opercular deformities. Opercular deformities (i.e., opercular shortening) expose gills and may increase susceptibility to gill diseases and other mortality risks, particularly as a result of environmental stressors. The frequency of opercular deformities in the combined 2011 – 2012 samples of age-0 catostomids (n = 12,933) was 8.9%, occurring in 6.2% of *Catostomus discobolus*, 9.4% of *Catostomus latipinnis*, and 32.1% of *Xyrauchen texanus*. We analyzed the frequency of opercular deformities in age-0 catostomids from 1998 – 2012 for spatiotemporal patterns and relationships with temperature and discharge. Understanding patterns of occurrence of this potentially lethal deformity in native catostomids in the San Juan River is necessary for conservation, management, and recovery of these species.

0297 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD GENERAL HERPETOLOGY

Anthony Barley¹, Jordan White¹, Arvin Diesmos², Rafe Brown¹

¹University of Kansas, Lawrence, KS, USA, ²Philippine National Museum, Manila, The Philippines

Species Delimitation at the Extremes: Diversification Without Morphological Change in Philippine Sun Skinks (Squamata: Scincidae: *Eutropis*)

Species represent one of the fundamental units of the evolutionary process, and an accurate understanding of species diversity is essential to studies across a wide range of biological subdisciplines. However, delimitating species remains challenging in

evolutionary radiations where morphological diversification is rapid and accompanied by little genetic differentiation or when genetic lineage divergence is not accompanied by morphological change. We investigate the utility of a variety of recently developed approaches to examine genetic and morphological diversity, and delimit species in a morphologically conserved group of Southeast Asian lizards. We find that species diversity is vastly underestimated in this unique evolutionary radiation, and find an extreme case where extensive genetic divergence among lineages has been accompanied by little to no differentiation in external morphology. Although we note that different conclusions can be drawn when species are delimited using molecular phylogenetics, coalescent-based methods, or morphological data, it is clear that the use of a pluralistic approach leads to a more comprehensive appraisal of biodiversity, and greater appreciation for processes of diversification in this biologically important geographic region. Similarly, our approach demonstrates how recently developed methodologies can be utilized to obtain robust estimates of species limits in “non-adaptive” or “cryptic” evolutionary radiations.

0749 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Lloyd Barr

NMSU, Las Cruces, NM, USA

Rattlesnake Slithering: A Hypothesis

It appears that rattlesnakes have more than a few modes of locomotion. The most common is usually called Lateral Undulation but, I will use "slithering" to differentiate it from the locomotion seen in quadrupeds and fish. It appears that as a rattlesnake slithers each of its segments follows the same path as the one ahead of it. The trace left on the ground is a sinusoidal line. The vertebral column of the snake is not compressible. These two facts together predict that the articulation of the ribs and movement of the skin by them are necessary for slithering. Using a conveyor belt "space clamp" to hold a snake in a constant position relative to an observer should allow adequate testing of this hypothesis.

0716 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Cameron W. Barrows¹, Hector Gadsden², Mark Fisher³, Cristina García-De la Peña⁴, Gamaliel Castañeda⁵, Hugo López-Corrujedo⁶

¹*University of California at Riverside, Riverside, CA, USA,* ²*Instituto de Ecología, A. C., Chihuahua, Chih., Mexico,* ³*University of California Natural Reserve System, Palm Desert, CA, USA,* ⁴*Universidad Juárez del Estado de Durango-Facultad de Ciencias Biológicas, Gómez Palacio, Durango, Mexico,* ⁵*Universidad Juárez del Estado de Durango-Facultad de Ciencias Biológicas, Gómez Palacio, Durango, Mexico,* ⁶*Universidad Juárez del Estado de Durango-Facultad de Ciencias Biológicas, Gómez Palacio, Durango, Mexico*

Patterns of Lizard Species Richness within National Parks and Biosphere Reserves across North America's Deserts

Warm deserts world-wide provide habitats for rich lizard species assemblages; North American deserts are no exception, however the desert regions of the US and Mexico are experiencing habitat changes from multiple anthropogenic sources. Our objective here was to document lizard species richness patterns across the North American within the existing network of protected conservation areas. We identified 110 lizard species occurring in one or more of the 19 sites we analyzed. Three species richness hot spots were identified; 1) the northern Baja California extension into the US, 2) the northeastern Sonoran Desert centered on Saguaro National Park, and 3) two sites within Coahuila, Mexico, as well as high endemism in the Cape Region of Baja California and La Comarca Lagunera of Coahuila and Durango. Species richness was correlated with a greater range of available elevations, overlap of ecoregions, and insular isolation, Uncertainty regarding how species will respond to the multifaceted aspects of global change outweighs what we can predict. Large protected natural areas with complex topography may be the most effective strategy for protecting desert lizards as along with overall biodiversity. The 19 sites we analyzed represent a backbone of a more robust conservation network that will be needed for the protection of biodiversity across North American Deserts.

0357 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Henry Bart

Tulane University, New Orleans, LA 70118, USA

The complicated genetics and taxonomy of western populations of *Carpiodes carpio* Rafinesque: reflection, resurrection and revelation

The distribution of the river carpsucker, *Carpiodes carpio* Rafinesque, as presently delimited, extends from the Mississippi River Basin to westward the Rio Grande Basin, including a few minor Gulf of Mexico and Pacific coastal drainages of northern Mexico. Subsumed within this wide ranging species are a number of early taxonomic concepts that are only now being re-evaluated with modern systematic methods. The reanalysis reveals a complicated history of invasions of *C. cyprinus*-like species into river basins of the western Gulf Slope, with evidence of introgression with *C. carpio*-like species inhabiting these basins. Nevertheless, I make the case that *C. elongatus* should be resurrected from the synonymy of *C. carpio* and propose recognition of a new species of *Carpiodes* in the upper Colorado River system of Texas.

0584 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Kim Bassos-Hull¹, Robert Hueter¹, Peter Hull¹, Dean Dougherty¹, Krystan Wilkinson¹, John Morris¹, Anna Sellas²

¹*Mote Marine Laboratory, Sarasota, FL, USA*, ²*California Academy of Sciences, Center for Genomic Studies, San Francisco, CA, USA*

Biology and Genetics of the Spotted Eagle Ray in the Eastern Gulf of Mexico

The spotted eagle ray, *Aetobatus narinari*, is IUCN listed as near-threatened with a decreasing population trend. This study began in July 2009 to gather information on biology and behavior of spotted eagle rays in the eastern Gulf of Mexico (southwest Florida coast). Between July 2009 and October 2012, 349 spotted eagle rays (148 females, 201 males) were captured, measured, sampled, tagged, photographed, and released. Five percent (18 rays) were recaptured anywhere from five to 984 days (avg. 224.2 days \pm 263.5 SD) after initial capture. Disc width ranged from 41.4 cm to 203.0 cm (119.2 cm \pm 37.9 SD) and females were, on average, slightly larger than males (females 121.283 cm \pm 39.6, males 117.9 cm \pm 36.5 SD). Aerial surveys documented a decline from 97 individuals per flight (2009) to 6 individuals per flight (2011). Genetic data from one mitochondrial DNA locus (cytochrome *b*) and 10 nuclear microsatellite markers were used to investigate genetic diversity and structure. Based on 136 individuals, results identified nine unique haplotypes and genetic diversity estimates comparable to those reported for other batoid species ($h = 0.72$, $H_o = 0.70$). Population structure analyses do

not show evidence of significant differentiation suggesting spotted eagle rays off southwest Florida comprise one, homogeneous population. These apparent declines off southwest Florida, together with concerns about sustainability of Gulf fisheries for rays in Mexico and Cuba, call for further investigations into stock structure, abundance, and habitat use of spotted eagle rays throughout the Gulf of Mexico and Caribbean Sea.

0446 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Javan Bauder, Dirk Stevenson, Christopher Jenkins

The Orianne Society, Clayton, GA, USA

Using Occupancy Rates of Potential Overwintering Habitat to Monitor Eastern Indigo Snakes (*Drymarchon couperi*) in Southern Georgia

The eastern indigo snake (EIS, *Drymarchon couperi*) is a federally threatened species found in southern Georgia and peninsular Florida and is closely associated with the imperiled longleaf pine ecosystem. In the northern part of its distribution, the EIS is dependent upon gopher tortoise (*Gopherus polyphemus*) burrows in xeric upland soils for overwintering refugia. Despite its protected status, few monitoring programs exist for EIS and these are largely confined to single sites. In 2010, The Orianne Society began a monitoring program for EIS across the lower Altamaha River Drainage in southeastern Georgia. Our goals were to establish baseline levels of EIS occupancy of potential overwintering habitat and identify site- and landscape-scale factors that influence detection and occupancy rates. We selected 40 monitoring sites on public and private conservation lands across the Drainage using stratified random sampling, stratifying our sampling by subdrainage. We surveyed each site by conducting four visual encounter surveys between November 1 and March 31 from 2010 to 2013 during which we recorded the presence of live EIS or shed skins. Detection rates were positively influenced by air temperature and mean overall detection rate was 0.42. There was no support for changes in occupancy rates among years and mean overall occupancy was 0.30. Site-scale variables, particularly the number of gopher tortoise burrows at the site, had stronger model support compared to landscape-scale variables. Our approach can serve as an effective method for monitoring EIS populations over broad scales and could potentially be applied to other upland snake species.

0345 General Herpetology, San Miguel, Monday 15 July 2013

Aaron Bauer¹, Alessandro Ceregato², Massimo Delfino³

¹Villanova University, Villanova, PA, USA, ²ISMAR - CNR, UOS Bologna, Bologna, Italy, ³Università di Torino, Torino, Italy

The Oldest Herpetological Collection in the World: The Surviving Amphibian and Reptile Specimens of the Museum of Ulisse Aldrovandi

The natural history collection of the Bolognese polymath, encyclopedist, and natural philosopher Ulisse Aldrovandi (1522-1605) was the first museum in the modern sense of the term. Unlike many collections of the Renaissance and Enlightenment it was intended as a resource for scholarship and a microcosm of the natural world, not simply a cabinet of curiosities. In addition to physical specimens, Aldrovandi's material included a large series of paintings of animals that he considered integral to the collection. Following Aldrovandi's death, his collection was maintained intact but by the 19th century relatively little remained. We examined the surviving herpetological components of the collection, comprising 19 specimens of ten species, as well as the corresponding paintings and associated archival material in the Museum of Palazzo Poggi, Museo di Zoologia, and Biblioteca Universitaria Bolognese in Bologna, Italy. Although the antiquity of some of these dried preparations is in question, many are documented in the *Tavole di Animali* and/or are mentioned in 17th century lists of the museum, verifying them as the oldest museum specimens of amphibians and reptiles in the world. Exotic species are best represented, including two specimens of *Uromastyx aegyptia* and several boid snakes - the first New World reptiles to be displayed in Europe. However, the original herpetological collection was dominated by Italian taxa, suggesting that a greater effort may have been made over the centuries to conserve the more spectacular specimens. The Aldrovandi collection provides a tangible link to the dawn of modern herpetology in Renaissance Italy.

0499 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Katherine Baumberger, Michael Horn

California State University, Fullerton, California, USA

Home range and habitat preference of the western spadefoot (*Spea hammondi*) in Orange County, California protected areas

The western spadefoot (*Spea hammondi*) is a small, burrowing amphibian that inhabits arid ecosystems in California and Baja California. The species lives underground during

the dry season and emerges only after a certain amount of rainfall to make its way to vernal pools for breeding. It is extirpated from most of its range in southern California, with only a few populations remaining in coastal Orange County, western Riverside County and inland San Diego County. Given that little is known of its biology and that both its terrestrial and aquatic habitats are imperiled in California, the spadefoot is recognized as a species of special concern by the U. S. Fish and Wildlife Service and California of Department of Fish and Wildlife, a sensitive species by the Bureau of Land Management and a species of interest by the County of Orange Natural Community Conservation Plan. In response to the need to learn more about the ecology of this cryptic species, we used 11 months of telemetry data for 15 spadefoot to characterize the movement and habitat use for these animals. We found that spadefoot moved a maximum of 262 m away from the breeding pools. Their aestivation sites were between 10 m and 90 m from the breeding sites (mean=46 m). Preliminary analysis of the spadefoot home range suggests that they cover from 24 m² to 6.5 km². From field observations, the spadefoot do not seem to show a habitat preference for burrowing sites, but the data have yet to be analyzed.

0582 Fish Biology, Doña Ana/ Cimarron, Sunday 14 July 2013

Jeremiah Bautista

Cal State University Northridge, Northridge, CA, USA

Reproductive biology of a severely depressed sport fish, the barred sand bass (*Paralabrax nebulifer*) from Southern California

Years of intense fishing pressure has caused the fishery of the barred sand bass, (*Paralabrax nebulifer*) of Southern California to decline precipitously in the first decade of the 21st century. The large aggregations that this species forms during their spawning season have left them vulnerable to fishermen who remove them by the tens of thousands each summer. Recently declared by the California Department of Fish and Wildlife as a severely depressed the species is on the possible verge of collapse. Specifically this proposed study into the reproductive biology of barred sand bass aims to document for the first time a complete annual gonado-somatic index (GSI) for both male and female for a full year and determine batch fecundity for a wide size range of females. Age at size correlations will also be performed to check for possible shifts in age and size class due to fishing pressure. Understanding the reproductive cycles and the duration of energy allocation towards reproduction is important for the proper management of this fishery. Historically, barred sand bass have played a prominent role in the recreational fishing industry of Southern California. As one of the top three sport fish since the 1970's, we must protect and properly manage this fishery to prevent any further decrease in the stocks and the ultimate collapse of the fishery.

**0153 SSAR SEIBERT AWARD CONSERVATION, Galisteo/Aztec, Friday 12
July 2013**

James Baxter-Gilbert, David Lesbarrères, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

**On The Road Again: The Effectiveness of Mitigation Structures for Reducing
Reptile Road Mortality and Maintaining Habitat Continuity**

Roads negatively impact reptile populations directly by increasing mortality, and indirectly by causing fragmentation. The Highway 69/400 corridor, connecting southern and northern Ontario, runs along the eastern Georgian Bay Coast, one of Canada's richest areas of reptile biodiversity. The newest section of Highway 400 (a high speed, 4-lane divided highway) was recently opened, and included reptile-specific mitigation measure (e.g. ecopassages and fences). If the mitigation structures of the new highway are effective, a reduction in reptile road mortality is expected and movement patterns of reptiles around the highway should remain unchanged. Using a Before-After-Control-Impact-Paired (BACIP) study, road-cruising and foot transect surveys were conducted along the old Highway 69 and along the new Highway 400 prior to completion of mitigation construction and at a control site where no changes to Highway 69 occurred in the 2012 active season. During these surveys, abundances of reptiles present on the road were recorded, and a total of 485 reptiles found on the highway. A radio telemetry study examined the movement patterns of turtles around the new highway alignment: 13 individuals were tracked, and 3 crossed the highway using the ecopassages. In the 2013 active season, surveys will be replicated and the number of radio-tagged individuals will be increased. In addition, automated PIT-tag readers and camera traps will be installed in ecopassages, and behavioural tests will be used to create a thoroughly-rounded analysis of the effectiveness of the mitigation structures. Conclusions drawn from this study will provide recommendations for future implementation of mitigation.

0154 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

James Baxter-Gilbert¹, Julia Riley², Jacqueline Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada, ²Magnetawan First Nation, Britt, Ontario, Canada

Merging Aboriginal Traditional Knowledge (ATK) with Contemporary Road Ecology to Develop Successful Highway Mitigation for At-Risk Reptiles

The Georgian Bay coastline in Ontario, Canada is known as one of the nation's areas of highest reptile biodiversity. It is also an area where several First Nation Aboriginal communities are located, and along with a number of ecologically and culturally significant animals. Paralleling the Georgian Bay coastline is Highway 400/69, a major traffic corridor undergoing a large expansion project. Roads are known to negatively affect reptile populations by creating direct and indirect sources of mortality. Magnetawan First Nation recognized this threat, and formed a partnership with the scientific community to jointly collect baseline abundance and spatial ecology data on reptile species at risk occurring on their lands surrounding highway. The information collected is being used to inform highway mitigation measures, to ensure the level of protection afforded to the at-risk reptile species aligns with the local ATK and up to date road ecology. From May to November 2012, field work was conducted to determine the abundance of reptiles on roads, and radio-telemetry studies were undertaken to determine natural reptile movement patterns around the proposed highway expansion area. Coinciding with the field research, community outreach and involvement was emphasized, and locations of reptiles and cultural importance of biodiversity were often contributed by community members. Currently, these baseline data are being used to inform highway design and sustainable community development. This presentation will serve as a case study of how a multi-partner approach, combining ATK and road ecology, can be used to create ecologically- and community-friendly infrastructure.

0093 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Christopher Beachy

Minot State University, Minot, North Dakota, USA

The Influences of Growth and Temperature on Metamorphosis in the Plethodontid Salamander, *Eurycea wilderae*

Most species of animal have a complex life cycle, i.e., one that includes a metamorphosis. When larvae of the same species grow at different rates, the result is usually variation in metamorphic timing. However, in all species of plethodontid salamanders that have

been the subject of experimental manipulations of larval growth, variation in growth has failed to elicit variation in larval period. These manipulations have only been conducted on members of two of the three larval lineages (i.e., *Desmognathus* and *Hemidactylum*).

We conducted a growth experiment on *Eurycea wilderae*, a member of the third plethodontid lineage that includes biphasic species. We collected 64 larval *E. wilderae* from a headwater stream in Jackson County, North Carolina. We grew larvae at two food levels and two temperatures and analyzed the effects on metamorphic timing and size. As expected, larvae at high food grew more. At low temperature, larvae grew slower. Larvae at low temperature metamorphosed later. Variation in growth rate failed to induced variation in metamorphic timing. It now seems clear that plethodontid salamanders are unique among animals in that variation in growth rate fails to affect metamorphic timing. I propose a model wherein this metamorphic inflexibility is directly accountable for the remarkable life history variation (and diversification) in the Plethodontidae.

0084 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Christopher Beachy¹, Hyla Beachy², Wyatt Beachy³

¹Minot State University, Minot, North Dakota, USA, ²Jim Hill Middle School, Minot, North Dakota, USA, ³Sunnyside Elementary School, Minot, North Dakota, USA

Effect of Temperature, Sex, and Maturation Status on Metamorphosis in the Western Tiger Salamander, *Ambystoma mavortium*

Like other western tiger salamander populations, growth is very rapid and individuals can attain large sizes (>100 mm SVL) in their first summer of life. In North Dakota, populations are completely metamorphic when ponds are ephemeral, completely paedomorphic in deep cattle ponds, and are mixed metamorphic/paedomorphic/larval in larger shallow lakes that dry periodically. We hypothesized that temperature variation among these types of habitats is a significant cause of life cycle variation. In order to test this hypothesis, we collected 77 salamanders using minnow traps from the flooded Agsite Pond/Swalls Lake in Ward County in northwestern North Dakota. This site is characterized by a mixed population of paedomorphic and metamorphic salamanders. We tested three hypotheses: (1) metamorphosis is temperature dependent; (2) metamorphosis is dependent on maturation status; and (3) metamorphosis is dependent on sex. We placed large (>85 mm SVL) larvae in individual boxes and placed 40 larvae in a cooler at 14 degrees C and 37 larvae in a cooler at 20 degrees C. As expected, larvae are more likely to metamorphose at high temperature. However, this effect is influenced in a complex way by sex and maturation. Females always showed a propensity to metamorphose, although this was less strong in adult females. In stark contrast, all juvenile males at high temperature metamorphosed and no adult males metamorphosed under any condition. These complex interactions suggest that life cycle evolution in facultatively paedomorphic

salamanders is influenced by the variation in life history pressures experienced by males and females.

**0467 SSAR PHYSIOLOGY & MORPHOLOGY BEST STUDENT POSTER
AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013**

Martin Beal, Matthew Lattanzio, Donald Miles

Ohio University, Athens, Ohio, USA

**Cool Runnings: Linking Body Temperature, Performance, and the Ecology of
*Sceloporus jarrovi***

Body temperature is vital to the function of many physiological processes including digestion and performance. However, these physiological processes are associated with different optimal body temperatures, which suggests trade-offs may occur in nature. For instance, lizards may select open microhabitats to thermoregulate after feeding, but these spots may also increase their risk of detection by a predator. Given that locomotor capacity is strongly associated with survival (e.g., predator escape), lizards may need to balance any thermal preferences for digestion with those that favor optimal locomotor performance. In this study we explore these considerations using field and laboratory data collected on a population of adult Yarrow's spiny lizards (*Sceloporus jarrovi*) in southeastern Arizona. We show that both male and female lizards select higher temperatures when recently fed, although this result was only significant for females. Endurance capacity in both sexes is temperature-dependent, with both males and females performing best between roughly 26-32 °C. However, the temperatures preferred by recently fed lizards were significantly higher than these values (~34 °C). This suggests that *S. jarrovi* likely experience a performance cost when thermoregulating for digestion. Finally, we apply path analysis to investigate how variation in the thermal environment, thermal preference (in a laboratory gradient), and morphology may influence the field body temperatures of male and female *S. jarrovi*. We discuss our results with respect to known differences in the life history and ecology of male and female *S. jarrovi* in this region.

0730 Plenary, Brazos, Thursday 11 July 2013

Steven J. Beaupre

University of Arkansas, Fayetteville, AR, USA

Physiological Ecology: Past, Present, and Future

I explore the actual and potential roles of physiological ecology in modern studies of distribution and abundance. The life-histories of all living things are governed by the

laws of thermodynamics. Emerging from these fundamental laws are constraints that place boundaries on morphology, function, and diversity in both ecological and evolutionary contexts. I review foundational mechanistic approaches that link individual performance to population-level processes. Through several case studies, I illustrate how knowledge of time and energy allocation informs population biology and conservation. In particular, long-term studies of rattlesnakes with specific focus on bioenergetics and behavior have yielded mechanistic insights regarding geographic variation in life-history, sexual size dimorphism, boom and bust resource dynamics, impacts of environmental change, and novel conservation strategies. Rattlesnakes appear to be highly adapted to a low energy life style, which explains in part their success in resource-poor and unpredictable environments. The explanatory power of thermodynamics and bioenergetics is frequently underestimated. Moreover, researchers should fully embrace lessons from foundational studies of mechanism when planning future studies.

0036 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Christine Bedore¹, D. Michelle McComb², Stephen Kajiura³

¹Duke University, Durham, NC, USA, ²Ocean Classrooms, Boulder, CO, USA, ³Florida Atlantic University, Boca Raton, FL, USA

Visual biology of cownose rays, *Rhinoptera bonasus*

Sensory systems are tuned to provide functionality for a species according to its ecological characteristics. Cownose rays are derived Myliobatid rays that display several morphological and behavioral characteristics that reflect their ecological niche and adaptations in their sensory capabilities. Strictly benthic basal Myliobatids, like yellow stingrays, have dorsally positioned eyes, which affords them a 360° visual field in the horizontal plane, but restricts the ventral visual field. In contrast, cownose rays have laterally positioned eyes and benefit from an expansion of the vertical visual field to 360°, while retaining a large horizontal visual field of 321°. The large visual fields likely aid in visual tracking of conspecifics while schooling, however, the ability to track schoolmates may be limited by low-light conditions in their turbid estuarine and coastal habitats. Although cownose rays have the same visual temporal resolution as the reef inhabiting yellow stingray when light is not limited, the cownose ray scotopic temporal resolution is faster than yellow stingrays. This suggests that cownose rays are adapted for dim-light conditions and can visually track objects when light is limited. Color sensitivity is also spectrally tuned to the turbid, green-dominated estuarine waters that they inhabit; cownose rays have two cone classes, with maximal sensitivity to short-wavelength and long-wavelength light, in addition to a green-sensitive rod. This combination of photoreceptors enhances contrast of objects against their dim background. This suite of sensory adaptations would enhance tracking of schoolmates and predators, intraspecific communication, and image formation of objects in a variable light environment.

**0719 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Anat Belasen¹, Erin Burkett¹, Allison Injaian¹, Kevin Li¹, David Allen², Ivette Perfecto¹

¹University of Michigan, Ann Arbor, MI, USA, ²Middlebury College, Middlebury, VT, USA

**Effect of Subcanopy on Habitat Selection in the Blue-spotted Salamander
(*Ambystoma laterale-jeffersonianum* unisexual complex)**

Elucidating the mechanisms that influence spatial distribution patterns is vital to understanding how populations persist. We examined distribution in one of the most common salamanders in Southeastern Michigan, the Blue-spotted Salamander (*Ambystoma laterale-jeffersonianum* unisexual complex). Three major tree species dominate the sub-canopy in the study site and form monospecific patches, which may have an effect on the distribution of terrestrial phases of local amphibian species. To examine this, we tested whether adult salamanders are significantly associated negatively or positively with patches of particular tree species. We then examined two potential causal factors: habitat quality, using leaf litter macroinvertebrate biomass as a proxy, and behavioral site choice in the Blue-spotted Salamander. We found that this species is positively associated with patches of red maple and negatively associated with patches of black cherry. We also found that, when presented with a choice, salamanders choose red maple leaf litter over black cherry leaf litter. In the absence of differences in physical leaf litter characteristics between patches of red maple and black cherry, we suggest that the Blue-spotted Salamander may be utilizing chemical cues to select habitat. Our findings imply that salamander populations may be affected not only by habitat loss, but also by changes in forest composition. These results provide evidence for a more complex model than the traditional amphibian metapopulation concept, where even fully forested habitat may form a matrix of optimal and sub-optimal, or even intolerable, patches.

0757 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

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Dentition and Tooth Replacement Rate of the Narrownose Smoothhound Shark *Mustelus schmitti*

The genus *Mustelus* is the most specious genus of the Family Triakidae comprising at least 31 species. The narrownose smoothhound shark *Mustelus schmitti* inhabits coastal waters from southern Brazil (27° S) to Patagonia Argentina (47°45'S). A total of 47 males and 56 females of *M. schmitti* were collected on scientific trawl surveys conducted by the The National Institute of Fisheries Research and Development (INIDEP) in Argentina during November 2007, November and December 2008. To carry out quantitative and qualitative analyses, dental laminas were extracted from the jaw cartilage and attached to onionskin paper for the dehydration treatment, maintaining their original jaw position. Tooth replacement rate was estimated following established methods used for fossil sharks based on the premise that tooth length within each row decreases from the lingual to the labial side of the jaw as a consequence of wear. Thus, the length difference between consecutive teeth in four representative rows should be proportional to the tooth replacement rate. *Mustelus schmitti* exhibits homodontition, where teeth are similar in shape or design, arranged in a semi-pavement like dentition. The dental formula was 47-63 / 50-63 for juveniles, and 50-77 / 50-69 for adult specimens. Teeth from the symphyseal and adsymphyseal rows showed higher wear and faster replacement rates than adcommissural and commissural rows. The estimated mean replacement rate was four days/series. Considering the dental formulae and replacement rate, *M. schmitti* replaces approximately 5350 teeth each year throughout their life time.

0316 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Katherine Bemis, William Bemis

Cornell University, Ithaca, NY, USA

Tooth Development, Attachment, and Replacement in Atlantic Wolffish, *Anarhichas lupus*

Wolffishes (Zoarcoidei: Anarhichadidae) are noted for a highly heterodont dentition comprising long caniniform fangs in the symphyseal regions of the dentary and premaxilla and molariform teeth of differing shapes and sizes posteriorly on the

dentary, vomers, and parasphenoid. These molariform teeth appear anamestic, in that they form a crushing surface in which all of the teeth fit closely together, with the individual shapes of teeth being highly variable. Wolffishes use this dental apparatus to eat prey ranging from crustaceans and echinoderms to fishes. Less well known is the unusual replacement pattern for these teeth, with some populations of *Anarhichas lupus* reported to lose all of their teeth seasonally in the winter. Seasonal tooth loss in *Anarhichas* is confirmed by aquarium data. This unusual pattern of seasonal tooth loss and replacement requires extensive regrowth of the bone of attachment and rapid growth of new tooth germs. Using micro and nano CT as well as conventional histology, we studied a series of *Anarhichas lupus* to better understand details of this process. We place our findings in the context of dental anatomy of other zoarcoids and teleostean tooth attachment and replacement more generally.

0074 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Nathan Bendik

City of Austin, Austin, Texas, USA

Photographic Mark-Recapture: Applications and Utility for the Study of an Endangered Aquatic Salamander, *Eurycea tonkawae*

Photographic identification (photoID) is becoming an increasingly popular technique used for mark-recapture studies. Recent advances in digital image analysis tools and pattern recognition algorithms have increased the application of photoID to a range of species, especially among amphibians and reptiles. Here, I demonstrate the application and utility of photoID for studying an endangered, neotenic salamander, *Eurycea tonkawae* (Jollyville Plateau salamander) by discussing the following four topics: (1) implementation of photoID techniques using standard photographic equipment and the free software Wild-ID; (2) advantages and disadvantages of photoID compared to other common methods of marking amphibians and reptiles; (3) accuracy of photoID compared to visible implant elastomer tagging; (4) how digital photography and photoID are changing our ability to collect ecological data and its potential for expanding our biological knowledge of this and other herpetofaunal species of conservation concern.

**0312 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Amanda Bennett, Dennis Murray

Trent University, Peterborough, Ontario, Canada

Characterizing the Acute and Chronic Stress Response of Tadpoles (*Lithobates sylvaticus*) to Perceived Predation Risk

The stress hormone corticosterone (CORT) has been mechanistically linked to both short-term behavioural and long-term morphological plasticity in tadpole anti-predator responses. However, the acute (0-2 hours post-exposure) physiological response of tadpoles to predation risk has not been characterized. We hypothesized that tadpoles have a similar acute stress response to other vertebrates, and predicted that the published short-term (2-4 hrs post-exposure) decrease in whole body CORT is a result of negative feedback caused by an initial increase in CORT peaking less than one hour post-exposure. We also predicted that over chronic exposure, this negative feedback is suppressed and CORT levels would remain high. We exposed wood frog (*Lithobates sylvaticus*) tadpoles to predator-conditioned water and sampled at 0, 30, 60, and 90 minutes post-exposure to characterize the acute response in whole body CORT. Exposure to predation risk resulted in a 2-fold increase in CORT at the 30 minute exposure period, followed by a decrease in CORT back to control levels by 90 minutes post-exposure. The addition of plain water caused no change in whole body CORT over 90 minutes. After three weeks of chronic exposure (presence/absence of a caged dragonfly larva), tadpoles under predation risk had whole body CORT levels approximately 1.5 times higher than tadpoles raised in the absence of predators. Unexpected preliminary results also suggest the acute response to predation risk is lost later in development. Our understanding of the interactions between ontogeny, the stress response axis, and predation risk is limited, and remains an important area of future exploration.

0324 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Amanda Bennett, Dennis Murray

Trent University, Peterborough, Ontario, Canada

Does Maternal Investment Influence Offspring Response to Predation Risk? Rearing Captive-Bred Northern Leopard Frog Tadpoles in the Presence or Absence of Aeshnid Dragonfly Larvae

Individual female amphibians differ in the size of eggs they produce and, in general, larger eggs hatch into larger larvae. Amphibian larvae show phenotypic plasticity in response to predation risk, however, the magnitude and direction of plastic response varies both within and between populations. While genetic variation accounts for some of the variation in plasticity between families, we hypothesized that variation is also explained by differential investment in broods between females. We predicted that females in better body condition will lay larger, heavier eggs, and that these eggs, in turn, will hatch into tadpoles that show a higher magnitude of plastic responses to predation risk. Adult Northern leopard frogs (*Lithobates pipiens*) were captured in the spring near Peterborough, Ontario, Canada. Leopard frogs were then induced to breed using the AMPHIPLEX method developed by Trudeau et al. (2010). Tadpoles (N=30) were reared in the presence or absence of dragonfly larvae (N=3 replicates per brood); behaviour, morphology, growth, and development were monitored weekly for three weeks. Preliminary results (N=6 mothers) suggest a positive relationship between female body condition and egg size (mass and diameter) as well as clutch size (number of eggs). We also found interactions between time, maternal identity, and predation risk on the development and growth of tadpoles that indicates variation between clutches in the direction and magnitude of response. Our results are important for frog conservation as females in poor body condition (due to disease, habitat loss, or pollution) may have young with lower survivorship under natural predation regimes.

**0198 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD GENERAL HERPETOLOGY**

Jasper Bennett, Nicole Harings, Wiebke Boeing

New Mexico State University, Las Cruces, NM, USA

Response of spotted salamander (*Ambystoma maculatum*) to Salinity and Temperature

Amphibian populations are on the decline worldwide due to numerous environmental and anthropogenic stressors. One of the main stressors influencing amphibians is climate change. Climate change affects many environmental factors such as air and water temperature ranges, along with aquatic salinity, pH, nitrogen, and dissolved oxygen levels. We conducted a laboratory experiment looking at the response of the spotted salamander (*Ambystoma maculatum*) to different salinity and temperature level combinations. Hatching success and metamorphosis rates of *A. maculatum* were observed in salinities of 0.3 ppt, 3 ppt, 6 ppt and 9 ppt with water temperatures of either 21°C or 27°C. None of the embryos exposed to 6 ppt or 9 ppt salinities hatched, regardless of temperature. The hatching success of embryos in the 3 ppt treatments was lower than those in the 0.3 ppt treatments. Larvae in 21°C treatments achieved the largest asymptotic length compared to those in the 27°C treatments regardless of the salinity. Larval growth rate was fastest in treatments of low salinity (0.3 ppt) and high temperature (27°C), while the slowest rate occurred in high salinity (3 ppt) with high temperature (27°C). This study demonstrates that even moderate increases in salinity concentrations (3 ppt) can result in significantly reduced hatching rate and slow growth rate of *A. maculatum*. Both temperature and salinity are predicted to increase due to climate change. This might negatively impact survival and fitness of *A. maculatum* and potentially other amphibians.

**0399 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Abigail Berkey

University of Illinois, Champaign, IL, USA

Influence of Kinship on Fine-scale Spatial Distribution of Four-toed Salamander, *Hemidactylium scutatum*

Influence of kinship in interactions among adult plethodontid salamanders is poorly understood. In species with indirect development clutches from multiple individuals may be laid in the same breeding pool, but subsequent dispersal during the larval stage likely removes spatial association of kin. In contrast, aggregation of kin may occur in

direct developing species due to limited spreading by siblings from the original nest location. The role of kinship in social interactions may differ in species with direct versus indirect development and could influence spatial distribution of related individuals within a population. Clusters of related individuals could be formed due to kin selection or, alternatively, a lower degree of relatedness than expected could be present if aversion toward kin is expressed as a result of inbreeding avoidance. To investigate this phenomenon, I examined the spatial distribution of genotypes in a population of the indirect developing four-toed salamander, *Hemidactylium scutatum*, for any relationship between kinship and location. Tail clips and GPS locations were taken for individual salamanders sampled at the Middle Fork State Fish and Wildlife Area in Illinois. Genomic DNA was extracted and individual genotypes derived from six microsatellite loci to determine genetic relatedness of individuals. The potential relationship between inter-individual location, determined via simple linear distance, and relatedness, determined based on allele sharing between individuals relative to allele sharing between these individuals and the entire population, was assessed using a Mantel test. Preliminary results suggest that kinship does not play a significant role in the spatial distribution of individuals.

0529 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

Andrea Bernard¹, Kevin Feldheim², Michael Heithaus³, Sabine Wintner⁴, Brad Wetherbee⁵

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The evolutionary history of a coastal-pelagic species: the global phylogeography of the tiger shark (*Galeocerdo cuvier*)

The tiger shark is a globally distributed, highly mobile, dietary generalist predator that plays an important role in community structuring. The population dynamics of this fishery exploited apex predator remain enigmatic in most parts of its range. We investigated the global genetic population structure and phylogeography of tiger sharks utilizing a multi-locus approach [10 nuclear microsatellite loci (n = 389) and two mitochondrial loci: control region (mtCR) (1,068 bp; n = 349) and cytochrome oxidase I (642 bp; n = 152)]. With respect to population structure, western Atlantic and Indo-Pacific tiger sharks were found to be highly genetically differentiated using all three sets of genetic markers; however, intra-basin population structure appears to be much more complex. For instance, patterns of genetic isolation by distance were detected using mtCR in the western Atlantic, and microsatellite DNA in the Indo-Pacific. Investigation

into the evolutionary history of the tiger shark using coalescent analyses of the mtCR suggest an Indo-Pacific center of origin for the tiger shark, followed by colonization into the western South Atlantic via South Africa during the Pleistocene. Interestingly, tiger sharks collected from the western South Atlantic possess a number of unique mtCR haplotypes, but also haplotypes occurring in both the western North Atlantic and the Indo-Pacific. Overall analyses (diversity- and coalescent-based) suggest that the western South Atlantic was likely an important historical connection that facilitated dispersal between basins, allowing the tiger shark to attain its contemporary global distribution.

0027 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Nick Bertrand

Texas A&M University, College Station, TX, USA

Fish Dentistry: Distribution and Evolution of Heterodonty in Extant Ray-Finned Fishes (Actinopterygii)

Heterodonty (having multiple types of teeth) is well documented in chondrichthyan and sarcopterygian fishes (including tetrapods), yet it remains inadequately surveyed across the Actinopterygii. Though some striking examples of actinopterygian heterodonty are well known (e.g., in the oral jaws of the wolf fish) our rudimentary knowledge of the distribution of this trait across extant ray-finned fishes currently hinders our ability to investigate general macroevolutionary hypotheses concerning the evolution of heterodonty within the group. The results of a literature-based survey of the different tooth types present in the oral jaws of extant actinopterygian fishes revealed heterodonts to be present in 19 of the 44 orders. Utilizing a novel terminology for actinopterygian tooth types (based on tooth shape, mode of attachment and arrangement), at least 10 distinct combinations of teeth (e.g., incisiform combined with molariform or caniniform with cardiform teeth) can be identified. Ancestral character state reconstruction methods employed using available phylogenetic hypotheses for the Actinopterygii indicate that heterodonty has evolved at least seven times independently (and likely many more times) throughout the evolutionary history of the group. Within Actinopterygii, different types of heterodonty (e.g., cardiform combined with caniniform teeth or caniniform with fangiform teeth) have evolved multiple times. Furthermore, very distantly related actinopterygian taxa have converged on strikingly similar dentitions (e.g., heterodonts with caniniform combined with fangiform teeth are common throughout the Anguilliformes, Aulopiformes, and Perciformes) Problems with the current terminology applied to actinopterygian tooth types and the need for a revised terminology will be discussed.

0423 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Alice Best, Carol Johnston

Auburn University, Auburn, Alabama, USA

Trends in fish assemblage structure following the invasion of a nonindigenous cyprinid

The impacts of nonindigenous fish species on native fish assemblages have been poorly studied relative to the effects of exotic species introductions. Changes in native fish assemblage structure caused by invasive species are especially concerning in the Southeast United States, which harbors the highest fish diversity in the country. Recent studies document an increasing rate of aquatic faunal homogenization, in part due to species introductions. Bear Creek in north Alabama and northeast Mississippi is a highly diverse tributary of the Tennessee River Drainage, with approximately 106 species. Weed shiner (*Notropis texanus*) was detected in the Bear Creek system in 2007, and is thought to have moved into the drainage from the Mobile Basin via the Tennessee-Tombigbee Waterway. The species has since been collected in over 34 collections at 21 sites in the Bear Creek system. We document the invasion path of Weed Shiner in the Bear Creek system, and correlated fish assemblage change at selected study sites. In addition, we examine the role of hydrology and stream size on the successful establishment of Weed Shiner.

**0450 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday
13 July 2013**

Ricardo Betancur-R.¹, Richard Broughton², Edward O. Wiley³, Kent Carpenter⁴, Andres Lopez⁵, Chenhong Li⁶, Gloria Arratia⁷, Nancy I. Holcroft⁸, Dahiana Arcila⁹, Millicent Sanciangco¹⁰, James Cureton II¹¹, Feifei Zhang¹², Matthew Campbell¹³, Adela Roa-Varon¹⁴, Stuart Willis¹⁵, W. Calvin Borden¹⁶, Guoqing Lu¹⁷, Terry Grande¹⁸, Guillermo Orti¹⁹

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EToL: The Tree of Life and a New Classification of Bony Fishes

The tree of life of fishes is in a state of flux because we still lack a comprehensive phylogeny that includes all major groups. Most of what we know about the higher-level relationships among fish lineages has been based on morphology, but rapid influx of molecular studies is changing many established systematic concepts. We report a comprehensive molecular phylogeny for bony fishes that includes representatives of all major lineages. DNA sequence data for 21 molecular markers were collected for 1416 bony fish species, representing 369 families, and all traditionally recognized orders. The maximum likelihood tree provides unprecedented resolution and high bootstrap support for most backbone nodes, defining for the first time a global phylogeny of fishes. The general structure of the tree is in agreement with expectations from previous morphological and molecular studies, but significant new clades arise. Most interestingly, the high degree of uncertainty among percomorph taxa is now resolved into nine well-supported supraordinal groups. The order Perciformes, considered by many a polyphyletic taxonomic waste basket, is defined for the first time as a monophyletic group in the global phylogeny. A new classification that reflects our phylogenetic hypothesis is proposed to facilitate communication about the newly found structure of the tree of life of fishes. Finally, the molecular phylogeny is calibrated using 60 fossil constraints to produce a comprehensive time tree. The new calibrated

phylogeny will provide the basis for and stimulate new comparative studies to better understand the evolution of the amazing diversity of fishes.

0246 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Jennifer S. Bigman¹, David A. Ebert¹, Joseph J. Bizzarro²

¹*Pacific Shark Research Center--Moss Landing Marine Laboratories, Moss Landing, CA, USA*, ²*School of Aquatic and Fisheries Sciences--University of Washington, Seattle, WA, USA*

North Pacific spiny dogfish (*Squalus suckleyi*) trophic ecology: using integrated gut content and stable isotope analysis to infer short and long term feeding trends

North Pacific spiny dogfish (*Squalus suckleyi*) are commercially and ecologically important predators that are abundantly distributed in North Pacific waters, and therefore may play an important role in regional marine ecosystems. Most historic research on this species has been focused on dogfish collected within the inland waters of Washington and British Columbia, but little is known about offshore populations. We used traditional gut content analysis (GCA) and stable isotope analysis (SIA) to elucidate the trophic ecology of dogfish from central California, U.S.A. GCA allows for quantification of prey items contained within the stomach of a single individual and reveals what actual species are consumed on a short-term basis. SIA uses elements as tracers (specifically carbon and nitrogen) to identify predator-prey relationships as well as trophic position, allowing for long-term diet information. SIA analysis can be used to complement gut content data via integrating both short and long term food habits, enhancing information known about the trophic role of a given species. Based on GCA, the most abundant and important prey taxa by number, weight, and the prey-specific index or relative importance were euphausiids, fishes, and cephalopods. Similarly, the most frequently occurring prey taxa were fishes, euphausiids, and cephalopods. In addition to diet composition, sources of dietary variability with respect to size, sex, depth, location, season, and year were investigated for GCA and SIA and will be presented.

0380 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, AES CARRIER AWARD

Jennifer S. Bigman¹, Bruce P. Finney², Scott L. Hamilton³, David A. Ebert¹

¹*Pacific Shark Research Center, Moss Landing Marine Laboratory, Moss Landing, CA, USA*, ²*University of Idaho, Pocatello, ID, USA*, ³*Moss Landing Marine Laboratories, Moss Landing, CA, USA*

Monterey Bay food web: Insights from stable isotope analysis

Marine food webs are an essential component to developing and implementing ecosystem-based management plans. We used stable isotope analysis of carbon and nitrogen to assess trophic positions and sources of primary productivity for several species in Monterey Bay, in central California. This data was used to create trophic links among species from numerous trophic positions and habitats with emphasis on an apex predator, the North Pacific Spiny Dogfish, *Squalus suckleyi*, and its prey. The Bay is a dynamic upwelling ecosystem with many resident and seasonally abundant marine organisms that is part of the Monterey Bay National Marine Sanctuary, the largest in the network of marine sanctuaries that are federally protected. Due to the plethora of species in this area, trophic interactions are extremely important to quantify. Fishes, cephalopods, crustaceans, and chondrichthyans were opportunistically collected in the Bay, and include Krill (*Euphausiid spp.*), Sand dabs (*Citharichthys sordidus*), Longspine thornyhead (*Sebastolobus altivelis*), Dover sole (*Micostomus pacificus*), shrimp (*Pandalus spp.*, *Crangon spp.*), Anchovy (*Engraulis mordax*), Sardines (*Sardinops sagax*), Pacific herring (*Clupea fallasi*), English sole (*Parophrys vetulus*), Longspine combfish (*Zaniolepis latipinnis*), Plainfin midshipmen (*Porichthys notatus*), Croaker (*Genyonemus lineatis*), Market squid (*Doryteuthis opalsecens*) and North Pacific spiny dogfish (*Squalus suckleyi*). Humboldt squid, *Dosidicus gigas*, was opportunistically collected from Southern California. The data resulting from this study will be used to create a food web and has the potential to be extremely useful in developing ecosystem-based management plans.

0652 AES Ecology, Mesilla, Thursday 11 July 2013

Joseph J. Bizzarro¹, David A. Ebert², Mary M. Yoklavich³, Linda A. Kuhn⁴, Adam P. Summers⁵

¹University of Washington, School of Aquatic and Fishery Sciences, Seattle, WA, USA, ²Moss Landing Marine Laboratories, Moss Landing, CA, USA, ³Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, CA, USA, ⁴Monterey Bay Aquarium Research Institute, Moss Landing, CA, USA, ⁵University of Washington, Friday Harbor Laboratories, Friday Harbor, WA, USA

Comparative spatial associations of skates (Rajidae) off central California

Comprehensive knowledge of distribution and abundance patterns is necessary to determine essential fish habitat (EFH) for groundfishes such as skates (Rajidae). Off the US Pacific Coast, where the creation of marine protected areas (MPAs) is a primary regulatory approach of regional fisheries managers, skates are common and abundant components of benthic marine communities. However, reliable information on spatial associations of skates is sparse because of generalized landings data and misidentification. Based on the state of knowledge of skate spatial associations in other regions, the following hypothesis was posited: H₁) skates segregate spatially by species and life stage, and exhibit distinct habitat preferences and seasonal shifts in distribution. To test this hypothesis and fill the described knowledge gap, a twenty-year data series (1991-2010) was compiled using a variety of survey techniques and analyzed for the five most abundant skate species (*Bathyraja kincaidii*, *Raja binoculata*, *R. inornata*, *R. rhina*, *R. stellulata*) occurring in continental shelf and upper continental slope waters off central California. Multivariate techniques, geostatistics, and regression models were used to: 1) determine EFH for each species/life stage, 2) identify groups of co-occurring species/life stages as habitat guilds, 3) determine species/life stage-specific patterns of distribution and abundance and the processes driving these patterns, and 4) determine areas of high abundance and diversity for the overall skate assemblage. Results will contribute substantially to an improved understanding of the spatial dynamics of skates and skate assemblages, and to the creation of more effective fisheries management strategies off the US Pacific Coast.

0008 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Michael Blum¹, Peter McIntyre², James Gilliam³

¹*Tulane University, New Orleans, LA, USA*, ²*University of Wisconsin, Madison, WI, USA*, ³*North Carolina State University, Raleigh, NC, USA*

Ridge-to-Reef Connectivity and Source-Sink Dynamics of Amphidromous Fish Across Oceanic Islands

As the predominant members, and in some cases the sole constituents, of freshwater fish assemblages on tropical and subtropical oceanic islands, amphidromous species represent important constituents of global freshwater fish biodiversity. Completion of the amphidromous life cycle requires migration from freshwater to the marine environment and back again; therefore amphidromous fishes rely on surface water connectivity to move between spawning habitats in streams and larval habitats in the ocean. By eliminating contributions to the marine larval pool and post-larval recruitment to freshwater, disrupted surface flow of streams and rivers consequently represents one of the greatest threats to the viability of amphidromous fish. Here I overview genetic, demographic, and biophysical modeling results that illustrate population connectivity of amphidromous fish across the Hawaiian archipelago. By characterizing the degree of connectivity within and among islands, this work demonstrates that metapopulation dynamics of the amphidromous life cycle are not sufficient to prevent local and island-wide extirpation, where net-exporting populations do not supply enough immigrants to sustain compromised populations. Adoption of in-stream flow standards to sustain at-risk populations, which has been highly contentious in Hawaii, will require building on this knowledge to determine the hydrological conditions necessary to positively impact recruitment to breeding populations.

0771 NIA Oral Papers, Doña Ana/Cimarron, Monday 15 July 2013

Flávio Bockmann¹, Fernando Apone¹, Mário de Pinna²

¹*Universidade de São Paulo, Ribeirão Preto, SP, Brazil*, ²*Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brazil*

Reassessment of Morphological Characters Bearing on the Phylogenetic Relationships of Pimelodidae (Ostariophysi, Siluriformes)

The phylogenetic relationships among the pimelodid catfishes were recently proposed through a large molecular dataset, recovering some new clades, and generating incongruences in relation to the morphology-based phylogeny of this family as well. To evaluate this situation, we started a detailed revision of all morphological evidence supporting higher-level relationships of Pimelodidae. We found that many characters

had universality levels different from those that were originally proposed, some were redundant, and others were not properly defined. We also discovered several new characters supporting groups recognized by the molecular analysis. An initial survey indicated that molecular and morphological phylogenies are widely congruent to each other, with few anatomical characters suggesting otherwise. New synapomorphies for the family were recognized, including features of the facial innervation and of the laterosensory system of skull. Monophyly of the OCP Clade (*Calophysus-Pimelodus* Clade plus '*Pimelodus ornatus*'), 'sorubimines', *Calophysus-Pimelodus* Clade, 'pimelodines', and *Pimelodus* Group (which comprises *Pimelodus*, *Bergiaria*, *Iheringichthys*, and *Parapimelodus*), were corroborated on the basis of characteristics found in distinct anatomical complexes, such as neurocranium, suspensory, branchial arches, trigeminofacial nerve complex, and mentonian cartilages. On the basis of the characters herein analyzed, *Hypophthalmus* cannot be considered closely related to *Parapimelodus* as it was thought because it does not belong to the OCP Clade or any of its subgroups in which *Parapimelodus* is nested within. A reevaluation of the arrangement and homologies of the sonic muscles in Pimelodidae suggested a hypothesis of close relationships with at least Ariidae, Auchenipteridae, and Doradidae.

0663 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Mark E Bond¹, Elizabeth A Babcock², Demian D Chapman¹

¹*Stony Brook University, Stony Brook, New York, USA*, ²*University of Miami, Miami, Florida, USA*

Southern stingrays concentrate on shallow flats inside marine reserves: response to top-down or bottom-up processes?

Marine reserves release fished species from harvest pressure but their effect on unfished species is unpredictable and may even be negative. Southern stingrays (*Dasyatis americana*) are not commercially targeted in Belize, but nonetheless are potentially important ecotourism attractions and bioturbators. We used Baited Remote Underwater Video (BRUV[®]) to survey stingrays in two distinct habitats (flats N=40 and fore-reef N=50) at four sites, two reserves and two otherwise similar fished reefs. A generalized linear model (GLM) is being used to explain the effect of the factors "marine reserve", "habitat", "reef type" (atoll or barrier) and a range of environmental variables on the presence of stingrays on BRUVs. Preliminary analysis of BRUV deployments within one reserve and one fished reef found that stingray presence was significantly influenced by "habitat", but only at the reserve site. Specifically, stingrays were more commonly observed on BRUVs deployed in shallow flats than on the deeper forereef habitats inside the reserve. In contrast, there was no significant effect of habitat on stingray presence at the fished site. We present the full results from all four sites and discuss the potential drivers of this pattern. "Top-down" possibilities include avoidance of deeper habitats due to intimidation by sharks, which we have shown are more common at the reserve

sites. "Bottom-up" possibilities include habitat or prey differences between sites. Understanding how marine reserves influence unfished species is intrinsically important given their burgeoning use for marine conservation, and can also provide insights into ecological interactions otherwise difficult to study.

0572 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Ronald Bonett¹, Ana Lilia Trujano-Alvarez¹, Michael Williams², Elizabeth Timpe³

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Biogeography and body size shuffling of aquatic salamander communities on a shifting refuge

Freshwater habitats of coastal plains are refugia for many divergent vertebrate lineages, yet these environments are highly vulnerable to sea-level fluctuations, which suggests that resident communities have endured dynamic histories. The Southeastern Coastal Plain (SECP) of North America is a refuge for many divergent lineages of freshwater vertebrates. However, this region was submerged by a marine transgression throughout the Eocene, so the modern SECP and its communities are relatively young. Using the fossil record and a multi-locus nuclear phylogeny, we examine divergence times, biogeography, body size evolution, and patterns of community assembly of aquatic salamanders from North American coastal plains since the Late Cretaceous.

Ampiumids, batrachosauroidids, proteids, scapherpetonids, and sirenids occurred on the extensive Western Interior Coastal Plain (WICP), which existed between the Late Cretaceous through the Eocene. Ampiumids, batrachosauroidids, proteids, and sirenids subsequently colonized the emergent SECP by the Early Oligocene to Late Miocene. Only ampiumids, proteids, and sirenids ultimately survived and underwent extensive body size evolution in situ on the SECP. This included at least two major size reversals in recent ampiumids and sirenids that are convergent with confamilial WICP ancestors. Dynamics of the coastal plain, major lineage extinctions, and frequent extreme changes in body size have resulted in significant shuffling of the size structure of aquatic salamander communities on this shifting refuge since the Cretaceous.

0643 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

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The Emerging Phylogenetic Pattern of Parthenogenesis in Snakes

Recent studies have removed facultative parthenogenesis (FP) from the realm of obscurity and placed it firmly in a position where it now warrants focused scientific attention. Until recently FP, the ability for a sexually reproducing species to reproduce asexually, has been considered an evolutionary novelty, confined to captive specimens and thus ascribed as a captive syndrome. With the abundance of papers confirming FP across a diverse array of species, namely birds, sharks, and several lineages of non-avian (squamate) reptiles (lizards and snakes), such opinion is changing. With the recent detection of FP in two natural populations of North American pitviper snake, paradigms are now beginning to shift with FP theoretically an important aspect of vertebrate evolution. Species capable of FP may therefore potentially represent ideal model organisms for understanding the evolution and maintenance of sex. As such, it is important to understand fully the distribution of FP within phylogenies, to understand subtle variations and commonalities that may exist across species, and to identify the conditions and proximate mechanisms by which the “sexual-asexual switch” is accomplished. Here, we present a review of FP in reptiles and then through character mapping of recent phylogenies we discuss the phylogenetic pattern of parthenogenesis in snakes.

0559 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, Doña Ana/Cimarron, Thursday 11 July 2013

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Delineating plethodontid species diversity in Nuclear Central America: phylogeography and systematics of *Bolitoglossa* subgenus *Mayamandra* from multi-locus sequence data

The Neotropics are a hotspot of plethodontid salamander diversity, with new species being described each year. The largest genus of neotropical salamanders, *Bolitoglossa*, has been partitioned into seven subgenera by previous studies on the basis of mitochondrial sequence data and morphology. Many recent taxonomic revisions also

rely primarily on mitochondrial sequence data to delineate species. In this study we have obtained sequence data from two mitochondrial and four nuclear loci for three species in the subgenus *Mayamandra*, which range from Chiapas, Mexico to northwestern Guatemala. We elucidate geographic species boundaries and test both the recently proposed taxonomic hypotheses and the monophyly of *Mayamandra* in relation to its sister subgenus, *Nanotriton*. Phylogeographic results show a complex spatial distribution of named species with large mtDNA divergences between different lineages over short geographic distances. The most striking example is a single population restricted to Cerro Tzontehuitz in central Chiapas that displays a level of divergence comparable to that of other described species within the subgenus. Our results suggest that unrecognized species diversity remains a factor in Central America and that comprehensive, multi-locus studies of other taxa would provide a more accurate estimate of salamander biodiversity in the tropics.

0190 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

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Shaping up: A Geometric Morphometric Approach to Community Ecomorphology

The connection between ecology and morphology has long intrigued ecologists, and investigation of this relationship has given ecologists insight into the factors that influence assemblage structuring of fish communities. Niche-partitioning has presumably allowed for high species richness in stream fishes communities in the southeastern United States, however, slight differences in morphology may optimize stream fish for certain microhabitats or diets. By examining these differences in morphology, it is possible to predict the niche position of stream fish, although this relationship may be an artifact of phylogenetic relationships. The purpose of this study was to take an eco-morphological approach to examine the utility of body shape as a predictor of niche position with and without the influence of phylogenetic relationships among stream the fishes of the Tickfaw River (Lake Pontchartrain Basin) in southeastern Louisiana. To accomplish this, point sample collections were made throughout the year and ecological (habitat and trophic) and body shape (geometric morphometric) data were collected for each specimen of fish. Multivariate analyses were performed to examine relationships and differences among stream fish species body shape and niche position. Results indicate that a strong relationship exists between body shape and trophic guild as well as flow regime, but no significant correlation between body shape and substrate was found. Within a stream fish community, body shape was shown to be an indicator of basic niche position for stream fish species.

0394 Fish Biology, Doña Ana/ Cimarron, Sunday 14 July 2013

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Electric organ discharge and sound emission in *Synodontis* spp. catfishes (family Mochokidae): variation of an apomorphic muscle

Many families in the catfish order Siluriformes are able to produce sounds. These include high-frequency stridulations and low-frequency swimbladder sounds, the latter of which is often attributed to an elastic spring apparatus (ESA). Stridulations are well known from mochokids, however, few swimbladder sound descriptions exist. Recent studies documented weak electric organ discharges (EODs) from some members of the diverse mochokid genus *Synodontis* and suggest that the ESA protractor muscle is the electric organ. We examined EODs, swimbladder sounds, and protractor muscles in five *Synodontis* species. Four species produced EODs: *S. euptera*, *S. angelica*, *S. robbianus*, and *S. nigriventris*. The behavioral context of EOD emission and spectral frequency of EODs varied among species. Cross-correlation analysis of EOD and sound waveforms indicated species specificity for EODs, but not for sounds. Among EOD producing species, all except *S. nigriventris*, produced weak swimbladder sounds. By contrast, *S. grandioops*, produced robust swimbladder sounds but no EODs. Protractor muscle ultrastructure was unusual and the ratio myofibril/sarcoplasm area was reduced greatly in EOD forming fishes but was well developed in the sound producer *S. grandioops*. Unlike electrocytes of many electric fishes, protractor muscle myofibrils were usually present and contained complete sarcomeres. Like other electric fishes, muscle fibers of some EOD forming species contained numerous canaliculi. Injection of an acetylcholine antagonist into protractor muscle suppressed EOD amplitudes, supporting the hypothesis that muscle fibers act as electrocytes. Our results indicate plasticity in form and function in an apomorphic skeletal muscle and provide insight into electric organ evolution.

0418 Fish Conservation, San Miguel, Sunday 14 July 2013

Howard Brandenburg, Michael Farrington, Steven Platania

American Southwest Ichthyological Researchers, Albuquerque, New Mexico, USA

Early life history of native catostomids, and inference of their spawning periodicity, in the San Juan River (2003-2011)

Native catostomids (flannelmouth sucker, *Catostomus latpinnis*, bluehead sucker, *Catostomus discobolus*, and razorback sucker, *Xyrauchen texanus*) begin to spawn early in

the annual cycle of ichthyofaunal reproduction in the San Juan River (CO, NM, and UT). Inferred spawning periodicity of these sucker species occur from March to early August, based on captures of the earliest larval stages (protolarvae and recently transformed flexion mesolarvae). Larval flannelmouth sucker is the first catostomid captured in each year surveyed. About 78% of the annual first captures of this species were at or downstream of McElmo Creek, a perennial tributary of the San Juan River. Highest densities of age-0 flannelmouth sucker were in May and June ($F=143.84$, $P<0.0001$). Collection of larval bluehead sucker indicated a broader spawning periodicity (May-August) encompassing the ascending and descending limbs of the spring hydrograph. Densities of larval bluehead sucker were highest in June and July ($F=126.27$, $P<0.0001$) and also highest in the upper two reaches of the study area ($F=36.13$, $P<0.0001$). Back-calculated spawning of razorback sucker began in late March to mid-April (prior to spring run-off) and usually concluded prior to the decline of run-off. The highest density of larval razorback sucker occurred in May ($F=109.98$ and $P<0.0001$). Among years, the highest density of larval razorback sucker was in the reach furthest downstream. Relating spawning periodicity to environmental variables is an important next step that may ultimately guide water management to promote spawning and rearing habitats for these native catostomids.

0656 AES Ecology, Mesilla, Thursday 11 July 2013

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Telemetry techniques elucidate *Manta alfredii* ecology in the eastern Red Sea

Manta spp. are distributed globally in tropical and sub-tropical waters, but local populations appear small and widely dispersed. The reef manta, *Manta alfredii*, is the smaller, coastal cousin of the two recognized *Manta* species, and sighting records suggest preferential occupation of nearshore tropical waters with strong site affinity and limited movements. Connectivity among populations is largely unknown, but available evidence suggests regional isolation. While recent efforts have initiated investigation of a few populations worldwide, Red Sea *Manta* spp. remain completely enigmatic. We use satellite and acoustic telemetry techniques to elucidate short and long-term movements of *Manta alfredii* in the central Saudi Arabian Red Sea. In addition, we investigate high-resolution dive data of three individuals. These findings enable a better understanding of manta ray ecology in this poorly-studied region. As demand in Asian markets continues to rise, basic information about manta ray behavior and its applicability to regional management efforts become increasingly urgent. *Manta* spp. harvest and the lucrative ecotourism trade also render this work economically important and could lead to significant local support of conservation efforts.

**0533 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER
HERPETOLOGY AWARD**

Maria Florencia Breitman, Luciano Javier Avila, Mariana Morando

CENPAT-CONICET, Puerto Madryn, Argentina

**Synthesis of Morphological and Phylogenetic Patterns of the Southernmost
Clade of South American Lizards, the *Liolaemus lineomaculatus* Section
(Liolaemidae)**

Twenty-one species of lizards are included in the *Liolaemus lineomaculatus* section, which is the southernmost clade of South American lizards. Two hypotheses of species-grouping have been proposed for this section, one based on morphological similarities and another based on molecular phylogenetic relationships; although discordant, both are in use. The 'morphological arrangement hypothesis' sorts *L. lineomaculatus* section species into three morphological groups (*kingii*, *archeforus* and *lineomaculatus*); however, despite taxonomic changes and a doubling of described species diversity since it was proposed ~30 years ago, this hypothesis has never been tested. Here, we test the accuracy of the 'morphological arrangement hypothesis' using new morphological data from 34 characters (morphometric, meristic and qualitative) from ~350 individuals representing all species in the section. Using ANOVA and multivariate analyses (MANOVA, DFA), we show that the practice of classifying eleven of these species in the *kingii* and *archeforus* groups, which is not supported by molecular data, is similarly unsupported by morphological variation; thus, we recommend that this practice be abandoned. We suggest referring to this clade as the *kingii* group. We also found that the recently-proposed molecular groups/clades (*magellanicus*, *lineomaculatus* and *kingii*) are differentiated morphologically. Finally, we comment on future prospects for studying sexual dimorphism in the section and its possible ecological implications. Our review provides a critical synthesis of morphological and phylogenetic patterns, providing a useful framework for testing taxonomic hypotheses as well as physiological, behavioral and evolutionary questions within the *L. lineomaculatus* section.

**0374 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

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Phylogeography of *Delma* (Squamata: Gekkota: Pygopodidae) in Arid and Semi-arid Australia

Delma, with 21 recognized species, is the most speciose genus in the flap-footed lizard family Pygopodidae. Delmas have been hypothesized to be the sister-group to all remaining pygopodids, are geographically and ecologically diverse, and as Australo-Papuan endemics, may represent a valuable model for understanding the biogeography of the Australian continent. Although a near-complete species-level phylogeny exists for the Pygopodidae, patterns of intraspecific variation remain largely unstudied. We investigated intraspecific relationships using analyses of mitochondrial (ND2) and nuclear (RAG1 and MXRA5) genes of over 200 individuals of 16 nominal species of *Delma*. To identify patterns of genetic variation relative to geographic context, we sought to (1) test the monophyly of a number of broadly distributed or sympatric species, and (2) investigate potential cases of cryptic speciation in these groups. Our results suggest a number of cryptic species within *D. australis* (2 spp. nov.), *D. butleri* (1 sp. nov.), and *D. tincta* (1 sp. nov.). Additionally, some confusion previously existed regarding the validity of the largely sympatric, and morphologically and ecologically similar sister-species *D. fraseri* and *D. grayii*. Our results support their recognition as two discrete species, and identify their distributional overlap as the result of recent range expansions. Despite low human population density in arid and semi-arid Australia, mining and agriculture have extensively modified vast expanses of land and drastically reduced suitable *Delma* habitat, particularly in the Western Australian Wheatbelt. Such threats highlight the need for critical investigation of species boundaries, both geographic and phylogenetic, in order to inform conservation efforts.

0240 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

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Quantifying the Cost of Thermoregulation: Thermal and Energetic Constraints on Growth Rates in Hatchling Lizards

The optimality model of thermoregulation makes explicit predictions about optimal thermoregulation strategies based on costs associated with specific thermal habitats. To test the hypothesis that thermal constraints reduce growth rates in lizards, we designed a manipulative experiment - comparing growth of hatchling collared lizards exposed to high and low energetic cost of thermoregulation treatments. Treatments were designed to mimic restricted thermal microenvironments (which increase time and energy devoted to maintenance of body temperature) and unrestricted thermal microenvironments (which minimize time and energy needed to maintain body temperature). Counter to predictions of the optimality model of thermoregulation, lizards thermoregulated similarly between treatments - but grew more slowly in length in the high cost thermoregulation treatment than lizards in the low cost thermoregulation treatment. The reduction of growth rates in the high cost thermoregulation treatment is most consistent with lizards diverting energy from growth to locomotion for thermoregulation.

0445 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

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The influence of temperature on activity level and behavior for a juvenile elasmobranch species

Determining accurate field metabolic rate (FMR) is important for quantifying a species impact on the ecosystem, estimating the effect of their removal on lower trophic levels and producing reliable bioenergetics models for fisheries management. Since activity-based energy expenditure is likely to be the largest component of FMR in sharks, their fine-scale activity levels can be used as a proxy for relative FMR at varying temperatures. We used tri-axial acceleration data loggers to classify body-movements for 14 free-living juvenile lemon sharks (*Negaprion brevirostris*; 75-90cm TL) in a shallow

inlet in East Bimini, Bahamas. Each data set contains 96-120 hours of temperature, depth and acceleration data, and allowed for classification of behaviors such as resting, steady and fast-start swimming. Ten lemon sharks were tagged during the summer with water temperatures between 26-38°C. The remaining four sharks were tagged during the winter at water temperatures of 20-28°C. Initial results show an average of 10.83% ± 5.92 (mean ± SD) and 15.74% ± 5.64 time spent resting during summer and winter respectively; 89.04% ± 5.90 and 84.17% ± 5.65 for steady swimming; 0.12% ± 0.04 and 0.08% ± 0.03 for fast-start swimming. Two individuals were tagged during both seasons allowing for direct comparison of behaviors. Future aims of the study include determination of thermal preferences by temperature profiling, increasing sample size and determining the effect that temperature has on FMR and general behavior.

0018 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Robert Brodman

Saint Joseph's College, Rensselaer, IN, USA

The direct effects of aquatic herbicide on Spotted Salamander eggs & larvae

To better understand the specific effects of aquatic herbicides on amphibians we designed a series of experiments under controlled laboratory conditions to examine long-term lethal and sublethal effects of the herbicides Roundup and Accord and the separate components of Accord (Glyphosate, Cide-Kick II, tracer dye) on Spotted Salamander eggs and larvae. All eggs treated with Roundup died within four days of treatment, whereas the 94% of the control eggs and 91% of the Accord treatments survived the first week post-treatment. All four Accord treatments (5% glyphosate, surfactant, dye, and full mix) resulted in significantly delayed hatching and development, and increased fluctuating asymmetry compared to control eggs and larvae. Treatments with glyphosate, and the full mix had significantly reduced survival compared to control. Treatments with glyphosate, surfactant, and the full mix were significantly smaller than control larvae.

0524 AES Conservation, San Miguel, Sunday 14 July 2013

Edward Brooks¹, Stephen Connett², Stephanie Liss³, Christopher Koch¹, Jeffrey Stein³

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A Fisheries Independent Study Documenting 30-Year Trends in Shark Diversity and Abundance in the Eastern Exuma Sound, The Bahamas

Global declines in elasmobranch populations are well documented; however, the majority of studies rely upon fisheries dependent datasets that are commonly criticized due to the variable nature of fishing techniques over time. Fishery-independent surveys offer a more rigorous approach to detecting long-term changes in abundance and diversity of shark populations. Seasonal surveys were conducted from 1979 through 1981 in an area off the south coast of Eleuthera, The Bahamas. From 2011-2013 these surveys were exactly recreated, with a goal of identifying trends the diversity and abundance of elasmobranchs over the last 34 years. Catches for both historical and modern surveys were dominated by Caribbean reef (*Carcharhinus perezii*) and tiger (*Galerocerdo cuvier*) sharks. These two species showed distinct seasonal trends in relative abundance whereby *C. perezii* were significantly more abundant in the autumn ($F=16.64$, $p<0.001$), in contrast to *G. cuvier* which were significantly more abundant in the spring ($F=8.03$, $p=0.007$). Preliminary analysis indicates a 50.2% reduction in the relative abundance of *G. cuvier* over the last 34 years ($F=4.76$, $p=0.035$), in contrast to a 57.9% increase in the relative abundance of *C. perezii* in the same period ($F=5.73$, $p=0.021$). Changes in catch composition may be the result of differences in the extent of trans-boundary movements between the species, which as a result of the Bahamian longline ban instituted in the 1990s, imposed variable exploitation rates. This study highlights the importance of understanding long-term seasonal movement patterns when designing management and conservation strategies for elasmobranchs.

0547 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Edward Brooks¹, Cory Suski², Brendan Talwar¹, Rachel LaBella¹, Tyler Sanford¹, Steven Cooke³, John Mandelman⁴

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To chill or not to chill: does on-hook behavior modulate the physiological status of longline-caught sharks

It is clear from past work on elasmobranchs that the magnitude of the acute physiological disturbance and/or subsequent mortality tied to fishing capture varies widely by species. What is not fully resolved, however, is why such differences exist. Recent evidence in one carcharhinid suggests that physiological convalescence is possible while still on a longline hook. Moreover, it is readily apparent that sharks exude differing degrees of vigor while hooked and/or during handling. We therefore hypothesize that the degrees of physiological disturbance and recovery may be intimately linked to behavior while on the longline hook (i.e. the magnitude, duration and cyclicity of escape responses). Through the combined use of video imaging, data logging accelerometers, and blood biochemical profiles, the present study is examining how behavior on a longline relates to physiological status. Preliminary results from Caribbean reef, blacktip, tiger, blacknose and nurse sharks suggest that initial high energy escape responses are terminated 3-5 minutes post hooking and replaced by lower energy circling interspaced with infrequent low energy escape responses. In nurse sharks, heightened activity levels early in the capture event correspond with a maximally disturbed blood biochemical status over short to medium hook durations, and the partial recovery of physiological homeostasis over longer hook durations. This work ultimately hopes to reveal possible strategies (abbreviated soak times, extended gangion lengths, etc.) to enhance survival. Moreover, examining species with divergent phylogenies, life histories and respiratory strategies can help signify those taxa more susceptible to capture-stress, and inform specific broader-scale fishery management strategies.

**0484 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday
13 July 2013**

Richard Broughton¹, Ricardo Betancur-R.², Chenhong Li³, Gloria Arratia⁴,
Guillermo Orti²

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EToL: Phylogenetic Relationships and Divergence Dates of "Basal" Bony Fish Lineages

Investigation of fundamental areas of vertebrate biology depend critically on a robust phylogeny of fishes, yet evolutionary relationships among the major actinopterygian and sarcopterygian lineages have not been conclusively resolved. Although a consensus phylogeny of teleosts has been emerging recently, it has been based on analyses of various subsets of actinopterygian taxa, but not on a full sample of all bony fishes. We conducted a comprehensive phylogenetic study on a broad taxonomic sample of 61 actinopterygian and sarcopterygian lineages emerging from the base of the osteichthyan tree (with a chondrichthyan outgroup). The analysis included DNA sequences from 21 independent loci with nearly 20,000 nucleotide characters. These data yielded a resolved phylogenetic hypothesis for extant Osteichthyes, including 1) reciprocally monophyletic Sarcopterygii and Actinopterygii, as currently understood, with polypteriforms as the first diverging lineage within Actinopterygii; 2) a monophyletic group containing gars and bowfin (= Holostei) as sister group to Teleostei; and 3) the earliest diverging lineage among teleosts being Elopomorpha, rather than Osteoglossomorpha. Relaxed-clock dating analysis employing a set of 24 newly applied fossil calibrations reveals divergence times that are more consistent with paleontological estimates than previous studies. Establishing a new phylogenetic pattern with accurate divergence dates for bony fishes illustrates several areas where the fossil record is incomplete and provides critical new insights on diversification of this important vertebrate group.

0429 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

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Preliminary findings on the reproductive biology of the finetooth shark, *Carcharhinus isodon*, in Atlantic waters of the Southeastern United States

The finetooth shark is a member of the small coastal shark (SCS) fishery complex. It is found in Atlantic waters from South Carolina to Florida and throughout the Gulf of Mexico. This species has come under increased fishing pressure and populations in the southeast U.S. Atlantic have been reported to be overfished in recent years. New data is needed in order to properly assess the reproductive biology of this species so that populations can be sustained. However, the most recent published study on the Atlantic population of *C. isodon* was conducted 20 years ago and other studies have found variations from published findings on the reproductive periodicity of *C. isodon*. In order to comprehensively understand the reproductive biology of *C. isodon*, morphological measurements of reproductive structures are being taken throughout the year. Preliminary data indicates that for males, testis width increases starting in September and peaks in late April/early May, then drops quickly in mid to late May. Morphological measurements of head epididymis width follow the same pattern of growth followed by rapid decline in following mid-May. Histological analysis of the testis confirms this pattern, demonstrating the presence of mature spermatozoa in Spring samples. In females, maximum follicle diameter was greatest from winter-early Spring, indicating that this is the period of vitellogenesis. Follicular diameter decreased after late Spring, suggesting that this is the period of ovulation and fertilization. Embryos were presented in only non-vitellogenic females during winter and spring, suggesting that reproduction is biennial and vitellogenesis and gestation are non-concurrent.

0682 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Rafe Brown¹, Cameron Siler²

¹*University of Kansas Biodiversity Institute, Lawrence, Kansas, USA*, ²*Department of Biology, University of South Dakota, Vermillion, South Dakota, USA*

Spotted stream frog diversification at the Australasian faunal zone interface, mainland versus island comparisons, and a test of the Philippine dual umbilicus hypothesis

We utilize comprehensive geographical sampling and a new, multilocus dataset to re-examine the biogeography of spotted stream frogs throughout Southeast Asia. We compare patterns of diversification among stream frog populations on land-bridge and oceanic islands to reevaluate a previous 'dual-invasion' hypothesis for the origins of several endemic Philippine taxa. We use summary statistics and phylogenetic networks to characterize the geographic distribution of genetic variation and employ coalescent-based historical inference to test for demographic population changes. Phylogenetic relationships and ancestral biogeographic ranges were estimated using Bayesian and likelihood methods. In contrast to expectations, we found evidence of highly divergent, demographically stable, and geographically regionalized lineages (including currently unrecognized putative species) in the land-bridge island clade, but minimally divergent, widespread and clinally distributed (with evidence of recent demographic expansion) populations in adjacent oceanic island populations. Novel phylogenetic relationships depart from previous studies and our data strongly reject the previously published 'dual-invasion' hypothesis. Our results join a new body of literature suggesting that amphibian lineages on mainland areas and continental shelf islands may harbor high levels of unrecognized diversity, whereas adjacent oceanic island archipelagos can and do support naturally occurring widespread species or minimally divergent clades. Although our study indicates that the identities of species previously hypothesized to be involved in the 'dual-invasion' scenario may have been incorrect, multiple faunal exchanges between the archipelago and adjacent mainland undoubtedly have contributed to the accumulation of endemic vertebrate diversity in the Philippines.

0230 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Nancy J. Brown-Peterson, Mark S. Peterson, Robert T. Leaf, Samuel D. Clardy

University of Southern Mississippi, Ocean Springs, MS, USA

Life History Patterns in the Sciaenidae

The family Sciaenidae occurs world-wide in temperate and subtropical marine and estuarine waters and many are commercially or recreationally important. We compiled a

suite of eight representative somatic and reproductive life history characteristics for valuable sciaenids within three regions of the United States EEZ (n=24) to further the understanding of the dynamics of this group of fishes. Only 16 stocks had sufficient data for analysis. PCA ordination of five somatic and reproductive variables identified two components that explained 68.3% of variation among species: PC1 is a size-related gradient (positive maximum total length (TL) and age at maturity (AM), negative relative batch fecundity (RBF)) and PC2 represents spawning season dynamics (positive spawning season duration (SS) and parameter b in the weight-at-length power function). Five distinct groups were identified: A-large TL, AM and small RBF; B-long SS, high b , low RBF, TL and AM; C-high RBF, low SS, b , TL and AM; D-low TL, AM, intermediate SS, RBF, b ; E-all parameters intermediate. Species occurring in the same group from the same region differ in habitat or spawning season with the exception of group E. The results suggest that groups A and E can be characterized as having a periodic or K life-history strategy whereas group C has an opportunistic or r strategy. Groups B and D (seven species) do not fit classic life history strategy definitions, suggesting that strategies of smaller sciaenids with lower fecundity may be more susceptible to environmental or physiological variation.

0375 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

John Bruner

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***Stizostedion* Rafinesque, 1820 is a valid generic name in Percidae**

Sander is the Latvian/Estonian common name for *Stizostedion lucioperca*. Sander is not a Latin or Greek name, but a common name for German males in the 17th & 18th centuries, e.g. *Prince Sander*. Lorenz Okenfuss's use of the name Sander in 1817 cannot be considered a valid generic name. His work was rejected in Opinion 417 (1956) of the International Commission on Zoological Nomenclature. An abbreviated timeline is given of the publications which led to the incorrect acceptance by the AFS/ASIH 2004 *Committee on Names of Fishes* of the common name Sander as the generic name for the genus *Stizostedion* (Percidae).

0217 AES Behavior, San Miguel, Sunday 14 July 2013

Michelle Buckhorn³, James Ketchum⁴, Christina Slager², Peter Klimley¹

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Movements and residency of sevengill sharks (*Notorhynchus cepedianus*) in San Francisco Bay

The diel movements and seasonal residence of adult cow sharks are described in San Francisco Bay. Four adult sevengill sharks were tracked continuously for periods as long as five days. The sharks displayed rheotaxis in response to the tidal cycle. For example, a male cow shark exhibited the same pattern during successive days: 1) swimming non-directionally in the center of the bay during daytime in slow flows, 2) swimming out of the bay in a highly directional manner up in the water column during the evening in strong outward flows, 3) descending to the bottom and moving non-directionally in the mouth of the bay during slow flows, and 4) rising in the water column and returning to the bay in a direct path traveling in strong inward flows. Coded ultrasonic beacons were placed on 21 sharks. Their seasonal tenure in the bay was determined over a period of three years by multiple cross-bay arrays of tag-detecting monitors. The adult males and females resided just inside the bay, being detected frequently at the paired Golden Gate array. The subadult males and females occupied the interior of the bay. The adults sharks were absent in the winter but were present from early spring to late fall. Sevengills tagged in the bay were detected during the winter months in the coastal waters off San Diego, over six hundred kilometers away, indicating that they make extensive annual migrations between the temperate latitudes.

0448 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Rob Bullock¹, Lauran Brewster¹, Nick Whitney³, Adrian Gleiss⁴, Tristan Guttridge², Samuel Gruber²

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'A Day in the Life of a Shark' Understanding the Fine-scale Behaviour of Free-ranging Juvenile and Sub-adult Lemon Sharks (*Negaprion brevirostris*), Using Novel Accelerometer Technology

Understanding the behavioural ecology of key marine predators is required to determine the significance of the roles they play in marine ecosystems and therefore

facilitate their conservation. Animal-attached acceleration data loggers are now giving scientists the ability to delve deeper into the cryptic lives of marine animals. Here we use three-dimensional acceleration data loggers alongside traditional acoustic telemetry to elucidate the fine-scale behaviour of free-ranging juvenile (1-1.2m total length) and sub-adult (1.2-2m total length) lemon sharks at Bimini, Bahamas. Observations under semi-captive conditions were conducted on six sharks, equipped with external tag packages (CEFAS G6a accelerometers with attached Sonotronics PT4 acoustic transmitters). Using tri-axial acceleration we defined steady swimming, resting and burst swimming behaviours. K-means clustering analyses were then used to characterise these behaviours in wild sharks. Thus far we have tagged eight wild lemon sharks for periods between 3-5 days, during which time sharks were also both passively and actively tracked. At this stage, the research has identified distinct patterns in resting and active swimming behaviours. Sharks rest for periods of several hours in sheltered areas over the high tides. During periods of active swimming they occupy open lagoon areas and exhibited prolonged burst swimming events, hypothesised to represent predatory behaviour. In future the study means to resolve burst swimming into predatory and predator-avoidance behaviours and to assess distribution and abundance of prey species. This will help determine what factors are driving daily decision-making processes in these sharks.

**0417 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Michael Burns, Benjamin Frable, Brian Sidlauskas

Oregon State University, Corvallis, Oregon, USA

A new species of *Leporinus* (Characiformes: Anostomidae) from the Orinoco Basin, Venezuela

A new species of slender bodied *Leporinus* is described from the Orinoco Basin, Venezuela. This new species has an extremely dorsoventrally slender body (percentage of body depth immediately anterior to the dorsal-fin origin in standard length in range of 19-26%) and a pigmentation pattern of one to three spots centered along the lateral line scale row. These two characteristics make this new species most similar to the *Leporinus cylindriciformis* species complex. The *L. cylindriciformis* group is a cluster of elongate species possessing a series of dark spots centered along the lateral line, with the main species, *L. cylindriciformis*, being described from Porto de Moz, Brazil. Linear morphometrics and meristics were used to distinguish it from other slender bodied fish in the *L. cylindriciformis* complex. This species differs from others in the *L. cylindriciformis* species complex in the combination of pigmentation pattern, morphometrics and meristics. Specifically, it differs most greatly in number of spots centered along the lateral line, snout depth, and length of snout to adipose-fin origin.

**0069 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Bruce Bury

CORe, 1410 NW 12th St, Corvallis, OR, USA

Effects of Forest Biomass Removal on North American Herpetofaunas: Can We Have Our Cake and Eat It, Too?

Some consider slash, burned standing trees, and crowded trees to be excess or harmful to forest health. This biomass can be used as fuel to generate electricity (via steam power). Others caution against widespread removal because fire is a natural process in many stands and burned trees become nutrients returned to the forest floor. Amounts of this material can be massive. Old-growth stands in the Pacific Northwest may have 200+ metric tons or 300 cubic m³ of wood per hectare. Further, downed wood accumulates in streams and rivers as major energy inputs. Amount of 500+ t per ha occurs in natural forests. U.S. forests now hold 55 billion tons of stored carbon. Downed wood is home to many forest species, including amphibians and reptiles. A few case studies show that removal of timber and downed wood reduces cover and habitat for wildlife, and sometimes at >50% of the population. There can be local extirpation of sensitive species. We have barely addressed these impacts, especially at the landscape level. Further research is needed to determine what types of biomass should be retained in forest (e.g., existing downed and rotting logs) and configuration of removal (e.g., avoid riparian areas).

**0362 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Gwendolynn Bury¹, Christina Baggett¹, Jason Bracken², Bruce Bury³

¹*Oregon State University, Corvallis, OR, USA*, ²*Miami University, Oxford, OH, USA*,
³*COR, Corvallis, OR, USA*

Aggressive Behavior in the Western Pond Turtle on Stable and Rolling Logs

Western Pond Turtles (*Actinemys marmorata*) engage in atmospheric basking during warm portions of the year and, often, become crowded on preferred structures (e.g., a log away the edge of shore). Earlier studies recorded aggressive interactions in this turtle, including: shoving, open mouth gestures and, rarely, biting attacks. Such behavior likely ensures retention of position of turtles on crowded basking sites. In the Willamette Valley, Oregon, we observed these social interactions among turtles on stable wood structures as well as a rolling log. We used video to document a variety of behaviors, including: approach, open mouth gestures, and avoidance by turtles.

**0452 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Thaddaeus Buser

University of Alaska, Fairbanks, Fairbanks, AK, USA

Physiological Color Change In Marine Sculpins (Pisces; Cottidae)

Sculpins, like many benthic, sedentary fishes, exhibit a variety of physiological (i.e. disruptive coloration, dorsally-compressed bodies, elaborate cirri, etc.) and behavioral (i.e., quiescence) traits that presumably contribute to their ability to avoid detection by potential prey or predators. The ability to actively change color through the movement of pigment granules within a chromatophore (i.e., physiological color change) has been described and quantified in the freshwater species, coastrange sculpin (*Cottus aleauticus*) and slimy sculpin (*C. cognatus*). However, despite extensive anecdotal evidence suggesting that marine sculpins also exhibit physiological color change, the trait has not been studied systematically in any of those species. To investigate the use of physiological color change in marine sculpins, members of seven species were collected from wild populations in Kachemak Bay, Alaska and exposed to a variety of experimentally manipulated background colors. The color of the dorsal surface of each fish was quantified using the CIE 1976 L*a*b* color space model from digital images taken over the course of each trial. Images from t = 0min and t = 60min were compared and any differences were noted both qualitatively and quantitatively. Physiological color change was documented for the first time in five species: *Oligocottus maculosus*, *Clinocottus acuticeps*, *C. embryum*, *Artedius fenestralis*, and *Myoxocephalus polyacanthocephalus*. *Enophrys lucasi* and *A. harringtoni* were also tested, but produced no measurable change in color.

0492 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Thaddaeus Buser, J. Andres Lopez

University of Alaska, Fairbanks, Fairbanks, AK, USA

Mitochondrial Genome Rearrangement in Members of the Sculpin (Pisces; Cottidae) Subfamily, Oligocottinae

The organization of the vertebrate mitochondrial genome is highly conserved. Here we report the rearrangement of the tRNA genes flanking the D-loop (mitochondrial control region) in members of the sculpin subfamily, Oligocottinae (the tidepool sculpin and its allies). Using publicly available complete mitochondrial genomes of *Clinocottus analis*,

Cottus hangiongensis, and *Cottus poecilopus*, we designed novel primers to examine gene arrangement in the region between Threonine-tRNA (tRNA-Thr) and 16s rRNA (16s). This region was then amplified and sequenced in members of the genera: *Artedius*, *Clinocottus*, *Oligocottus*, *Orthonopias*, *Leiocottus*, *Cottus*, *Myoxocephalus*, *Leptocottus*, *Hemitripteris*, *Podothecus*, and *Scorpaenichthys* to reconstruct the origin of the sculpin mitochondrial rearrangement. The standard arrangement of the genes flanking the D-loop region is: cytochrome b, tRNA-Thr, Proline-tRNA (tRNA-Pro) on the 5' side and Phenylalanine-tRNA (tRNA-Phe), 16s on the 3' side. This standard order has been documented in many species of sculpin examined by previous authors and as part of this study (e.g., species of *Cottus*, *Hemitripteris*, *Scorpaenichthys*, *Podothecus*, and *Leptocottus*). However, within the genera *Artedius*, *Clinocottus*, *Oligocottus*, and *Leiocottus*, the gene arrangement is: tRNA-Thr; D-loop; tRNA-Pro; Region-X; tRNA-Phe; 16s. The region herein titled "Region-X" is of unknown function and may constitute vestigial genomic regions leftover from a hypothetical, ancestral duplication event within the mitochondrial genome of these species. Additionally, there is evidence that the region containing the D-loop, tRNA-Pro, and Region-X has been duplicated in the genera *Oligocottus*, *Clinocottus*, *Leiocottus*, and *Orthonopias*. In these lineages the duplicated region has evolved to varying degrees.

0480 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Thaddaeus Buser, J. Andres Lopez

University of Alaska, Fairbanks, Fairbanks, AK, USA

Molecular Systematics of the Oligocottinae (Tidepool Sculpin and its Allies)

Species of the sculpin (Cottidae) subfamily Oligocottinae are important members of intertidal communities in the North Pacific. This group was first delineated in 1926 for the species that today make up the genera, *Clinocottus*, *Oligocottus*, and *Sigmistes*. Since then, it has been expanded and/or inferred to include the genera, *Artedius*, *Leiocottus*, *Orthonopias*, *Phallocttus*, and *Ruscarius*. Two recent studies attempted to test the monophyly of the group using primarily mitochondrial DNA sequence data. Here, we present results of analyses based on sequences from five molecular loci (mitochondrial protein-coding region: COI; nuclear introns: EPIC loci 1777E4 and 4174E20; and single-copy protein-coding nuclear loci: ptchd1 and Rhodopsin) from all but two (*Ruscarius* and *Sigmistes*) of the modern genera that have been historically placed in the Oligocottinae. This dataset generated an aggregate total of 2,580 nucleotide sites. Phylogenies were inferred through maximum likelihood and Bayesian inference methods. Sequences were analyzed both separately and as part of a partitioned, concatenated dataset. Tree topologies were compared between single-gene and concatenated-dataset based phylogenies. The results of this study suggest that multiple genera (e.g., *Oligocottus*, *Clinocottus*) are in need of revision but that the Oligocottinae as a whole form a well-delineated monophyletic group.

0207 General Herpetology, San Miguel, Monday 15 July 2013

Pier Cacciali¹, Norman Scott², Aida Luz Aquino³

¹*Instituto de Investigación Biológica del Paraguay, Asunción, Paraguay*, ²*Museum of Southwestern Biology, Albuquerque, New Mexico, USA*, ³*World Wildlife Fund, Asunción, Paraguay*

Annotated Taxonomic and Distributional Checklist of the Reptiles of Paraguay

Paraguay occupies an important ecological position in the Southern Cone of South America. Here, two critical environmental gradients intersect: heavy rainfall in the east grading gradually to semi-desert in the west, and tropical temperatures in the extreme north grading to a cool, temperate climate in the south.

Paraguay is also in a critical biogeographic gap. Various reptilian faunas intersect and mix here: characteristic tropical species, such as *Paleosuchus*, *Boa*, *Iguana*, *Norops* and *Dracaena*, reach their southern limit in Paraguay; and wet Atlantic forest species, such as *Clelia plumbea*, *Dipsas buchephalala*, *Epicrates crassus*, *Rhachidelus*, and *Sibynomorphus mikani* come to their western terminus. Dry forest species inhabit the Gran Chaco west of the Río Paraguay: *Chelonoidis chilensis*, *Epicrates alvarezi*, *Boa constrictor occidentalis*, *Tropidurus spinulosus*, *Tropidurus etheridgei*, *Liolaemus chacoensis*, and *Teius teyou*; and species characteristic of the Brazilian Cerrado: *Philodryas livida*, *P. nattereri*, *Lygophis paucidens*; come to their southwestern range limit in the scattered patches of Cerrado in eastern Paraguay. Argentina and Brazil, its neighbors to the east and west, have maintained vigorous herpetological research programs since the end of the nineteenth century, but, until recently, little has been done in Paraguay since the publications of Bertoni and Schouten in the early 1900s. However, research since 1978 by a new wave of Paraguayan scientists, including this publication on the 178 reptilian species, provides the bases necessary to analyze the connections with and between neighboring faunas.

0403 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Cristhian Cadena¹, Alicia Kennedy², Aaron Bauer³, Monte Thies¹, Patrick Lewis¹

¹*Sam Houston State University, Huntsville, Texas, USA*, ²*University of Texas-Austin, Austin, Texas, USA*, ³*Villanova University, Villanova, Pennsylvania, USA*

Cranial Morphology of the Cape Dwarf Gecko (*Lygodactylus capensis*) Using High Resolution X-ray Computed Tomography

The gekkonid gecko genus *Lygodactylus* (dwarf geckos) comprises 63 species restricted to Sub-Saharan Africa, Madagascar, and portions of South America. *Lygodactylus* are both

miniaturized and secondarily diurnal, and this is likely to affect the skeletal morphology of these geckos. Currently, however, only incomplete osteological descriptions of a few species of *Lygodactylus* are available. A detailed description of the cranial anatomy of mature and half-grown specimens of *Lygodactylus capensis* is presented here, based on High Resolution X-ray Computed Tomography (HRXCT) imagery. Due to a complex sequence of postnatal fusions of cranial bones, a juvenile specimen exhibited characters absent in the adult. The fully disarticulated basicranium of a juvenile specimen shows that both the basioccipital and otooccipital elements contribute to the occipital recess, contrasting the condition seen in other miniaturized geckos. The postparietal process contacts both the prootic and otooccipital in the juvenile specimen, although this association is difficult to discern in the adult specimen. The sphenoccipital tubercle is composed primarily of the anterolateral edge of the basioccipital, with only a minor contribution from the otooccipital. A suture along the sagittal plane of the frontal bone is still evident in the juvenile specimen, indicating that the fusion of this element occurs at a relatively late developmental stage.

0235 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

David Camak, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Adding fuel to the fire: A phylogeographic assessment of diversity within the firemouth cichlids (*Thorichthys*: Cichlidae)

Thorichthys is a Neotropical cichlid genus in the Tribe Heroini (Teleostei:Cichlidae) with nine currently recognized species that are collectively distributed along the Atlantic slope from southern Veracruz, Mexico into Belize and northern Guatemala. Species descriptions for many species within *Thorichthys* have been incomplete, and diagnostic characters used are often overlapping. In addition, the geographic distributions of the species are often unclear, thereby making taxonomic and phylogenetic studies challenging. Although the genus is considered monophyletic, relationships of species within the genus have only been addressed with mitochondrial DNA and have been of limited geographic scope. Therefore, a better understanding of the phylogenetic relationships and levels of phylogeographic variation within species in the genus is warranted. We conducted a multilocus phylogenetic study of *Thorichthys* to examine the phylogenetic relationships and divergence times to better understand the evolutionary history of this genus. Results suggest distinct species groups corroborating the current taxonomy for most species, although some species show little to no variation between the widely distributed firemouth cichlid (*Thorichthys meeki*). More troubling, various individuals, based on published sequences from previous studies, are phylogenetically positioned in unexpected places, thereby questioning the identification of the species used in these studies. Furthermore, these misidentified species have been regularly used in higher level phylogenetic studies of cichlids, thereby re-emphasizing the

importance of complete species descriptions and accurate presentation of the geographical ranges of species.

0229 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Arley Camargo¹, Mariana Morando¹, Luciano J. Avila¹, Jack W. Sites²

¹CENPAT-CONICET, Puerto Madryn, Argentina, ²Brigham Young University, Provo, UT, USA

Morphological Evolution in the *Liolaemus darwini* Species Group (Squamata: Liolaemini) Suggests Adaptive Diversification Associated with Climatic Niches

Patterns of diversification at the macroevolutionary level can be due to adaptive processes or simple random divergence, and adaptive divergence can be driven by natural selection in response to ecological factors and/or sexual selection. We evaluated diversification models in the *L. darwini* group using comparative phylogenetic methods. We took seven morphometric measurements for all species, obtained climatic data from georeferenced localities, and used the phylogeny of Camargo et al. (2012). We compared Brownian motion vs. adaptive models of diversification based on the morphological variation mapped on to the phylogeny (R packages *picante* and *geiger*). We compared the evolutionary rates among ecomorphological traits and sexual dimorphism based on Mahalanobis and phylogenetic distances among species pairs. We evaluated the evolutionary correlation between the morphological variation and the climatic niches using a phylogenetic canonical correlation analysis (R *phytools*). Three morphometric traits showed phylogenetic signal and fit a model of adaptive optima better than a Brownian model. Morphological divergence and sexual dimorphism variation was similar between species pairs, suggesting that both natural and sexual selection have operated during diversification of this clade. Taking into account phylogeny, the among-species morphological variation of males is significantly correlated with the variation in climatic niches. These results suggest that adaptive diversification in the *L. darwini* group took place as a response to divergent climatic niches in gradients of the Monte Desert in west-central Argentina. Our results also support recent theoretical and empirical findings suggesting that sexual selection can interact with natural selection to complete processes of adaptive speciation.

0091 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Todd Campbell

University of Tampa, Florida, USA

Synergistic Effects and Management of Two Invasive Carnivorous Lizards in Florida

Over 50 species of introduced reptiles are established in Florida. The Nile monitor (NM; *Varanus niloticus*) and Argentine black-and-white tegu (ABWT; *Tupinambis merianae*) are the largest of the established lizards. My team has been studying NMs in Cape Coral since 2003 and ABWTs near Tampa since 2012. Both species were captured with live traps baited with carrion (NMs) or chicken eggs (ABWTs) and dissected to assess their reproductive cycles and diets, and aged via skeletochronology. Since 2003, over 400 NMs have been captured and processed. NMs reproduce from April to August, and begin reproduction as early as two years of age. They consume a wide variety of prey types, but the high proportions of amphibians and reptiles, particularly whole clutches of turtle eggs, are particularly disconcerting, and may partly explain differences in head morphology of the invasive population. Management options are disappearing rapidly in Cape Coral as inaction by federal and state agencies continues. In 2012, 18 ABWTs were captured and processed. While their reproductive cycle could not be assessed, three gopher tortoise hatchlings (*Gopherus polyphemus*) were retrieved from their stomachs. The diets of Florida NMs and ABWTs are significantly different from the diets of these species in their native ranges. Currently, both are confined to urban and rural areas and barely overlap, but are rapidly expanding and will likely occupy vast areas of peninsular Florida and eventually become broadly sympatric and have synergistic and potentially devastating effects on native amphibians and reptiles and their prey.

0760 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Omag Cano, Gamaliel Castañeda, Amorita Salas

Universidad Juárez del Estado de Durango, Gómez Palacio, Durango, Mexico

Bullfrog (*Lithobates catesbeiana*) as an exotic predator in State Park Cañón de Fernández Durango, México

The American bullfrog (*Lithobates catesbeiana*) is one of the most dangerous species worldwide, though in Mexico there is little information about the negative effects of their colonization. As predators they tend to be generalists and the capacity of taking any large prey into their mouth relies on the mouth opening size. Bullfrogs can ingest other frogs and they also are known to displace native frog populations in other sites

around the world. In State Park Cañón de Fernández (Durango, México) we captured 30 frogs and separated them by sexes and age classes (juveniles and adults). We did an Importance value index to estimate the degree of impact on the native fauna by the bullfrog. Also, measures for niche width and trophic niche overlap were made among both classes and sexes. The main component found was the red crayfish (*Procambarus clarkii*) due to their high amount of relative volume compared to other invertebrates reported. Other items reported were coleopterans, hymenopterans and other eight different groups of invertebrates. Niche width index showed that bullfrogs act as opportunists rather than generalists. Also results showed that usage of food resources is similar among age classes and sexes.

0177 AES Ecology, Mesilla, Thursday 11 July 2013

Aaron Carlisle¹, Steven Litvin¹, Daniel Madigan¹, Kenneth Goldman², Sora Kim³, Barbara Block¹

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Use of the California Current as a nursery area by juvenile salmon sharks

The use of nursery areas by elasmobranchs is an important life history strategy that is believed to reduce mortality and/or increase growth rates. The endothermic salmon shark (*Lamna ditropis*) is believed to use the California Current System (CCS) as a nursery area, though outside of their occurrence in the CCS, nothing is known about habitat use or trophic ecology of juveniles. Studying how juvenile salmon sharks use the CCS has been limited by access to small sharks; however, young sharks consistently strand along the west coast of North America, providing an opportunity to study these animals using methodologies that do not require live specimens. We used records of stranding events to describe the spatial and temporal pattern of strandings and inform our understanding of distribution patterns. We also collected tissues for stable isotope analysis (SIA) from stranded sharks to examine trophic ecology and habitat use of juvenile sharks in the CCS, in particular to identify likely prey and habitats used by juvenile sharks. By integrating these two data sources, we are able to describe general patterns of distribution, habitat use, and diet of juvenile sharks in the CCS, and offer some theories about why strandings may occur.

0454 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Amy Carlson, James Sulikowski

University of New England, Biddeford, Maine, USA

Horizontal and Vertical Movement Patterns of Northwestern Atlantic Spiny Dogfish (*Squalus acanthias*)

Spiny dogfish (*Squalus acanthias*) are assumed to be a highly migratory species, making habitual north-south migrations throughout their Northwestern Atlantic U.S range.

Also assumed to be a benthic species, spiny dogfish stock structure is estimated through NEFSC bottom trawl surveys. Recent anomalies in population trends, including a recent four-fold increase in spawning stock biomass, suggest alternative movement behaviors may exist for this species. To obtain a better understanding of the horizontal and vertical movement dynamics of this species, Microwave Telemetry Pop-off Satellite Archival X-Tags have been attached to forty adult spiny dogfish at the northern (Gulf of Maine) and southern (North Carolina) extents of their central U.S. geographic range.

Reconstructed geolocation tracks, ranging in lengths from 2 to 12 months, suggest that the seasonal migration patterns may be local in nature to the respective deployment sites which differs from the previously published paradigms. Significant differences in distance between deployment origin and geolocations indicate two unique migration patterns, further supported by kernel utilization distribution models suggesting strong separate core home ranges between the tagging locations. Between the two regions, significant differences were also noted in abiotic preferences, such as temperature, depth, and distinct diel movements. In addition, vertical preferences indicate this species may not utilize the benthos as previously thought. The results of the current study suggest regional management of the species may be more appropriate, and coastwide NEFSC bottom trawl surveys may not be as accurate at estimating spiny dogfish populations as once perceived.

0685 Fish Conservation I, Doña Ana/Cimarron, Thursday 11 July 2013

Evan W. Carson¹, Ma de Lourdes Lozano-Vilano³, Lilia Vela-Valladares², Iris Banda-Villanueva², Thomas F. Turner¹, Mauricio De la Maza Benignos²

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Genetic diversity and effective population size of the critically endangered Julimes pupfish, *Cyprinodon julimes*

Cyprinodon julimes is a microendemic pupfish of the Chihuahuan Desert, Mexico. This critically endangered species is one of two pupfishes that share the distinction of having the highest extended tolerance to thermal stress among known teleosts. Our study assessed genetic variation in mitochondrial DNA sequences and nuclear encoded microsatellite loci, as well as contemporary and long-term inbreeding effective population size for the latter. Results are discussed with respect to long-term genetic monitoring and the 'Vital Signs' conservation initiative for *C. julimes*.

0751 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Lacie Carter, David Kerstetter

Nova Southeastern University, Dania Beach, Florida, USA

Elasmobranch Sensory Stimulation as a Bycatch Reduction Technique in Commercial Fisheries

Incidental catch of elasmobranchs on hooks intended for target species in commercial fisheries may have negative impacts on commercial fisheries, ecosystem dynamics, and conservation efforts. Recent studies have sought to repel sharks from baited hooks by stimulating the elasmobranch sensory system. This study follows this idea: a small epoxy-based capsule has been designed that, when immersed in water, emits a small electrical signal. These capsules, placed slightly above baited hooks, will be field tested in commercial longline fisheries with the intention is that sharks will be attracted to the bait, but then get distracted by the capsule before ingesting the bait and being caught. At the time of this writing, field tests are in process, and results will be presented at the Joint Meeting of Ichthyologists & Herpetologists in July 2013.

Tiago P. Carvalho, James S. Albert

University of Louisiana at Lafayette, Lafayette, LA, USA

Systematics and Evolution of the Toothless Knifefishes Rhamphichthyoidea (Ostariophysi: Gymnotiformes): Phenotypic Adaptation and Habitat Specialization Trade-offs

Rhamphichthyoidea is a morphologically diverse clade of Neotropical knifefishes with 40 described species and around 20 undescribed. Traditionally this group is distributed in two families: short-snouted Hypopomidae and long-snouted Rhamphichthyidae. The relationships of Rhamphichthyoidea are uncertain regarding whether Steatogenini is sister to Rhamphichthyidae or part of Hypopomidae. Rhamphichthyoid fishes inhabit a variety of habitats in lowland freshwaters; as small streams, river channels, and floodplains. We report results of a comprehensive phylogenetic analysis of Rhamphichthyoidea using 147 morphological characters and three mitochondrial markers (16S, COI, CytB). Geometric morphometrics was then used to study snout shape evolution, using 18 landmarks of the suspensorium and oral jaws digitized in TpsDig, and character evolution analyzed using Morpho J. Phylogenetic results indicate Steatogenini is sister to Rhamphichthyidae, not Hypopomidae, with support from both morphological and molecular datasets. The result indicates that a large displacement in the occupancy of the morphospace occurred in the base of Rhamphichthyidae and Steatogenini, which is associated with the snout elongation of the former. This coincides with the rhamphichthyid invasion of river channels according with ancestral reconstruction of habitat type. In Rhamphichthyidae limited subsequent morphological diversification in the suspensorium and oral jaws in Rhamphichthyidae is observed. Contrary to that Hypopomidae, explored more broadly the morphospace including regions occupied by Steatogenini species indicating convergence. Rhamphichthyidae has a high lineage density in the morphospace as compared with Steatogenini or Hypopomidae, suggesting that the origin of long snouts, which may have facilitated colonization of deep channels, also reduced subsequent phenotypic disparity.

0076 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Tiago P. Carvalho, Emmanuel L. Maxime, James S. Albert

University of Louisiana at Lafayette, Lafayette, LA, USA

Morphological Data Structure Current Understanding of Neotropical Fish Diversity

Neotropical freshwater fishes form the most species-rich and species-dense vertebrate fauna on Earth, with more than 6,000 species. Most (70%) available species phylogenies for Neotropical freshwater teleosts employ comparative morphology, partly because species-level sampling for most taxa requires collections over large (continental) scales, and because museum specimens are readily available from more than a century of scientific collecting. We identify several circumstances where morphology provides irreplaceable data. 1) Alpha taxonomy based on morphology forms the basis for fauna-wide analyses. 2) Fossils provide essential information on the spatial and temporal scales of diversification used for estimating minimum lineages divergences times and the age of phenotypic origins: e.g. *Corydoras revelatus* (Callichthyidae), *Gymnogeophagus eocenicus* (Cichlidae). 3) Extinct or relictual species known from museum specimens are often phylogenetically important: e.g. *Lithogenes villosus* (Loricariidae), *Rhizosomichthys totae* (Trichomycteridae). Many phylogenetically important species are extinct in wild; e.g. *Spintherobolus papiliferus* (Characidae). 4) Rare species, or species from localities difficult to sample, with transitional phenotypes. Some taxa known only from morphology are critical to resolve interrelationships; e.g. *Iracema caiana* (Rhamphichthyidae). Many species are also known from types only, or are so poorly understood that types provide unique information on species identity: e.g. *Gymnotus inaequilabiatus* (Gymnotidae). Computed tomography is shown to provide rich osteological information for the study of rare and phylogenetically or taxonomically important specimens. Despite the rapid growth of molecular information in this fauna, most current understanding of species richness, endemism, and interrelationships continues to be based on alpha taxonomy, largely informed by morphology alone.

0706 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Gamaliel Castañeda¹, Sara Valenzuela¹, Hector Gadsden², Fausto Mendez³

¹*Universidad Juarez del Estado de Durango, Durango, Mexico*, ²*Instituto de Ecología A.C, Chihuahua, Mexico*, ³*Universidad Nacional Autónoma de México, Mexico, Mexico*

Thermoregulation of *Uta stansburiana* at the South of its Distribution

Reptiles regulate body temperature mainly by displacement among sunny and shaded places; due to this behavior they are susceptible to global warming and habitat erosion.

For this reason, the study of thermal quality of the habitat and effectiveness of thermal regulation of lizards may reflect the intensity of their vulnerability. We describe thermal ecology of three populations of *Uta stansburiana* by calculating its precision and effectiveness of thermal regulation at the southeasternmost range of its distribution. *U. stansburiana* lizards were collected at the localities of Mapimi, San Juan de Guadalupe (Durango) and Matamoros (Coahuila). Air, substrate and body temperature of the lizards were recorded on field. Dataloggers were deployed on microhabitat for recording operative temperatures for each population. Set-point temperatures were estimated in a laboratory thermal gradient. Thermal quality of the habitat, precision and effectiveness of thermal regulation were calculated according Hertz protocol. The body temperature of lizards, both on field and lab were higher at San Juan de Guadalupe population, although thermal quality of the habitat, precision and effectiveness of thermal regulation tend to be similar for the three localities.

0489 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Christina Casto, Katherine Greenwald

Eastern Michigan University, Ypsilanti, Michigan, USA

Survivorship of Ploidy-Variable Unisexual *Ambystoma* Salamanders Across Stages of Development

Unisexual *Ambystoma* salamanders reproduce through a unique mode known as kleptogenesis. Entirely female populations can persist by "stealing" genetic material from males of compatible sexual *Ambystoma* species (e.g., the Jefferson salamander *A. jeffersonianum*, and the blue-spotted salamander *A. laterale* within SE Michigan). Kleptogenesis can result in ploidy-variable embryos within the same egg mass because the female may or may not incorporate the genome acquired from a male ambystomid. Therefore, diploid, triploid, tetraploid and pentaploid individuals can be found in unisexual populations. Little is known about the survivorship of ploidy-variable individuals across stages of development. Previous results suggest a decline in tetraploid and pentaploid individuals between larval and adult stages and that the triploid individuals are the most abundant. To determine when the mechanism for selection manifests, we assessed the frequency of ploidy levels (determined by microsatellite analysis) in three populations across four life stages within a single year: breeding adults, early larvae, late larvae, and metamorphs. We found that, instead of an abrupt change due to high-ploidy individuals not surviving metamorphosis, there is a gradual decline in tetraploid individuals as early larvae become juveniles. This suggests that selection, possibly through developmental complications, against higher ploidy-level individuals occurs gradually throughout larval development.

0127 AES Reproduction, Mesilla, Sunday 14 July 2013

Chris L. Chabot

UCLA, Los Angeles, CA, USA

A comparison of the frequency of multiple paternity between two populations of the brown smoothhound shark, *Mustelus henlei*

Multiple paternity was recently observed in a population of the brown smoothhound shark, *Mustelus henlei*, from Las Barrancas, Baja California Sur, Mexico with litters demonstrating the greatest percentage of multiple paternity for any shark species (0.93 of litters and an average number of sires = 2.3). To determine if this frequency is consistent elsewhere in the species' range, 4 polymorphic microsatellite loci were used to determine the frequency of multiple paternity in 18 litters of *M. henlei* from Santa Catalina Island, CA sampled in 2004, 2008, and 2012. Overall, multiple paternity was detected in 0.22 of litters with an average of 1.3 sires per litter. Multiple paternity varied among sampling periods with 2004 demonstrating multiple sires for 0.4 of sampled litters (n = 10) and 2008/2012 demonstrating a total lack of multiply sired litters (n = 8). Although multiple paternity was detected in this study, the frequency of occurrence is lower than that observed in the Mexican population. Based on these findings, investigators should take location into consideration when assessing the existence of multiple paternity in future studies of elasmobranch species.

0128 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Chris L. Chabot

UCLA, Los Angeles, CA, USA

Population connectivity of the brown smoothhound shark, *Mustelus henlei*, in the northeastern Pacific and the Gulf of California

To determine the effects of the prominent biogeographic and phylogeographic barriers of the northeastern Pacific (Point Conception, the Los Angeles Region, and the Peninsula of Baja California) on the population connectivity of the temperate brown smoothhound shark, *Mustelus henlei* (Triakidae), data from the mitochondrial control region (mtCR) and six nuclear microsatellite markers were used to measure gene flow among sample localities from throughout the range of the species (San Francisco Bay, CA, Santa Barbara, CA, Santa Catalina Island, CA, Punta Lobos, Baja California Sur, Mexico, and the northern Gulf of California). Microsatellite data demonstrated significant contemporary gene flow among all localities with mtCR sequence data detecting significant structure between both San Francisco Bay and Santa Catalina Island and all other localities. Based on these results, female philopatry to the known nursery of San

Francisco Bay may have been detected as well as the identification of a putative nursery at Santa Catalina Island. Furthermore, the barriers of the northeastern Pacific seem to have little effect on the contemporary population connectivity of *M. henlei*.

0336 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Tyler K. Chafin¹, Marlis R. Douglas², Michael E. Douglas¹

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Conservation Genetics of Humpback Chub (Cyprinidae) in Grand Canyon, Arizona

The endangered Humpback Chub (*Gila cypha*) is a morphologically unique minnow endemic to the Colorado River in western North America. An understanding of its ecology is impeded by its distribution within fast-flowing rivers with limited access. Of particular interest are the interrelationships among 9 canyon-bound subpopulations (aggregates) within the 446 km river corridor of Grand Canyon. These aggregates are associated with specific geomorphic reaches and/ or tributaries, yet it is unclear if their distributions were shaped by historical physical processes or are a result of anthropogenic habitat alterations that stem from construction in 1963 of Glen Canyon Dam (Lees Ferry AZ). To evaluate its distribution, we quantified genetic variability across 16 microsatellite DNA loci in 234 chub, as well as from 15 samples of the endangered Bonytail Chub (*Gila elegans*) so as to estimate the potential for introgressive hybridization. Bayesian analyses (*Structure* and *BayesAss3*) were used to quantify interrelationships of aggregates, gauge levels of dispersal among them, and assess their demographic independence so as to inform adaptive management scenarios.

0080 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Prosanta Chakrabarty¹, Caleb McMahan¹, William Fink², Melanie Stiassny³, Mike Alfaro⁴

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Phylogenetic insights into the evolution of Ostariophysi (Gonorynchiformes, Cypriniformes, Characiformes, Siluriformes, and Gymnotiformes) using Ultraconserved Elements

Ostariophysi is a superorder containing over 8,000 species (roughly 25% of all known bonyfishes and 75% of all freshwater fishes) in 1100 genera and 70 families. This superorder is divided into five major lineages: Gonorynchiformes (milkfishes and sandfishes), Cypriniformes (carps and minnows), Characiformes (tetras), Siluriformes (catfishes), and Gymnotiformes (Neotropical electric knifefishes). The relationships among these major groups remain poorly understood. Molecular and morphological analyses have yet to result in a consensus phylogeny except that most previous analyses distinguish Anotoptysi (Gonorhynchiformes) from the remaining four lineages (grouped together in Otoptysi). The Otoptysi lineage is united based on a number of unique features including a Weberian apparatus (a particular arrangement of vertebral structures that connect the swimbladder to the auditory system) and the production of a unique chemical alarm substance (Schreckstoff). In this analysis we use massively parallel sequencing techniques in a next-generation framework that utilizes the phylogenetically informative flanking regions of ultraconserved elements (UCE) to produce a phylogeny of thirty representative ostariophysan taxa. The UCE approach results in a highly supported and well-resolved phylogeny from several hundred genetic loci in one the most data-rich analyses of its kind.

0269 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY, Galisteo/Aztec, Friday 12 July 2013

Jeremy Chamberlain, Matthew Gifford

University of Arkansas at Little Rock, Little Rock, AR, USA

Variation in maternal provisioning of offspring in watersnakes from different resource environments

Capital-breeding reptiles allocate the majority of their energetic investment to offspring from stored resources during vitellogenesis. Thus, embryonic and neonatal growth

before the first feeding is fueled from only those resources allocated at vitellogenesis. Allocated lipid reserves, in particular, have important and diverse functions during growth and development within neonate diamond-backed watersnakes (*Nerodia rhombifer*), a capital-breeding reptile. Relative and absolute abundance of each allocated lipid class may vary within and between populations due to variation in the quantity and quality of prey resources. Variation in total lipid and proportions of lipid from different classes may influence early growth and survival in these snakes.

Triacylglycerols (TAG's), the major energy storage lipids, may especially fluctuate in absolute and relative abundance as this lipid class constitutes the majority of fat deposits in adults and is known to fluctuate throughout the year. This study examines the influence of environmental variation in prey availability and quality on lipid allocation to neonate diamond-backed watersnakes in three populations in Arkansas. Pregnant females collected from each site gave birth in lab. Neonate snakes were euthanized and lipid was extracted using standard methods. Total lipid quantity and the absolute and relative abundance of each lipid class were quantified using thin-layer chromatography. This study tests the hypothesis that females with access to higher quantity and/or quality food allocate more total lipid and proportionally more TAG's to their offspring than females with poorer quality or more variable prey.

0766 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

E. Anne Chambers, Paul D. N. Hebert

University of Guelph, Guelph, ON, Canada

Museums, molecular methods, and misidentification: DNA barcoding North American herpetofauna

DNA barcoding allows for the rapid identification of species based on sequence divergence in a segment of the mitochondrial cytochrome *c* oxidase subunit 1 gene. We assessed the applicability of DNA barcoding 1) as a technique for delimiting species of North American reptiles and amphibians, 2) for detection of errors in museum collections and morphological identifications, and 3) in the recovery of the barcode region from formalin-fixed specimens. We sequenced 1,083 samples, 197 of which were formalin-fixed. Construction of a neighbor-joining tree using the Kimura-2 parameter and analysis of pairwise distances revealed that 12 specimens from a single institution clustered separately from their species group. Investigation revealed that databasing or labeling errors had occurred for each of these specimens. Additionally, *Apalone spinifera* specimens formed two distinct clusters, indicating potential misidentification due to specimen damage. Comparisons to previously identified specimens from this study as well as sequence comparisons using online databases supported these results, suggesting that multiple specimens were *Apalone ferox*. Using multiple primers and a refined PCR regime for formalin-fixed specimens resulted in the successful amplification of fragments from the COI gene, demonstrating that formalin collections could be used

to expand genetic databases. Heightened conservation efforts for herpetofauna have made museum collections an invaluable source for molecular work. This study provides a reference library of DNA barcodes that can be used to quickly and effectively flag errors in both museum collections and morphological identifications. This study also highlights the merit of further investigation into obtaining genetic material from formalin-fixed tissue.

0536 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Stevland Charles, George Middendorf

Department of Biology, Howard University, Washington, DC, USA

Habitat and Microhabitat Use, Daily Activity Patterns and Relative Abundance of *Gonatodes* (Squamata: Sphaerodactylidae) in Trinidad and Tobago

Relatively little is known of the ecology of most of the Neotropical diurnal geckos of the genus *Gonatodes* and very few ecological studies of lizards have been conducted in Trinidad and Tobago. We present the findings of ecological field studies on four species of *Gonatodes* from Trinidad and Tobago. Between 2006 and 2012, over the course of 174 field days and 844.5 person hours, we conducted time constrained visual surveys which focused on microhabitat and habitat use parameters, activity period and relative abundance of *Gonatodes* at multiple sites on small satellite and large main islands. Sympatric *Gonatodes* tended to segregate along habitat parameters, and when syntopic segregated along microhabitat parameters. *Gonatodes* demonstrated bimodal peaks in daily activity patterns that seemed to be associated with ambient temperature, and abundance was higher at satellite island sites than at main island sites. Comments are also made regarding trends in distribution patterns of male polymorphs of two species of *Gonatodes* across two main habitat types.

0506 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Louise Chavarie¹, Kimberly Howland², William Tonn¹

¹*University of Alberta, Edmonton, Alberta, Canada*, ²*Fisheries and Oceans Canada, Winnipeg, Manitoba, Canada*

Resource Polymorphism in Lake Trout: the Coexistence of Multiple Shallow-Water Morphotypes in Great Bear Lake, Canada

Although intraspecific morphological variation is not uncommon among fishes in northern lakes, it is thought to be relatively limited in Lake Trout and associated

primarily with niche partitioning by depth and diet. Preliminary studies suggested, however, that several morphotypes of Lake Trout coexisted in the shallow (<30m) waters of Great Bear Lake, Northwest Territories, Canada. To quantify morphological differences among adult and juvenile shallow-water Lake Trout from Great Bear Lake, we combined classical morphometric/meristic measures with shape analysis (geometric morphometrics). A cluster analysis of 558 adult Lake Trout distinguished three different morphs that co-exist in the shallow waters of Great Bear Lake. A fourth distinct albeit rarer morph was also identified from other analyses. In contrast, no consistent patterns of variation were found among juveniles, suggesting that divergence develops at later stage. The most important differences among adult morphotypes were associated with head and fin measurements, whereas body shape was less distinctive. Furthermore, we found that within adult morphotypes, morphology, including body shape, varied among each sub-section, or arm, of this large northern lake. Preliminary analyses of diets, fatty acids, and stable isotopes suggested the observed morphological variation is associated with trophic differentiation. This intraspecific diversity challenges prevailing ideas that Lake Trout has a low degree of phenotypic variation compared to its congeneric relatives, especially Arctic Char, and that Lake Trout ecomorphs are segregated primarily by depth.

0442 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Evan Chipouras¹, Erich J. Dietterle¹, Johanna F. Polsenberg², Floriane Cardiec²

¹*Department of Biology, University of Tampa, Tampa, Florida, USA*, ²*Wildlife Conservation Society, Libreville, Gabon*

Preliminary Characterization of Fish Assemblages Targeted by Small-scale Fishers in Mangrove-dominated Habitats of the Komo River and Mondah Bay Estuaries, Gabon, West-Central Africa

The Komo River and Mondah Bay Estuaries are located on the northwest coast of Gabon, West-Central Africa. These mangrove-dominated estuaries provide hydrological linkages between freshwater habitats within the Lower Guinea Ichthyofaunal Province and the Guinea Current Large Marine Ecosystem (LME #28). Previous studies have been conducted which describe mangrove fish assemblages from other sites within the region. However, these investigations were restricted to estuaries located between Senegal and the Gambia in the west and Nigeria in the east and, therefore, did not include systems within the Gulf of Guinea South Ecoregion (MEOW #85). Multi-panel variable-mesh-size gill nets and finer-mesh seine and block nets were employed to capture animals in larger channels and smaller tributaries, respectively. Fishes were identified to lowest taxonomic level, and by-category abundances and sample or sub-sample length and mass measurements were recorded. Physical parameters including depth, turbidity, surface and bottom temperature, salinity, pH, and dissolved oxygen were also measured at each site. Of particular interest was the characterization of assemblage constituents known to be targeted by regional artisanal

fishers based on previous field and landings-survey observations. Results were compared with those obtained from studies conducted in other West African mangrove-dominated systems in order to better inform ongoing management and conservation efforts.

0366 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Heather Christiansen¹, Nigel Hussey¹, Sabine Wintner², Jeremy Cliff², Sheldon Dudley², Aaron Fisk¹

¹Great Lakes Institute for Environmental Research, University of Windsor, Windsor, On, Canada, ²KwaZulu-Natal Sharks Board, Umhlanga Rocks, South Africa

Sample preparation techniques for stable isotope analysis of elasmobranch vertebrae

Stable isotope analysis (SIA) provides an important ecological tool to study the feeding and movement dynamics of animals. Elasmobranch vertebrae can be serially sampled to obtain an isotopic history of an individual from birth to death. It has been suggested that elasmobranch vertebrae must be decalcified before undertaking SIA because the inorganic portion of the vertebrae may affect isotopic values. In this study, we used three species of shark (white (*Carcharodon carcharias*), tiger (*Galeocerdo cuvier*), and sand tiger (*Carcharias taurus*)) to study the effects of sample preparation techniques on shark vertebral isotopic compositions. First, we determined the minimum sample weight required to obtain an accurate and consistent isotopic value on our IRMS (Isomass Delta V) using a non-dilution program. We then compared the isotopic values of untreated vertebrae vs. vertebrae treated with ethylenediaminetetraacetic acid (EDTA). We found no significant difference in $\delta^{13}\text{C}$ values for white and tiger sharks between treatments, but for sand tigers differences were observed. There was no significant difference between $\delta^{15}\text{N}$ values of treated and untreated samples for any species. Lastly, the percent yield of material for SIA following standardized EDTA treatment also varied among species. Given these results it is recommended that EDTA treatment is unnecessary for SIA of white and tiger shark vertebrae, however it may be necessary for sand tiger sharks. We recommend conducting a preliminary study investigating the weight of vertebral material required to obtain a reliable isotopic value and to determine if EDTA treatment is needed specific to your species and instrument.

0358 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, AES CARRIER AWARD

Heather Christiansen¹, Victor Lin², Sho Tanaka³, Anatoly Velikanov⁴, Henry Mollet⁵, Aaron Fisk¹, Nigel Hussey¹

¹Great Lakes Institute for Environmental Research, University of Windsor, Windsor, ON, Canada, ²Taipei, Taipei, Taiwan, ³School of Marine Science and Technology, Tokai University, Shimizu, Shizuoka, Japan, ⁴Sakhalin Research Institute of Fisheries & Oceanography, Yuzhno-Sakhalinsk, Russia, ⁵Moss Landing Marine Laboratories, Moss Landing, CA, USA

The last frontier: catch records of white sharks (*Carcharodon carcharias*) in the Northwest Pacific Ocean

White sharks are globally distributed apex predators in temperate, sub-tropical and tropical waters. Our knowledge of their biology and ecology has increased recently based on dedicated research at aggregation sites. For the Northwest Pacific Ocean, little is known regarding white sharks aside from short notes documenting occurrence. This study provides a comprehensive meta-analysis of 240 observations of white sharks from the Northwest Pacific Ocean between 1951 and 2013. Records include by-catch in commercial fisheries, from shark attacks and personal observations and were documented from China (32), Japan (129), the Philippines (1), Russia (8), South Korea (22), Taiwan (45) and Vietnam (3). The highest percentage of observations (42%) occurred April-June (spring). Sex was recorded for 113 observations (53 male and 60 female), with no significant difference of sex by country. Of the 60 females recorded 11 were pregnant with individuals ranging from the beginning stages of pregnancy (egg cases present) to near term (1.4 m embryos); on average five embryos were found per litter with a maximum of 10. The smallest shark was 1.3 m total length and weighed 16 kg captured near Popov Island, Russia. The largest shark was 6.02 m total length captured in the East China Sea, while the heaviest shark weighed 2530 kg (Guang Zhou, China). These observations indicate there is a resident population of white sharks in the Northwest Pacific Ocean and given limited data available on this CITES and IUCN Red Listed species, there is a need for dedicated research to assist regional management planning.

0274 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Diana Churchill¹, Michael R. Heithaus¹, R. Dean Grubbs²

¹Florida International University, Miami, FL, USA, ²Florida State University, Tallahassee, FL, USA

Trophic variation within and among hagfish species, a numerically dominant scavenger in the Gulf of Mexico

Hagfish are a numerically dominant benthic scavenger and predator present in the deep-sea communities of the Gulf of Mexico (GoM). Very little attention, however, has focused on the trophic interactions of jawless fish in these communities. We used stable isotope analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) to describe the trophic interactions of three species of hagfish (*Eptatretus minor*, *Paramyxine springeri* and *Myxine mcmillanae*) relative to the rest of the deep-sea fish and scavenger community in GoM. Hagfish (n=217) were collected along the northern slope of the eastern GoM using benthic traps. Because of the highly variable lipid content found in hagfish muscle tissue, we lipid-extracted samples. Lipid extraction resulted in considerable shifts in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$, which both correlated to bulk muscle C:N ratios. After lipid extraction, hagfish isotope values covered a considerable range for both $\delta^{13}\text{C}$ (-19.70 to -14.15) and $\delta^{15}\text{N}$ (6.05 to 15.05) relative to overall variation in the deep-sea community. Neither $\delta^{13}\text{C}$ nor $\delta^{15}\text{N}$ varied with total length for any species. Also, $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values did not differ between *E. minor* and *P. springeri*, but both species showed lower values of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ than *M. mcmillanae*. Interestingly, $\delta^{15}\text{N}$ values of *E. minor* and *M. mcmillanae* were similar to larger deep-sea predators (sharks and teleosts) but *P. springeri* had the lowest mean $\delta^{15}\text{N}$ value of all species (n = 13) sampled. This study represents important baseline information regarding the trophic interactions and variation in stable isotope values within hagfish in the GoM.

0520 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER ICHTHYOLOGY AWARD

Todd Clardy, Eric J. Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Systematic Relationships of the Prickleback Family Stichaeidae (Cottiformes: Zoarcoidei) Using Morphological Data

The prickleback family Stichaeidae is a diverse group of small, eel- or blenny-like marine fishes that are distributed in intertidal and subtidal waters of the northern hemisphere. The family is one of nine in the Cottiformes suborder Zoarcoidei and currently includes six subfamilies, 38 genera, and about 80 species. The systematics of Stichaeidae and their relatives remain unresolved due in part to a lack of fundamental morphological data. A

systematic framework is necessary to address aspects of their biology such as the evolution of life history patterns and biogeography. In this presentation, we present preliminary results of a morphological analysis of Stichaeidae and their relatives. This analysis includes representatives from at least 28 genera of Stichaeidae, all other zoarcoid families, several taxa from within Cottiformes, and additional outgroup taxa scored for over 90 morphological characters. Preliminary analyses indicate that Stichaeidae is not monophyletic. Few of the subfamily units are recovered as monophyletic, and many non-stichaeid taxa are interspersed within the resulting cladograms. The lack of resolution in Stichaeidae could be in part a result of the high degree of homoplasy in the characters. Most clades in the recovered cladograms are supported by a few homoplastic characters. These results reflect the general trend in Zoarciodei for variable and reductive skeletal systems, which makes the identification of synapomorphies for families and subfamilies within the suborder problematic. Additional study needs to be conducted, including adding stichaeid genera and incorporating additional characters, to develop robust hypotheses of the relationships among Stichaeidae and their relatives.

0522 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Todd Clardy, Eric J. Hilton, Wolfgang K. Vogelbein

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Morphology and Ontogeny of Multiple Lateral Lines in the Prickleback Genus *Xiphister*

Several members of the family Stichaeidae have multiple, complexly branching trunk lateral lines that are supported by small, dermal, ring-like ossifications. Multiple lateral lines are rare among teleostean fishes and are found in representatives of only twelve other families. Members of the genus *Xiphister* develop three paired, branching lateral lines along the length of their body, plus a short, mediodorsal canal that extends from the neurocranium to the dorsal fin origin (canals 1-4 in dorsal to ventral sequence). The ossifications that support these canals develop asynchronously and have a developmental pathway distinct from body scales. Canals 1 and 2 develop rostro-caudally at 30mm, followed by canal 4 caudo-rostrally at 38mm, and, finally, by canal 3 rostro-caudally at 40mm. Canals 1 and 2 are connected to the cephalic sensory canal on the head, which features branches radiating from the infraorbital bones that are supported by ring-like ossifications as found on the trunk. Canal 4 develops a short loop around the abdomen, and the left and right sides are connected by a short, anterior medioventral extension. The distribution of neuromasts, the sensory components of the mechanosensory lateral line system, was examined histologically. Superficial neuromasts were observed on most of the body surface of *Xiphister*. Canal neuromasts were observed in only canal 2. The other canals, while similar in structure, lacked neuromasts

and therefore cannot serve a sensory role in *Xiphister*. The functional role of multiple lateral line canals in *Xiphister* warrants further investigation.

0251 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

William Clark¹, Daniel McEwen², Robert Weaver³

¹Western Wyoming Community College, Rock Springs WY, USA, ²University of Minnesota Moorhead, Moorhead MN, USA, ³Central Washington University, Ellensburg WA, USA

Effects of Land Use on Macroinvertebrate Communities and White Sucker (*Catostomus commersoni*) Diet

Extensive landscape modifications of prairie habitat due to agricultural practices have altered the hydrology and species composition of most river basins in the upper Midwest. We analyzed the relationships between fish and macroinvertebrate community structure, watershed and riparian area land use, and fish diet. Thirteen streams, five located in the Missouri River basin of North Dakota and eight located in the Red River Basin of North Dakota and Minnesota, were sampled in the Fall of 2007 and 2008. Macroinvertebrate community was predicted by land use immediate to the tributaries (2000 m riparian sub-corridor), while fish community was predicted by watershed land use. We observed a significant correlation between taxonomic identity of macroinvertebrates in gut samples and those found in the environment. These results suggest white suckers are consuming zoobenthos based on their availability and exhibit a random feeding strategy. In addition, further analysis demonstrates that white suckers practice a size selective foraging behavior (preferentially selecting larger prey) on taxa that are most available in that environment. The ability of white suckers to change their diet in accordance with macroinvertebrate taxa availability in the environment, along with a size-selective foraging behavior may contribute to the broad distribution of this species in North America. The results from this study indicate that land use management of entire watersheds may be necessary to maintain the biodiversity in the Midwestern river systems.

**0259 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Timothy Clay, Matthew Gifford

University of Arkansas at Little Rock, Little Rock, AR, USA

**Thermal Sensitivity of Energy Assimilation and Range Limitation in
*Plethodon***

Thermal sensitivity of energy assimilation should be optimized for local environmental conditions and might serve as a factor limiting species' distributions. Within *Plethodon* there are numerous examples of elevational replacement between montane endemics and lowland congeners. Previous work suggests that the montane endemics are physiologically restricted in distribution; whereas, species interactions primarily limit the distributions of lowland species. In the laboratory, we determined the thermal sensitivity of energy assimilation for several montane and lowland *Plethodon* by measuring standard metabolic rates and energy assimilation rates across a range of ecologically relevant temperatures. Preliminary data suggest that thermal sensitivity of energy assimilation differs between high and low elevation species, but is similar between species inhabiting similar elevation ranges. In particular, high elevation species appear to have narrower thermal performance curves than low elevation species, suggesting specialization to a narrower range of environmental conditions. In addition, the high elevation species appear to optimize energy assimilation at cooler temperatures than do low elevation species. In summary, these physiological patterns are consistent with predictions that montane species are physiologically limited to colder, and perhaps more stable environments, and these cooler high elevation habitats should not exclude the low elevation species through compromised energetics.

**0591 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13
July 2013**

Paul Clerkin¹, Dave Ebert¹, Gavin Naylor²

¹*Moss Landing Marine Laboratories, Moss Landing, California, USA*, ²*Hollings Marine Laboratory, Charleston, West Virginia, USA*

**Reproductive biology and maturity of deep-sea sharks in the Southern Indian
Ocean**

Examination of chondrichthyans from a survey of Southern Indian Ocean seamounts aimed to: 1) survey species in this region, 2) construct a phylogenetic framework of chondrichthyans based on DNA samples as part of the *Assembling the Tree of Life* project, and 3) assess life history characteristics of elasmobranch bycatch. The trawler operated

southeast of Madagascar within an area bounded by 29° – 40° S and 43° – 54° E where seamounts appear to be hotspots of biodiversity. Reproductive and maturity data including sex, length, maturity stage, oviducal gland development, egg width, and number of eggs were recorded from 2,400 chondrichthyans and analyzed.

Approximately 400 specimens of the genera *Centrophorus*, *Deania*, *Centroscymnus*, *Centroselachus*, *Proscymnodon*, *Zameus*, *Etmopterus*, *Dalatias*, *Apristurus*, *Parmaturus*, *Pseudotriakis*, *Hydrolagus*, and *Chimaera* were collected between depths of 500m – 1,500m. Additional data includes: 710 tissue samples for DNA studies, 225 vertebrae and spines for age/ growth studies, and diet data recorded qualitatively from sharks including poorly known species, e.g., *Proscymnodon plunketi* and *Pseudotriakis microdon*, as well as several undescribed species of *Etmopterus*, *Apristurus*, *Parmaturus*, *Hydrolagus*, and *Chimaera*. Project specimens have been deposited the American Museum of Natural History, California Academy of Sciences, and the Smithsonian Natural History Museum. The expedition was an international collaboration between the Pacific Shark Research Center, Moss Landing Marine Laboratories, Hollings Marine Laboratory, College of Charleston, Southern Indian Ocean Deepsea Fishers Association, Sealord Corporation, New Zealand, and the Mauritius Ministry of Fisheries. This project was funded, in part, by NSF grant: DEB 1132229.

0619 AES Ecology, Mesilla, Thursday 11 July 2013

Jesse Cochran¹, Camrin Braun¹, Simon Thorrold², Greg Skomal³, Michael Berumen¹

¹The King Abdullah University of Science and Technology, Thuwal, Makkah, Saudi Arabia, ²Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA, ³Massachusetts Division of Marine Fisheries, Massachusetts, USA

Habitat Use in Aggregating Red Sea Whale Sharks

The whale shark (*Rhincodon typus*) is known to aggregate seasonally in specific sites within its circumglobal range. The recent discovery of an aggregation site on Rope Reef (an inshore reef off the coast of the Saudi Arabia) has provided a starting point for whale shark research in the Red Sea. In March-May of 2010 an array of 32 acoustic receivers was installed on and around Rope Reef. Seventy-five whale sharks (28 male, 30 female, 17 undetermined) were fitted with acoustic tags in 2010, 2011, and 2012. Thirty-three of these sharks were also fitted with satellite tags during the 2010 and 2011 seasons. The acoustic data shows 85% of all detections have occurred in April or May. Over 90% of detections were made by receivers installed on Rope Reef. More than half of Rope Reef detections occurred at its northwest corner (25% of total effort). Both the acoustic and sighting data suggest parity and integration of the sexes within this population. Finally, approximately 40% of tagged sharks are detected again the following year. Satellite data shows that 15 of these phylopatric sharks migrated hundreds of kilometers from the Rope Reef in between aggregation seasons. Describing the characteristics of this

aggregation provides a baseline by which to guide the efforts of future whale shark studies in the area and in the greater Red Sea.

0044 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Phil Cochran

Saint Mary's University of Minnesota, Winona, MN, USA

Observations on a Timber Rattlesnake (*Crotalus horridus*) Color Variant in Southeastern Minnesota

Gray timber rattlesnakes were observed in one of two study areas in southeastern Minnesota. Several measures suggest that relative abundance was low. For example, 2 of 52 nuisance rattlesnakes PIT-tagged during 2006-2012 were gray. Maximum estimates of the percentage of snakes that were gray were provided by the observation of one of eight snakes at one den opening and one of nine at another. Recaptures of gray snakes that were PIT-tagged suggested movement patterns similar to those of other snakes. Four gray snakes observed during 2012 included at least two males, a female with a litter of newborns, and members of at least two age classes. The gray color variant may represent retention of the newborn color pattern by adults.

0718 Fish Conservation, San Miguel, Sunday 14 July 2013

Kathleen Cole

University of Hawaii at Manoa, Honolulu, HI, USA

The sustainability myth: making management and conservation decisions in a reproductive biology information vacuum

Population sustainability in the face of fishing impact and both biotic and abiotic environmental changes is dependent upon population replacement capacity. The latter consists of the ability to produce compensatory numbers of offspring that survive to adulthood and have sufficient individual lifetime reproductive output (LRO) to offset population losses. Ova are the limiting gamete in most commercially important species, so an understanding of female reproductive biology is critical to making valid estimates of population replacement capacity. Individual LRO among females varies according to the number of ova released during a single ovulation event (instantaneous fecundity), the quality of ova produced, the degree of fertilization success, the number of spawning events in a spawning season, and the number of spawning seasons a female remains reproductively active. However, for many commercial species, much of this information is unknown. We do know that all of the factors listed above can have significant

individual variation which will compound sources of error in estimates of individual LRO and population replacement capacity. In addition, there are likely to be as-of-yet undetermined interaction effects among reproductive factors and changing environmental conditions associated with climate change. Consequently, current positive statements as to the health and sustainability of either commercially important or presently unexploited fish populations are likely to be unfounded and premature.

0754 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Levi Cole, Charles Painter, James Stuart

NM Dept Game and Fish, Santa Fe, NM, USA

A Preliminary Status of the Big Bend Slider, *Trachemys gaigeae* in the Middle Rio Grande of New Mexico

Populations of the Big Bend Slider, *Trachemys gaigeae*, face several ecological challenges in the middle Rio Grande in New Mexico. Surveys during 2011 - 2012 in the area suggest that the non-native Red-eared Slider, *Trachemys scripta elegans*, has increased in population size in recent years. The two species are now sympatric throughout the range of *T. gaigeae* in New Mexico and hybridization between the species has been documented. A large collection of tissue samples from both species has been made and plans to investigate the rate of hybridization are being made. Record low water levels in the Rio Grande and Elephant Butte Reservoir may be impacting populations of *T. gaigeae* through the elimination of large areas of aquatic and basking habitat and decreasing nesting success.

0609 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Andrew W Coleman, Greg Sievert

Emporia State University, Emporia, KS, USA

Efficacy of Three Artificial Cover Materials in Herpetological Surveys

Cover objects are commonly used in studies of terrestrial amphibians and reptiles. Despite this, it is often unknown how the use of a particular material as a cover object affects the likelihood of detecting a particular species. This introduces a potential source of bias which must be considered when attempting to detect amphibians and reptiles using this method. Additionally, the different thermal properties of materials commonly used for cover objects make this bias likely to change over the course of a

year, as different species select cover objects that best suit their thermoregulatory needs at different times. Arrays of cover objects were placed at the Ross Natural History Reservation, in eastern Kansas, to detect preferences for wood, tin, or tar paper cover objects by terrestrial reptiles and amphibians. By monitoring these cover objects over the course of five years we determined that tin cover objects resulted in the most detections of reptiles and amphibians, while tar paper resulted in the fewest. The number of detections was highest in spring and lowest in summer for all species, with all three cover materials showing the same seasonal trend. Species-specific material preferences were detected in snakes, but not lizards. The results of this study will assist herpetologists in choosing the cover object material best suited to their research objectives.

0169 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

Angela Collins¹, Luiz Barbieri¹, Philip Motta²

¹Florida Fish and Wildlife Conservation Commission, Saint Petersburg, FL, USA,

²University of South Florida, Department of Integrative Biology, Tampa, FL, USA

Behavior and long-term movement patterns of goliath grouper after catch and release

Goliath grouper (*Epinephelus itajara*) have been protected from harvest within US waters since 1990. Despite the moratorium, the species continues to be targeted for catch and release and is also caught inadvertently as bycatch during hook and line fishing for other species. This study was established to identify survival of goliath grouper after catch and release events, and to quantify long term residence and behavioral patterns. Goliath grouper were caught on hook and line, fitted with acoustic tags and monitored via an array of acoustic receivers within the Gulf of Mexico. Between April 2011 and April 2013, 40 individuals (105 - 206 cm TL) were monitored for up to 689 days (17 - 689 d; mean = 336 d). Individuals were observed to have high site fidelity, displaying daily presence at resident sites for periods up to 571 days. Pressure sensors indicated fish position within the water column approximately every 3 minutes, providing confirmation of survival and information regarding diel activity patterns. In August 2011 and August 2012, coincident with spawning season, 30% of tagged fish disappeared from their resident sites and were observed to travel distances as far as 174 km. The majority of these fish returned "home" after absences ranging weeks to months. Individual rates of movement ranged 1 - 5 km/hr (mean = 2.3 km/hr). Preliminary analyses of vertical movement and diel activity patterns will be discussed. Research is ongoing, but results thus far demonstrate high site fidelity and relative resilience to responsible catch and release fishing.

Rupert Collins¹, Ralf Britz², Lukas Rüber³

¹*Universidade Federal do Amazonas, Amazonas, Brazil*, ²*Natural History Museum, London, UK*, ³*Naturhistorisches Museum, Bern, Switzerland*

A Tree of Leaffishes: Phylogenetic Relationships and Biogeography of Two Surprisingly Similar Looking, But Only Remotely Related Percomorph Families (Nandidae, Polycentridae)

Nandid and polycentrid leaffishes represent two superficially similar, but historically poorly diagnosed groups---a situation resulting in a convoluted systematic history. However, recent morphological work (e.g. Kullander and Britz, 2002) provides a basis for exploring their relationships in more detail. Here, we analyse a multilocus nuclear-gene dataset encompassing over 250 percomorph taxa, and generate a revised phylogenetic and biogeographic history of the leaffishes. In terms of biogeography, the Polycentridae, in common with the Cichlidae, show a classic Gondwanan distribution pattern with genera distributed in the freshwaters of both Africa and South America, while cichlids also occur around the southern tip of the Indian peninsula and Sri Lanka. Using relaxed molecular-clock techniques, we test an African-American divergence around the mid-Cretaceous, a pattern which would be consistent with a continental-vicariant explanation of polycentrid and cichlid distribution. In support of the morphological evidence, our results confirm that Polycentridae and Nandidae are only remotely related, and that the classic leaffishes are diphyletic. We also confirm the monophyly of the Nandidae+Badidae and their inclusion into a larger monophyletic group---along with the Pristolepididae, Anabantoidei and Channidae---comprising the Labyrinthici *sensu* Rosen and Patterson (1990). Again confirming morphological hypotheses, we report that the Polycentridae is monophyletic, with *Afronandus* sister to the remaining genera. The family, however, could not be confidently placed among other percomorpha taxa. In contrast to our findings supporting the congruence of molecules and morphology, we additionally present an evaluation of conflicting evidence among morphological and molecular data in the context of the channid-anabantoid sister group relationship.

0339 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Michael Collyer¹, Christopher Hoagstrom²

¹Western Kentucky University, Bowling Green/KY, USA, ²Weber State University, Ogden/UT, USA

Examining the association between ecology and morphology in the Pecos pupfish (*Cyprinodon pecosensis*) in an altered and ecologically diverse landscape

Pupfishes (*Cyprinodon*) are renowned for their high level of endemism in small, isolated habitats and for having exceptionally fast evolutionary rates. Recent evidence has suggested that human disturbances, including conservation efforts, can create “unnatural” selection pressures that lead to novel evolutionary trajectories. Because most *Cyprinodon* species have limited distributions with little ecological variation, understanding in situ evolutionary implications of habitat alteration is challenging. Here, we examine morphological variation of Pecos pupfish (*C. pecosensis*) in a preliminary investigation of associations between habitat and morphology. *Cyprinodon pecosensis* is ideal for this examination because, unlike its congeners, it ranges broadly among sinkhole, spring, marsh, and river habitats. We used an innovative analytical method to characterize morphospace occupied by Pecos pupfish from different habitats. Pupfish in large, diverse waterfowl impoundments (marshes) and spring systems had greater morphological diversity and occupied a “generalized” location of the morphospace. Those in isolated sinkholes occupied a smaller region of morphospace associated with deeper bodies but shallower caudal regions. Pecos pupfish from the Pecos River exhibited a more canalized body shape, which was deep-bodied with deeper caudal regions. The habitats we studied were historically connected, but became isolated over 150 years of land development, river regulation, and groundwater mining. Hence, we attribute the observed morphological divergence to habitat fragmentation. This implies that allopatric evolution of fragmented (refugial or captive) populations is a conservation concern for *C. pecosensis* and, perhaps even more so, for endangered pupfishes adapted to life in unique isolated environments.

0327 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Zuania Colon-Piñeiro, Carla Restrepo, Johanna Delgado-Acevedo

University of Puerto Rico-Rio Piedras, San Juan, Puerto Rico

Subtle skeletal abnormalities in two Puerto Rican *Eleutherodactylus* species increase with forest fragmentation

An increase of *severe* abnormalities among amphibians with indirect development provides unequivocal evidence of the threats faced by this group of vertebrates. Largely unnoticed are *subtle* abnormalities, which may reveal ongoing genetic and environmental stresses with variable fitness consequences. Focusing on two tropical frog species with direct development, *Eleutherodactylus coqui* and *E. antillensis*, we ask two questions. First, what is the prevalence of subtle skeletal abnormalities across a gradient of forest fragmentation? Second, what are the bones and type of abnormalities present across forest fragments? A total of 194 individuals of *E. coqui* and *E. antillensis* collected at three types of forest fragments in northern Puerto Rico where cleared and stained. Bones from the axial and appendicular systems, including right and left sides, were scored based on type of abnormality. The overall prevalence of subtle skeletal abnormalities was 36% but there were differences between *E. coqui* (22%) and *E. antillensis* (51%). Prevalence of subtle skeletal abnormalities increased with habitat fragmentation in *E. coqui* but not in *E. antillensis*. The phalanges of the third and fourth digits of the hind limb were the most commonly affected bones. Interestingly, the number of affected bones varied as a function of species and forest fragment.

Abnormally shaped and absent bones were the most common abnormalities observed. A high prevalence of subtle skeletal abnormalities in *coqui* and *antillensis* together with the observed differences between the two species across the gradient of forest fragmentation suggests that multiple causes may be responsible for the observed patterns.

0220 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER HERPETOLOGY AWARD

Benjamin Colteaux, Cynthia Scheuermann, Derek Johnson

Virginia Commonwealth University, Richmond, VA, USA

Historic Commercial Harvest of the Common Snapping Turtle, *Chelydra serpentina*, in Virginia

Overharvesting of animal populations, largely for economic benefit, has profoundly impacted both fresh water and marine ecosystems worldwide. The most well-known examples of population collapse due to overharvesting have been documented in

fisheries; however reptiles, particularly turtles, are also threatened. The common snapping turtle, *Chelydra serpentina*, is being commercially harvested at record levels in the Mid-Atlantic region to meet the demands of an increasing international market. Here we examine the commercial harvest of common snapping turtles in Virginia, which currently has size restrictions but no take limits, over the past decade with a thorough review of state records. Additionally, we review the harvest records of Maryland and North Carolina, which recently enacted tighter harvest restrictions, to reveal any apparent effects of stricter regulations. Finally, we track prices paid over time from the region's turtle processor to reveal potential economic drivers of commercial harvest. Virginia has experienced significant increases in the number of common snapping turtles harvested from its waterways in the last decade, from 11,522 lbs. in 2002 and to a high of 98,900 lbs. in 2010, with a mean annual harvest of 41,856 lbs. These trends in harvest intensity combined with late sexual maturation (between 5 - 18 years depending on latitude), low reproductive effort (12 - 16 eggs annually), and low hatchling survival (6 - 23%), suggests that continued aggressive harvest of common snapping turtles may be unsustainable in the region.

0691 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Kevin W. Conway, Nicholas Bertrand, Zoe Browning

Texas A&M University, College Station, TX, USA

Heterodonty in the New World Clingfishes (Teleostei: Gobiesocidae)

The majority of percomorph fishes are homodonts, with all oral teeth on the premaxilla and dentary consisting of either the cardiform or villiform type. These plesiomorphic conditions of homodont dentition are widespread among the Gobiesocidae. The only exception are the New World genera of clingfishes in which heterodonty is the norm. In addition to cardiform teeth, New World gobiesocids exhibit caniniform and/or incisiform teeth in various combinations in the upper and lower jaws. New World gobiesocids also exhibit a novel pattern of intraosseous tooth development at the dentary and premaxillary symphyses, in which large replacement teeth (cardiform and/or incisiform on premaxilla and incisiform on dentary) develop in shallow crypts on the lateral (labial) face of the bone. Posterior to the symphysis, tooth development is extraosseous and development occurs in the epithelium overlying the medial (lingual) face of the dentary or premaxilla, as functional teeth are replaced alternately. We document the dentition of New World gobiesocids using a combination of different morphological techniques (clearing and double staining, serial sectioning and micro-CT scanning) and propose a number of novel characters for use in future morphological phylogenetic studies on gobiesocid fishes.

0647 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Brian Cooper, Joel Snodgrass

Towson University, Towson, MD, USA

Relative Influence of Predator Populations on Amphibian Assemblages in Urban Environments

In developed areas, stormwater retention ponds have been used to control runoff from impervious surfaces. Even though it is known that urban ponds support life, it is likely that comparable urban and rural habitats will have different factors structuring their communities. Existing ecological theory views variation in life history characteristics among amphibian larvae as resulting from the tradeoff between avoiding desiccation in shorter hydroperiod ponds and avoiding predation in longer hydroperiod ponds. However, it is unclear if current ecological models adequately describe urban systems. To evaluate the potential role of predator-prey interactions in structuring larval amphibian communities in urban systems, we compared larval amphibian and predator communities in urban and rural ponds along a hydroperiod gradient. Samples of the predator and larval amphibian communities were collected from 28 urban and rural wetlands, located in Baltimore County, Maryland, USA, using dip nets and minnow traps. In both wetland types, variation across the hydroperiod gradient was present. The community structure in larval amphibians was similar in both urban and rural wetlands and was most diverse in longer hydroperiod wetlands. However, predator communities in urban environments were less diverse than their rural counterparts. These results suggest that hydroperiod remains a significant force structuring aquatic communities in urban systems, but disturbance associated with human activities impacts predator communities in urban wetlands with longer hydroperiods.

0562 Amphibian Conservation, Galisteo/Aztec, Friday 12 July 2013

Sarah Corey-Rivas

New Mexico Highlands University, Las Vegas, NM, USA

Using Phylogenetic Signal in Assessments of Amphibian Extinction Risk

Amphibians face dramatic declines worldwide and will benefit from more preemptive approaches to conservation with predictive power. More innovative applications of phylogenetic comparative methods can address the needs of conservation planning and help predict vulnerabilities. Phylogenetic signal can quantify the potential vulnerability of species and clades to particular mechanisms of threat. These methods are especially helpful when applied to poorly known species to assign tentative vulnerability given their clade membership. In this study, I call attention to the evolutionary assumptions inherent in comparative methods models and propose several methods that can improve

detection of signal in extinction risks. I suggest steps to quantify phylogenetic signal given present limitations and challenges in conservation assessments, including the use of phylogenies, branch lengths, and evolutionary assumptions of these metrics. I highlight ways to test for whether data follows a neutral model of evolution (Brownian motion) or a model accounting for the effects of evolutionary constraints (*i.e.* selection). With careful use, phylogenetic methods can allow us to better understand the severity of clade-level threats to amphibians and vulnerability of IUCN data deficient species, and can identify situations with the greatest return on conservation investments.

0322 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Taylor Cotten

Arizona Game and Fish Department, Phoenix, AZ/Southwest, USA

Lowland Leopard Frog Distribution and Habitat Use along the Greater Lower Colorado River Ecosystem

The lowland leopard frog (*Lithobates yavapiaensis*) has not been documented along the Colorado River south of the Grand Canyon in over 20 years. While there have been anecdotal reports of both species on the lower Bill Williams River, there has not been a verified sighting in over a decade. The Arizona Game and Fish Department through a cooperative agreement with USBR began conducting surveys in January 2011. A population of lowland leopard frogs was found on the Bill Williams River upstream from the Bill Williams River National Wildlife Refuge. Habitat was measured at locations where frogs were located. In addition, habitat was quantified at locations locally and regionally where frogs were not observed to compare to areas where individuals were present. Even in the presence of a suite of introduced predators, leopard frogs persist on the Bill Williams River due in part to a dynamic riparian corridor of shallow braided channels. Shallow backwater habitat has allowed the species to survive along with exotic predators and invasive plant species.

0087 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Brad Coupe

Castleton State College, Castleton, VT, USA

An Individual-based, Spatially-explicit Simulation of Male Sidewinder Rattlesnake (*Crotalus cerastes*) Mate-location Methods

I devised an individual-based computer simulation of male and female sidewinder rattlesnake (*Crotalus cerastes*) movement focused on understanding male mate-location methods. Four families of hypothetical male movement patterns were simulated: random-walk/straight-line continuum, spiral, back-and-forth (or “lawn mower”), and prior experience (where simulated males had gained knowledge of female locations). Each of these was tested in two landscapes, one where snakes were randomly distributed and another where they were evenly distributed. Prior-experience methods performed best, but were closely followed by linear searching. Thus, I propose that individual males flexibly adjust their mate-location method with age and experience.

0712 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Matthew Craig¹, Larry Allen³, John Hyde²

¹University of San Diego, San Diego, CA, USA, ²National Marine Fisheries Service, SWFSC, USA, ³California State University, Northridge, CA, USA

On the generic and species limits of *Polyprion* and *Stereolepis* (Polyprionidae)

The family Polyprionidae currently comprises two genera of marine fishes, *Polyprion* and *Stereolepis*, distributed primarily in temperate waters worldwide. *Stereolepis* is comprised of two species from the north Pacific, *S. gigas* and *S. doederleini* while *Polyprion* is represented by either two or three species, *P. americanus*, *P. oxygeneios*, and possibly *P. moeone*. With the exception of *P. oxygeneios*, the other four species superficially resemble each other, casting doubt on the placement of *P. americanus/moeone* and the two species of *Stereolepis* in separate genera. *Polyprion oxygeneios* is morphologically distinct having apparently evolved characteristics to suit its semi-pelagic lifestyle also casting doubt on its placement in a distinct genus. In the present study, we analyzed genetic and morphological data to establish the species limits and phylogenetic relationships among these forms. We use these results to clarify the taxonomic placement of each species into genera reflecting shared ancestry and propose a biogeographic hypothesis for the evolution of the group.

0114 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Callie Crawford

College of Charleston, Charleston, South Carolina, USA

Exploring Chondrichthyan Anatomy through Computed Tomography

Our current understanding of Chondrichthyan phylogeny lags behind those of most vertebrate classes. Of the studies that have been conducted to date, many have produced conflicting topologies. In an effort to address the lack of consensus about Chondrichthyan phylogeny we are examining both molecular and morphological data. Molecular estimates will be constructed from approximately 1000 single copy orthologous nuclear genes while morphological data will be based on comparative skeletal anatomy derived from CT scanned specimens.

In this presentation, I will discuss the skeletal component of this project and the challenges associated with creating digital representations of the skeletal structures. I will also discuss making the interactive representations of the CT scan data available on the internet. Additionally, I will present some skeletal structures we have encountered to date and discuss their implications in the context of alternative hypotheses of evolutionary relationship.

0371 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

Alison Cree¹, Sophie Penniket¹, Stephen Adolph², Jane Girling³, Kelly Hare⁴, Jennifer Rock¹

¹University of Otago, Dunedin, New Zealand, ²Harvey Mudd College, Claremont, CA, USA, ³University of Melbourne, Melbourne, Australia, ⁴Victoria University of Wellington, Wellington, New Zealand

Has reproductive frequency increased over the past 20 years in a viviparous, cool-climate gecko?

Global warming is already being attributed as a cause of extinctions for lizard populations close to the equator. Lizards from high latitudes, however, might be expected to benefit from warmer conditions over coming decades. One such candidate species is the common gecko (*Woodworthia* "Otago/Southland"; formerly *Hoplodactylus maculatus*), a viviparous, nocturnally foraging lizard from southern New Zealand. In the early 1990s, females at Macraes Flat (45°S, c. 600 m asl) were inferred to reproduce biennially with a 14-month pregnancy, a pattern attributed to cooler summers than at lower-altitude sites with annual reproduction. Here, we examined a 20-year data set to

examine whether pregnancy rates at Macraes Flat have since increased and their possible relationship with environmental conditions. The percentage of females beginning a pregnancy in spring varied from 52-88% but has not consistently increased over time. Data from NIWA's Virtual Climate Station network also indicate no significant increase in mean maximum or mean minimum air temperatures over the study period. However, the percentage of female geckos becoming pregnant in spring increased significantly with mean daily solar radiation, whether calculated over the previous summer ($p < 0.01$) or the previous 12 months ($p < 0.005$). This relationship, which could reflect increased basking opportunities, suggests that if climate change results in increased solar radiation rather than increased cloud cover then annual reproduction of geckos could eventually occur at Macraes Flat.

0519 Fish Biology, Doña Ana/Cimarron, Sunday 14 July 2013

Jenna Crovo, Carol Johnston

Auburn University, Auburn, AL, USA

The Effect of Traffic Noise on the Stress Response in the Blacktail Shiner (*Cyprinella venusta*)

The deleterious effects of anthropogenic noise have been studied in many taxa; however, comparatively few studies have investigated how noise affects freshwater fishes. Noise from boat traffic has been shown to elicit a stress response in several fish species. In stream systems, traffic noise propagated from road crossings is a concern because it may induce a similar stress response in stream fishes. The blacktail shiner (*Cyprinella venusta*) is a ubiquitous hearing specialist found throughout the Southeastern United States and was used as a model to investigate the extent to which traffic noise elevates cortisol levels. In this study, fish were exposed to an interstate traffic noise recording and waterborne cortisol was measured to assess changes in the stress response of the blacktail shiner.

0750 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Miriam Cueto-Mares¹, Gamaliel Castañeda-Gaytán¹, Sara Valennzuela-Ceballos¹,
Omague Cano-Villegas¹, Amorita Salas-Westphal¹, Jorge Becerra-López²

¹Universidad Juárez del estado de Durango, Gómez Palacio, Durango, Mexico,

²Universidad Autónoma del Estado de Hidalgo, Pachuca, Hidalgo, Mexico

***Terrapene coahuila*: population aspects within the valley of Cuatro Ciénegas Coahuila**

The coahuilan box turtle (*Terrapene coahuila*) is an emblematic and endemic species of the valley of Cuatro Ciénegas, Coahuila. It is a threatened species according to Mexican legislation and is the only member of the genus linked to water. Although there have been previous studies of the turtle population, behavior and current population abundance are unknown, therefore, the aim of this study is to estimate abundance, habitat use and population structure in eight sites in the valley of Cuatro Ciénegas. During 2012 eight transects were surveyed 1km long per 5-6 persons in a search belt of 4 m wide per person in each selected wetland. Each individual was measured, and morphological and environmental data were recorded considering the type of substrate and vegetation associated with the sites. 200 turtles were collected, of which 83.4% was linked to water bodies; the rest remained close to water. 66% of the turtles were recorded only at three sites. The population was composed mostly of males (57.7%), which obtained a greater size and weight than the females. The population consisted mainly of adult organisms. The variation in abundance of turtles during the sampling could be due to the fluctuation of water bodies throughout the year, showing greater abundance on permanent water bodies against seasonal sites. These results showed that coahuilan box turtles are closely related to water bodies and its abundance could be variable in the same place around the year.

0370 SSAR EVOLUTION, SYSTEMATICS, AND GENETICS BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Peterson Cullimore

University of Michigan-Flint, Flint, Michigan, USA

Comparative phylogenetics of an isolated population of Northern Dusky salamanders (*Desmognathus fuscus*)

Plethodontidae is the largest family of salamanders, exhibiting great diversity of natural history, and reaching maximum species richness in the Eastern United States throughout the Southern Appalachian Mountains region. There is much confusion and debate regarding the status of species placed within genus *Desmognathus*, a common issue

among plethodontid genera. Their widespread distribution and altitudinal separation have resulted in several populations that exhibit increased genetic variation. In 2004, researchers discovered an isolated population of *Desmognathus* salamanders at Murphy Lake State Game Area in Southeastern Michigan. As the nearest population is reported in north central Ohio, approximately 500 km away, the origin of this population is in question. We amplified a 648-bp fragment of the cytochrome c oxidase subunit I (CO1) gene obtained from individuals collected from the Michigan population and compared it with CO1 gene sequences from individuals collected across the species' distribution and from published data. Sequence data will help us to determine if the Michigan population's origin was due to a recent human introduction, if it was the result of a dispersal event, or if it is a relict population left over from Pleistocene glaciations when the range of *D. fuscus* was divided by glacial advances.

0428 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

David Cundall¹, Cassandra Tuttmann¹, Matthew Close²

¹Lehigh University, Bethlehem, PA, USA, ²Coastal Carolina University, Conway, SC, USA

The extraordinary nature of the anterior gut in snakes

The gross anatomy of the mouth of snakes has always been interpreted as an evolutionary response to feeding demands. It allows limited functional independence of right and left sides and the roof and floor of the mouth as well as wide separation of the tips of the mandibles. However, some of the common features of snake mouths, like their tongue and glottis, suggest extraordinary rearrangement of pharyngeal structures characteristic of all vertebrates. At a microscopic level, serial sections through the heads of a number of colubrid species show muscularis mucosal fibers appearing in the paratracheal gutter at varying levels between the eye and ear regions. Incomplete muscularis externa elements appear beneath the paratracheal gutter more caudally but typically at otic levels. Both muscle layers encompass more of the gut wall at more posterior levels, encircling the gut at the level of the atlas or axis. The pattern in snakes suggests developmental dissociation of dorsal and ventral splanchnic derivatives and a redesign of the esophagus. When snakes swallow large prey, the effective oral cavity becomes extremely short. Their palatamaxillary arches function as ratchets packing the prey almost directly into the esophagus. If our interpretation is correct, it raises a host of unanswered developmental questions.

0382 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Paul Cupp

Eastern Kentucky University, Richmond, KY, USA

Evidence of Male Parental Care in Green Salamanders, *Aneides aeneus*

Brooding behavior in *Aneides aeneus*, is well-documented. However, while studying brooding behavior in SE KY, eleven males were found in crevices adjacent to brooding crevices. The same males were in these crevices in subsequent visits, suggesting the possibility of being the paternal males. These males were sometimes found in breeding crevices outside the brooding period. Males were usually found near just one nest site with one exception in which a male occupied a crevice behind two narrow crevices where two females brooded eggs. Over seven years, young were produced successfully in both nest sites each year. A male identified by the pattern of head spots was found in a crevice adjacent to a brooding female. Over 10 years, this male was found in either an adjacent crevice or the breeding crevice. During this time, a female successfully brooded young in the breeding crevice each year. Also, in a separate breeding crevice, a male had replaced the female and was in front of and possibly in direct contact with hatchlings for five weeks. Also, in three instances, recent hatchlings were found in adjacent crevices in contact with males for 3-4 weeks. In addition, one year and older juveniles have been found in crevices with males on repeated visits. Although only females have been reported brooding young in breeding crevices, the proximity of some males to these crevices and the presence of young with males suggests that males may have a role in defending some nest sites.

**0495 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

James Cureton II

*Graduate program in Ecology and Evolutionary Biology, Department of Biology and
Oklahoma Biological Survey, University of Oklahoma, Norman, Oklahoma, USA*

Flow-induced phenotypic variation in *Pimephales* spp. (Cyprinidae)

Heterogeneity in local environmental selection pressures can drive the evolution of phenotypic differences across populations. If environmental differences persist for many generations, reproductive isolation can arise resulting in ecological speciation. I tested the hypothesis that body shape evolves in response to local flow regimes in a group of freshwater minnows, *Pimephales* spp. I predicted that: i) intra-specific body shape would correlate with discharge, ii) inter-specific body shape would correlate with discharge, and iii) *Pimephales* raised in low flow will develop deeper bodies than individuals raised

in high flow. I photographed 1,053 specimens of the four species and used geometric morphometric methods to quantify body shape based on 14 homologous landmarks. For three of the four *Pimephales* species, there was a significant correlation between body shape and discharge. For *P. tenellus*, there was a trend in the expected direction, but the correlation was not significant due to few obtainable samples. Across all four species, there was a remarkably strong correlation between body shape and average discharge. When juvenile *P. vigilax* were exposed to flow and no flow treatments in mesocosms, body shape was deeper in fish not exposed to flowing water. These results suggest that stream flow is an important determinant of body shape and may have played a role in the diversification of this group.

0372 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER ICHTHYOLOGY AWARD

James Cureton II¹, Rosemary Knapp², Richard Broughton³

¹*Graduate Program in Ecology and Evolutionary Biology, Department of Biology and Oklahoma Biological Survey, University of Oklahoma, Norman, Oklahoma, USA,*

²*Graduate Program in Ecology and Evolutionary Biology, Department of Biology, University of Oklahoma, Norman, Oklahoma, USA,* ³*Graduate Program in Ecology and Evolutionary Biology, Oklahoma Biological Survey and Department of Biology, Norman, Oklahoma, USA*

Revisiting the Evolution of Parental Care in Fishes using the New Euteleost Tree of Life Phylogenetic Hypothesis

Relative to other vertebrates, bony fishes exhibit a great diversity of parental care behaviors and associated morphology. This diversity includes internal gestation, external egg carrying, oral brooding, nest guarding, egg burying, ectodermal feeding, and splashing eggs deposited out of water. However, the evolution of most of these various modes of parental care is not particularly well understood and deserves more attention in light of recent revisions to our understanding of teleost evolution. We used the new phylogenetic hypothesis and revised classification of bony fishes (Euteleost Tree of Life) to quantify the number of times each mode of parental care has evolved and to identify transitions between paternal and maternal care and parental care types. We also characterized parental care in freshwater vs. marine fishes and assessed whether parental care has evolved more frequently in recently derived lineages. Parental care is observed in at least 100 teleost families and transitions between care giver and/or type of care have occurred within at least 16 families. Paternal care and nest building are the most frequent modes of parental care, although internal gestation, oral brooding, and external egg carrying are also very common. Parental care seems to have evolved frequently in freshwater fishes and even more so in recent freshwater fish lineages. No such pattern was observed in marine fishes. We will compare our findings to those of earlier treatments of this question, paying particular attention to transitions in mode of care affected by the revisions to the phylogeny.

0277 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Andrea Currylow, Rod Williams, April Johnson

Purdue University, West Lafayette, IN, USA

Evidence of Ranavirus Infections among Sympatric Larval Amphibians and Box Turtles

Ranaviruses are emerging as serious pathogens across ectothermic taxa, recently causing mass die-offs including entire chelonian populations. It has been suggested that amphibians may serve as reservoirs for chelonian infections. To assess whether chelonians in the Midwest are infected with (or at risk for) ranavirus infections, we tested for presence of ranavirus infections among sympatric larval amphibians (n = 135) and Eastern Box Turtles (*Terrapene carolina carolina*, n = 132) earlier and later in the box turtle active season (between May and August 2009) in south-central Indiana. Three larval amphibians (2.2%; one *Ambystoma* sp. and two unidentifiable Anuran larvae) and four box turtles (3.0%) tested positive for a ranavirus. Ranavirus infections were found in both early-season pond breeders (anurans) and then later-season pond breeders (salamanders), spanning the box turtle active period, but we did not detect mass die-offs. The majority (75%) of our ranavirus-positive box turtles were found later in the season. This represents the first documented case of ranavirus infection among a box turtle population in the Midwest and one of the few studies reporting ranaviruses across wild sympatric taxa. Our results suggest that ranaviruses persist sub-lethally in both larval amphibians and individual box turtles, and this may cause them to serve as reservoirs of outbreaks to the remainder of the population. Future studies should include sampling of all sympatric herpetofauna and further investigate prevalence and persistence of the viruses to better inform cross-contamination risks.

0270 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Judson M. Curtis¹, Gregory W. Stunz¹, Matthew W. Johnson², Sandra L. Diamond³

¹Harte Research Institute for Gulf of Mexico Studies, Texas A&M University-Corpus Christi, Corpus Christi, TX, USA, ²National Park Service, Gulf Islands National Seashore, Ocean Springs, MS, USA, ³Texas Tech University, Department of Biology, Lubbock, TX, USA

Hiding in Plain Sight: Tracking the Red Snapper Spawning Stock in the Western Gulf of Mexico

Red snapper (*Lutjanus campechanus*) in the Gulf of Mexico have been classified as overfished since 1984 but are recovering due to strict management regulations. Despite recent historically low stock sizes, current recruitment has been much higher than would be predicted. One hypothesis to explain this paradox is the existence of a locally recruiting source population of large, highly fecund “sow” snapper not targeted by the directed fishery responsible for maintaining elevated recruitment. These sow snapper are relatively un-fished because they may be using different habitats that move them away from commonly known structures where fishermen concentrate their effort. Using acoustic telemetry and catch data, our objectives were to: (1) test the hypothesis that large adult snapper have found spatial refuge from fishing by selecting different habitats than small adult snapper; (2) investigate large-scale movement and small-scale habitat use patterns of sow snapper. Acoustic returns of sow (>685 mm) snapper tagged and tracked using mobile acoustic telemetry showed 79% (11 of 14) recovery at initial tag sites after three months and 36% (5 of 14) after one year. Stationary acoustic telemetry showed small and sow snapper tagged on one platform exhibited similar long-term habitat use patterns. Catch-per-unit-effort at three popular surface platforms and three “unknown” sites revealed comparative catch rates and total lengths. Sow snapper appear to be showing high site fidelity, using same habitats, and exhibiting similar movement patterns as small adult snapper. These data suggest that high recruitment observed may be originating from other non-targeted sources.

0789 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Micah Daboub

New Mexico Highlands University, New Mexico, USA

The American Bullfrog (*Lithobates catesbeianus*): an amphibious assault on the Southwest

Invasive species are a leading conservation problem that threatens to eliminate native species by predation and exploitation of habitats. The American Bullfrog (*Lithobates catesbeianus*), native to northeastern United States, is a priority class III invasive species that is widely established in northern New Mexico. Riparian vegetation on the Mora River has declined from human activities, specifically overgrazing of pastures and the harvest of large riparian trees. Bullfrogs are believed to utilize these anthropomorphically-degraded riparian conditions consisting primarily of seral stages of thick grassy vegetation, uncommon in the native habitat of northern New Mexico floodplains. We utilized temperature recording radio telemetry equipment ($n = 4$) to identify home range and habitat selection of Bullfrogs in Rio Mora National Wildlife Refuge. We found that adult bullfrogs were preferentially selecting habitats containing thick secondary vegetation that resulted from human degradation of riparian forest canopy as well as artificial ponds. Adult bullfrogs seemingly use behavioral thermoregulation to maintain steady metabolic temperatures in spite of widely fluctuating air and water temperature. Also Bullfrogs appear to use the invasive Northern crayfish (*Orconectes virilis*) disproportionately to availability? This study provides a foundation to develop initial strategies for the management of invasive American bullfrogs that go beyond the simply eradication activities. There are many reasons why we should restore the original habitat in N.M; it seems that preventing invasions of exotic species is yet another reason to add to the list.

0029 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Fernando Dagosta, Mário C. C. de Pinna

Museu de Zoologia da USP - MZUSP, São Paulo - SP, Brazil

Biogeographic signal in amazonian characiform fishes: conflicts and resolution

Relatively few studies have explored quantitatively the distribution of Amazonian fishes to recognize biogeographic patterns. The present study investigates the significance of species and lineages from different families of Amazonian characiforms for understanding Amazonian biogeography. A database containing the distribution of almost 1000 species and lineages of characiforms from 22 different areas in Amazonia

and adjacent basins was assembled. Fourteen analyses with Cladistic Analysis of Distributions and Endemism (CADE) used exclusive datasets from different families of Characiformes. Whilst some clades are congruent in most trees, topologies and degree of resolution differ markedly among families. This seems to indicate major conflict in the data. Interestingly, however, analysis of the complete dataset results in a highly resolved biogeographic hypothesis. Additionally, resulting components of relationships agree in major part with independent biogeographic information. Apparently, separate analyses detect patterns specific to the history of individual families of characiforms, but perform poorly in retrieving broader biogeographic patterns. The latter emerges from combined ("total evidence") analysis of the entire data set. Results also indicate that most of noise in CADE analyses originates from low diversity clades, widespread lineages and poorly-known distributions. Results are partly skewed by specific assumptions of the methods employed and such effects are discussed in light of alternative implementations. The signal retrieved from a total evidence approach clearly indicates the importance of broad data bases for understanding general biogeographic patterns. Ongoing work is currently incorporating information from all groups of Amazonian fishes into a single extensive analysis.

0444 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

Toby Daly-Engel¹, Dean Grubbs²

¹University of West Florida, Pensacola, Florida, USA, ²Florida State University Coastal and Marine Laboratory, St. Teresa, Florida, USA

Aloha Dogfish: Description of a New Shark Species from Hawaii

Dogfish of the genus *Squalus* are small, deeper-water sharks with a slow rate of molecular evolution that has led to their designation as a series of species complexes, with low between-species diversity relative to other taxa. The shortspine spurdog, *Squalus mitsukurii*, is a medium-sized dogfish common to warm shelf and seamount habitat, with a putative circumglobal distribution that has come under investigation recently due to geographic variation in meristics, morphometrics, and genetic diversity. We examined the Hawaiian population of *S. cf. mitsukurii* using both morphometrics and genetic techniques and compared it to the type population in the West Pacific (Japan). External morphology differs with respect to head and interdorsal length, and molecular analysis of both the mitochondrial NADH2 gene and CO1 (barcoding region) show divergence with significant bootstrap support. Between-species diversity was low, but at least five-fold greater than within-species diversity and consistent with others in the *S. mitsukurii* complex. We suggest that *Squalus cf. mitsukurii* from Hawaii be designated as a distinct species, and both a new name and a holotype assigned.

**0321 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday
13 July 2013**

Kari Dammerman, Juan Steibel, Kim Scribner

Michigan State University, Lansing, Michigan, USA

**The effects of fluctuating thermal regimes on larval lake sturgeon
development and behaviour**

Climate change and variability are affecting environmental conditions worldwide. Understanding how organisms will phenotypically, behaviorally, and genetically respond to rapidly changing environments is a major basic and applied science goal. Aquatic ectothermic vertebrates including freshwater fishes such as lake sturgeon (*Acipenser fulvescens*) are particularly susceptible to environmental change given that streams are important integrators of climatic features. Few studies to date have examined the effects of fluctuating environmental conditions on organismal traits. We predicted that larval phenotypes (body size and shape) and behavior (timing of larval emergence and dispersal) would vary among families reared in fluctuating versus constant thermal environments. Experiments were conducted using a well-studied population of lake sturgeon located in the Black River of Michigan. Eggs from ten half-sib families were reared under two constant and two fluctuating thermal regimes. Constant treatments (10 and 18°C) represented mean incubation temperatures experienced by eggs from adults spawning early or late in the season, respectively. The two fluctuating treatments (10-19°C) represented ambient and simulated dam-effects on diel variation in river temperatures. At hatch, individuals were digitally photographed and images were used to quantify phenotypic traits. Individuals were subsequently placed in incubation chambers and monitored until emergence. Repeated measures of phenotypic traits were used to estimate growth and emergence time. Differences in phenotypic traits among families and treatment groups and dependencies of trait expression to thermal rearing habitat during earlier ontogenetic stages will be discussed relative to long-term consequences of fluctuating thermal regimes to future population phenotypic and genotypic distributions.

0033 Fish Conservation, San Miguel, Sunday 14 July 2013

Tanya Darden, Carolyn Tarpey

South Carolina Department of Natural Resources, Marine Resources Research Institute, Charleston, SC, USA

Effects of Overexploitation on the Genetic Diversity of Atlantic Red Snapper (*Lutjanus campechanus*)

Red snapper has been overfished and experiencing overfishing by commercial and recreational fishermen for the latter half of the 20th century. Currently, the Atlantic red snapper population is estimated to be only 11-14% of a sustainable level, and has been predicted to remain in an unsustainable level for many years. Our research evaluates if the population reduction experienced by red snapper has resulted in a decrease in genetic diversity or effective population size, and/or a change in genetic composition among four time periods: 1977-1978, 1983-1984, 1999-2000, and 2007-2009. Genetic results support the estimation of a small population census size for Atlantic red snapper, and the population appears to be experiencing influences from both genetic drift and inbreeding. The lack of a substantial decrease in diversity in light of continued reduction in census size is a positive indicator for red snapper. However, the low estimated effective population size is less than positive, indicating recovery of genetic diversity will likely take longer and the population has a higher likelihood of large influences from genetic drift. Therefore, for red snapper, overfishing appears to have resulted in a small effective population size leaving the Atlantic population potentially vulnerable to future anthropogenic and natural changes.

0167 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Drew Davis¹, Rafe Brown², Arvin Diesmos³, Cameron Siler¹

¹*University of South Dakota, Vermillion, SD, USA*, ²*University of Kansas, Lawrence, KS, USA*, ³*National Museum of the Philippines, Manila, The Philippines*

Morphology-based Species Delimitation in Philippine Slender Skinks: Evaluation of the *Brachymeles bonitae* Complex

High levels of vertebrate biodiversity and species endemism in the Philippines has highlighted the need for integrative studies incorporating morphological and genetic data to identify and describe cryptic diversity. One vertebrate group which has undergone a remarkable level of diversification in the country is Philippine slender skinks of the genus *Brachymeles*. Newly available, robust datasets have revealed that taxonomic diversity within this unique group of lizards is substantially underestimated.

Over the last few years, systematic revisions of diverse species complexes have resulted in increased taxonomic stability within the genus, with one exception: the *Brachymeles bonitae* species complex. Distributed across three major faunal regions in the Philippines, *B. bonitae* has long been recognized as a morphologically variable, non-pentadactyl species, with populations possessing combinations of 0-3 digits on their hands and feet. The species' wide geographic range has likely persisted as a result of weak sampling, morphologically similar body sizes, and similar patterns of scalation among populations. We evaluated morphological data using multivariate, principal component, and discriminant function analyses to define species limits in the *B. bonitae* species complex. Our results, combined with molecular data, indicate that *B. bonitae* is actually a complex of at least eight distinct lineages. The majority of the putative species breaks are associated with allopatric populations occurring on disparate mountain ranges or on islands separated by deep-ocean channels. This study adds to the incredible diversity of terrestrial vertebrates recognized as endemic to the Philippine islands and highlights the need to explore cryptic species diversity.

0260 AES Ecology, Mesilla, Thursday 11 July 2013

Jonathan Davis^{1 2}

¹University of New Orleans, New Orleans, LA, USA, ²University of Auckland, Auckland, New Zealand

The Bull Sharks of Lake Pontchartrain

Lake Pontchartrain is a productive estuarine ecosystem in Louisiana which provides food and protective habitat for coastal marine species including bull sharks (*Carcharhinus leucas*). I assessed fish assemblage data collected using multiple gear types (trawl, beach seines, and gillnets) from July 2000 to June 2011. Gillnet data collected during warmer months (May-September) from known bull sharks areas revealed that *C. leucas* were caught ~20% of the time. My analyses revealed trends in the occurrence and distribution of *C. leucas*. With this information, I will attempt to further understand *C. leucas* ecology in Lake Pontchartrain. Movement and distribution of *C. leucas* will be assessed using an acoustic receiver monitoring array. Acoustic transmitters will be surgically implanted in individual *C. leucas* and sharks will be tracked with an array that has been deployed in Lake Pontchartrain and surrounding habitats. These data will provide information about habitat preferences, water quality preferences, and seasonal distributions. These data will also provide insight into where juvenile *C. leucas* are distributed during the cooler winter months as well as the size and age at which they leave the estuary. Little is known about the distribution of *C. leucas* in these oligohaline habitats so this will be the first study of its kind for this species in Lake Pontchartrain.

0263 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Jonathan Davis^{1 2}

¹University of Auckland, Auckland, New Zealand, ²University of New Orleans, New Orleans, LA, USA

Movement and Behavior of the New Zealand Eagle Ray, *Myliobatis tenuicaudatus*

The New Zealand eagle ray (*Myliobatis tenuicaudatus*) is an intertidal species that has developed the ability to utilize highly productive intertidal habitats and avoid stranding. It has been suggested that the use of tidal information, particularly orientation to water current, may be used to avoid stranding on an outgoing tide. The movements of *M. tenuicaudatus* in relation to the tidal change were assessed by tracking individuals in an estuary. Data were analyzed using GPS data-loggers, telemetry transmitter and receivers, and behavioral modeling software. The models show use of the tides for transiting movement in and out of the estuary during rising and falling tides. The movement data also show that *M. tenuicaudatus* rests and feeds in channels of the lower part of the estuary at low tide while occurring over the mudflats during high tide. In addition to the fieldwork, two tanks were fitted to simulate the tidal cycle by changing water flow direction every six hours and ~12-15 minutes with 15 minutes of slack tide in between. Two juvenile eagle rays were placed in these tanks and behavior was recorded for 13 days. Both animals exhibited positive rheotaxis approximately 100% of the time during rest. When flow changed, both animals reacted within 90 seconds by turning and facing the new current direction. When food was present both animals exhibited negative rheotaxis approximately 100% of the time which suggests the utilization of tidal flow to search for food. This is consistent with orientation behavior and movements observed in the field.

0702 Herp. Systematics & Evolution, San Miguel, Saturday 13 July 2013

Julian Davis, Steven Poe

University of New Mexico, New Mexico, USA

A Phylogenetic Analysis of the *Anolis pentaprion* species group

The lizard genus *Anolis* is the largest amniote genus with 371 species spanning North America, Central America, Central America, South America, and the Caribbean. *Anolis* has been a model system for a variety of studies from behavioral, ecological, and morphological research to studies of biogeography, adaptive radiation, and character displacement. Despite decades of work, the phylogeny of *Anolis* has been difficult to elucidate. The relationships of mainland forms are especially poorly understood. The

Anolis pentaprion species group is found from southeastern Mexico to northwestern Colombia from sea level to approximately 2000 m. These small to medium-sized *Anolis* have short limbs and tail and a distinctive lichenous dorsal color pattern. Here I present a phylogenetic analysis of the *pentaprion* group, hereby defined to include *A. beckeri*, *A. charlesmeyersi*, *A. cristifer*, *A. fungosus*, *A. ortoni*, *A. pentaprion*, *A. salvini*, *A. utilensis*, and *A. sulcifrons*. I use molecular and morphological data and Bayesian and likelihood-based approaches to examine the evolutionary history of the *pentaprion* group and test its monophyl.

0541 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Mark Davis¹, Marlis Douglas², Colleen Webb³, Michael Collyer⁴, Andrew Holycross⁵, Charles Painter⁶, Michael Douglas²

¹Illinois Natural History Survey, Champaign, IL, USA, ²University of Arkansas, Fayetteville, AR, USA, ³Colorado State University, Fort Collins, CO, USA, ⁴Western Kentucky University, Bowling Green, KY, USA, ⁵Arizona State University, Tempe, AZ, USA, ⁶New Mexico Department of Game & Fish, Santa Fe, NM, USA

A Rattlesnake on the Brink: Global Change and its Impacts on Short-Range Biodiversity Endemics

Environmental change at global scales profoundly impacts biodiversity, particularly those elements identified as 'short range endemics' (SREs), as they possess life history traits that render them acutely vulnerable to climate fluctuations. The ecological niche of the federally listed sky-island SRE New Mexico Ridge-nosed Rattlesnake (*Crotalus willardi obscurus*) is impacted by extended drought and intense forest fire. It is constrained by aridity at lower elevations and loss of habitat as altitude increases. Here we coalesce demographic, climate, and molecular genetic data to evaluate its long term persistence. A long-term mark/recapture dataset assessed demographic status, evaluated impacts of a shifting fire regime on survival, and gauged its dynamics using stochastic population models and three fire intensity scenarios. Annual survival was estimated at 0.70 (± 0.10), while a deterministic (null) population model underscoring a declining intrinsic growth rate ($r = -0.1$). Using contemporary fire patterns and stochastic population simulations, intrinsic growth decreased significantly in this SRE and time to extinction was significantly shorter than expected (i.e., 133 ± 23 years). Furthermore, a substantial northwestern shift of 753 km was predicted in its climate envelope by 2080, with core habitat pushed to the envelope's trailing edge. Finally, lack of movement among populations is more pronounced than mark/recapture efforts suggest, with microsatellite data defining abrupt demographic isolation among populations. The Ridge-nosed Rattlesnake is not only a key sky-island SRE at the precipice of an extinction vortex, but is a bellwether for the collapse of the Madrean pine-oak ecosystem, one of Earth's three recognized "megadiversity" centers.

0571 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

Matthew Davis, Leo Smith

The Field Museum, Chicago, IL, USA

The Evolution and Invasion of Marine Fishes into Deep-Sea Environments

The deep sea is the least explored and largest habitat on Earth. While nearly one sixth of fishes are known to exist at depths below 200 meters, little is known about the macroevolutionary patterns and processes associated with diversification in the deep sea. In this study we provide a taxonomically broad and temporal hypothesis of teleostean relationships based on molecular data to investigate global macroevolutionary questions regarding the wide-spread dispersal and subsequent diversification of fishes into the deep sea. These questions include how many independent times have teleosts invaded the deep sea? What are the estimated ages for deep-sea invasions across fishes? Are any of these invasions simultaneous? And which deep-sea teleost lineages exhibit greater than expected species richness given the estimated ages of their clades?

0261 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Juan D. Daza, Aaron M. Bauer

Villanova University, Villanova, Pennsylvania, USA

Cranial morphology of *Aprasia repens*, a miniscule burrowing gekkotan

The pygopodid genus *Aprasia* is one of few truly fossorial gekkotan taxa. *Aprasia* spp. are among the most miniaturized of all lizards and their miniscule skulls are highly atypical for gekkotans, reflecting the interplay of subterranean lifestyle and size reduction. We used high resolution x-ray CT scan data from *Aprasia repens* to visualize in detail the skull anatomy of this species, including the individual bones and delicate internal structures (the vomeronasal organ and mushroom body region, palate, braincase). We discovered that *Aprasia repens* exhibits several unique features among squamates, including a high degree of asymmetry (which is congruent with previous observations of their visual system), a unique peg and socket joint between the premaxilla and nasal bones, a palatal arrangement unique among lizards, a relatively well developed vomeronasal organ, and greatly reduced dentition. Additionally, it exhibits several characters that are convergent with other limbless groups (amphisbaenians and snakes) such as a high degree of closure of the braincase, reduced mesokinetism, a solid interface between the frontal and the basicranium, and a

specialized auditory system for the detection of low frequency vibrations. The interaction of extreme miniaturization and specializations for fossoriality with classical gekkotan features (e.g., large eyes, loss of the postorbital and posttemporal bars) has the potential to shed some light on the debate regarding the origins of snakes.

0794 Plenary, Brazos, Thursday 11 July 2013

William deBuys

Noted Author and environmentalist, New Mexico, USA

Hotter and Drier: Life in the 21st Century Southwest

The changes wrought by a warmer, more energetic climate system are just beginning to be felt in the Southwest. In the future even higher temperatures are a virtual certainty. A decline in precipitation, both rain and snow, is strongly probable. Singly or together these two changes portend that substantially less water will be available for people, crops, trees, grass, and critters of all kinds, including herps and fish. Even the unlikely advent of semi-generous rains won't bail out the region, because a hotter environment will lose more of its water to evaporation – leaving the aridlands effectively more arid. We are experiencing a new form of desertification, different from the legacy of overgrazing, failed agricultural schemes, and other familiar forms of land abuse. Instead, the changes we are seeing stem from industrial society's abuse of the atmosphere, and there is no end to them in sight.

0683 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Marcelo de Carvalho¹, Mateus Soares¹, Carolina Laurini¹, João Paulo da Silva¹, Diego Vaz¹, Sarah de Figueirêdo¹, Thiago Loboda¹, João Pedro da Silva¹, Maira Ragno¹, Flávia Petean¹, Akemi Shibuya¹, Leandro Yokota¹, Murilo Carvalho¹, Wilson Soares¹, Andre Casas¹, Renan Moreira¹, Ulisses Gomes²

¹*Universidade de Sao Paulo, Departamento de Zoologia, Sao Paulo, SP, Brazil,*

²*Universidade do Estado do Rio de Janeiro, Rio de Janeiro, RJ, Brazil*

Morphology and Shark Non-monophyly, or Why Homology Still Matters in Systematics

We present morphological data addressing the higher-level relationships of elasmobranchs with the intention of exploring the current dichotomy between molecular and morphological elasmobranch phylogenies. Molecular data, from both nuclear and mitochondrial genes, resolves all sharks as a monophyletic group (i.e. without batoids); morphological data indicate, however, that batoids are closer to hexanchiforms,

Echinorhinus, squaliforms, *Squatina* and sawsharks, negating an all-shark collective. New morphological data that may impact the placement of these groups are discussed, along with evidence from comparative studies of the skeleton, mandibular and hyoid arch muscles, and afferent branchial vessels, all of which support the placement of rays (Batoidea) high within squalomorph sharks. We believe this 'discrepancy' to be indicative not only of a divergence concerning what the data imply (i.e they do not have to uncover the same patterns of relationship), but one that derives from a deeper philosophical incongruity. We should be interested in exploring the contribution of morphology whether it agrees or not with molecular data. Understanding the hierarchically distributed homologies of organisms requires the formation of specialists – specialists in the intricate description and comprehension of *form*; we need to be able to explain, after all, the patterns we observe. The consolidation and intensification of the morphological paradigm is indispensable for progress in molecular systematic studies of chondrichthyans.

0689 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Mauricio De la Maza-Benignos², Evan W. Carson¹, Ma de Lourdes Lozano-Vilano³, Lilia Vela-Valladares², Iris Banda-Villanueva²

¹University of New Mexico Department of Biology and Museum of Southwestern Biology, Albuquerque, NM, USA, ²Pronatura Noreste, A.C., Monterrey, Nuevo León, Mexico, ³Laboratorio de Ictiología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Monterrey, Nuevo León, Mexico

The *Cyprinodon julimes* experiment: a case study for development of a broadly effective conservation model in Mexico

Traditional approaches to conserve imperiled species have had a high failure rate in many parts of Mexico. This is particularly true for aquatic species in desert regions, where unsustainable exploitation of water resources not only threatens native and endemic species but also dims the long-term viability of local human communities. These repeated conservation failures have recently led to novel, bottom-up strategies for species and habitat protection. We report success under a new conservation initiative for the highly endangered Julimes pupfish *Cyprinodon julimes*, a microendemic species restricted to a single desert spring near the community of Julimes, Mexico. The conservation strategy for this species depends explicitly on local landowner participation and stewardship, as well as educational outreach and accommodation of community needs. As a result of this project, the long-term prospects of *C. julimes* have improved greatly because spring-flows have become more secure and critical habitat has been restored and expanded. Similar approaches of working *with* local communities towards sustainable management of water resources, combined with long-term habitat and population monitoring, may present the only effective means of conserving species in many desert areas of Mexico, especially in places where traditional conservation actions are impractical or unfeasible. Although this promising conservation paradigm is

recognized under the Mexican National Water Law of 1992, successful implementations have thus far been sporadic and local.

0218 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Rodrigo De Mello¹, Rosane Garcia Collevatti¹, Guarino Rinaldi Colli²

¹*Universidade Federal de Goiás (UFG). Laboratório de Genética & Biodiversidade, Goiânia, Goiás, Brazil,* ²*Universidade de Brasília (UnB). Laboratório de Herpetologia, Brasília, Distrito Federal, Brazil*

Preliminary Data from Mitochondrial Gene Suggest Divergences Occurring in Tertiary and Quaternary Periods in Lineages of the Brazilian lizard *Tropidurus oreadicus* (Squamata:Tropiduridae)

South American landscapes provide several features that make them particularly interesting for biogeographic and evolutionary studies, as a result of complex interactions between geomorphological and climatic events. The Brazilian savanna vegetation is called *Cerrado* and covers some 2 million km² of Central Brazil, representing about 23% of the land surface of the country. Disjunct and isolated areas of cerrado-like vegetation also occur within the Brazilian Amazon rain forest, which suggest the idea of botanic relicts of broader and past distributions of the past. Cerrado harbours a rich, complex and characteristic reptilian fauna, highly influenced by horizontal habitat variation and historical constraints on ecological traits. The Brazilian lizard *Tropidurus oreadicus* has an ecological history related to the open vegetation formations; it occurs in open areas of Cerrado and in savanna enclaves in Amazonia. Such range changes can be expected to have genetic consequences and methods based on coalescent theory represent great advances in testing for spatial and temporal congruence. In this context, we analyzed preliminary mtDNA data to estimate the time to the most recent common ancestor (TMRCA) for 20 populations. The oldest time of divergence for 12S mtDNA region is ~7 million years ago (Mya), with greater diversification in the last 3 Mya. Considering the variance of each node, the oldest divergences dated from Upper Miocene, probably reaching the Pliocene. Most splitting events seem to happen between Pliocene-Pleistocene transition. These results agree with studies that point Tertiary and Quaternary as great drivers for the diversification of South American herpetofauna.

0132 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Carlos David de Santana, Richard Vari

National Museum of Natural History, Washington, DC, USA

The untold story of the caudal skeleton in the electric eel: taxonomic, phylogenetic and functional implications (Ostariophysi: Gymnotiformes: *Electrophorus*)

The one recognized species in the electric eel genus *Electrophorus*, *E. electricus*, is widespread in the rivers of Guianas and through the Amazon and Orinoco basins. The electric eel can be recognized among the 200+ species of the Gymnotiformes by among other features its capacity to generate strong discharges for hunting and self-defense and by the presence of the elongate fin along the ventral surface of the body and tail from posterior of the abdominal cavity to the end of tail. Two hypotheses exist in the literature as to the components in this elongate fin in *Electrophorus*: 1) that the anal fin is posteriorly continuous with the rays of the caudal-fin, i.e. the caudal fin is present as originally proposed by Linnaeus in the original description of the species; and 2) that the terminal portion of the elongate fin is a posterior extension of the anal fin to form a false caudal fin, i.e. caudal fin is absent. This concept was adopted by all authors subsequent to Linnaeus. We tested the two hypotheses through the examination of ontogenetic series in *Electrophorus*.

0092 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Brett DeGregorio, Patrick Weatherhead, Michael Ward, Jinelle Sperry

University of Illinois at Urbana - Champaign, Urbana, Illinois, USA

Using Automated Telemetry to Monitor the Activity Patterns of Two Major Avian Nest Predators: Ratsnakes and Black Racers

Diel activity patterns in animals are often fixed within species such that most animals can be classified as diurnal, crepuscular, or nocturnal with deviations from these lifestyles viewed as minor changes in the timing of the active period rather than an overall shift in the diel schedule. Snakes appear to be a group in which diel activity shifts may be particularly common although evidence is often indirect and constrained by traditional research methods. Changes in a species diel activity pattern will alter the way in which that species interacts with both predators and prey. Here, we describe the results of an automated telemetry study monitoring the activity patterns of two snake species, the ratsnake (*Elaphe obsoleta*) and the black racer (*Coluber constrictor*), for one year in South Carolina. Ratsnakes shift from being principally diurnal during the early spring and fall to being more nocturnal during the warmer summer months. Black

racers were on average more active than ratsnakes in all seasons and were constrained to daytime activity. In addition to monitoring the two snake species, we monitored the nests of four species of common songbird. The timing of predation by snakes reflected their activity patterns. The ability of ratsnakes to depredate songbird nests at night increases their success at acquiring the entire contents of the nest and decreases the ability of birds to defend their nest.

0038 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Jennifer Deitloff¹, Sean Graham², Claire Floyd¹

¹Auburn University, Auburn, AL, USA, ²Pennsylvania State University, University Park, PA, USA

Head morphology and food use in two species of cryptic and co-occurring *Plethodon* salamanders.

Theoretical evolutionary ecology generates testable predictions concerning the effects of species interactions on ecological, behavioral, and morphological traits. These predictions can then be examined by comparing the characteristics of interacting species in regions where they co-occur (sympatry) to regions where each occurs separately (allopatry). A pattern of sympatric morphological divergence (character displacement) correlated with sympatric divergence of resource use is often treated as evidence of exploitative competition. In the genus *Plethodon*, morphological changes associated with exploitative food use and behavioral interference have been identified in several sympatric species. Here we examined morphological variation and diet among allopatric and sympatric populations of *Plethodon ventralis* and *P. websteri* in Alabama. These are cryptic species considered to be morphologically identical with the exception of dorsal color pattern (i.e., "leadback" versus "zigzag") at their zone of contact. We used landmark-based geometric morphometrics to quantify head morphology, and examined stomach contents between species and populations to compare food use. We found differences between the species, and differences between allopatric vs sympatric populations. However, the pattern of morphological change between allopatric and sympatric populations was consistent between species, and therefore neither character divergence nor convergence occurred. Some differences occur in diet between species and populations, but, in general diet is similar and morphology correlated with food use.

**0155 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

John Denton

American Museum of Natural History, New York, NY, USA

**Covariation patterns of symmetric and asymmetric shape features in the
lanternfish tribes Myctophini and Gonichthyini (Scopelomorpha;
Myctophidae; Myctophinae)**

Lanternfishes are a dominant midwater vertebrate clade notable for worldwide abundance, charismatic and disparate larval morphs, and diverse luminescent tissue complexes, including both sexually dimorphic luminous organs and body photophores, that have been hypothesized to serve roles in facilitating both species and mate recognition. Despite this compelling hypothesis, and although the relative positions of lateral photophores occurring in five discrete complexes (PVO+PLO, VLO, SAO, Pol, Prc) have traditionally informed taxonomy and identification keys within the family, very few studies have quantified the relationship between these lateral complexes and overall body form with sample sizes required for accurately estimating covariances. Not only are such estimates crucial for assessing the hypothesis of a species recognition role for lateral photophores, but accurate covariance estimates are also a critical component of assessing the broader question of how changes in modular covariance and integration influence the skewed patterns of species richness in the family. To address these questions, I conduct a geometric morphometric analysis of the tribes Myctophini and Gonichthyini, incorporating over 20 individuals from each of 32 of the 48 species of the tribes.

**0168 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Valerie Derouen¹, William Ludt¹, Hsuan-Ching Ho², Prosanta Chakrabarty¹

¹Louisiana State University, Baton Rouge, Louisiana, USA, ²National Museum of Marine Biology & Aquarium, Checheng, Pingtung, Taiwan

Phylogeny and Deep-Sea Habitat Shifts in Batfishes (Lophiiformes)

The deep sea is the least explored and largest habitat on Earth. Its extreme habitats and environmental conditions have led to intriguing evolutionary events among the fishes that have invaded this realm. However, our current understanding of the evolutionary history and timing of the independent invasions remains unclear. Batfishes have independently invaded the deep sea over the course of their evolutionary history and they possess shallow-water, mid-water and deep-sea marine species with restricted or

preferred depth ranges. There are currently 10 genera containing about 68 species of mostly benthic inhabitants ranging from shallow-water (along the continental shelf) to deep-water (along the continental slope). The current position of Ogcocephalidae within Lophiiformes (anglerfishes) is unresolved with somewhat incongruent hypotheses suggested by molecular and morphological data. The relationships among the genera within Ogcocephalidae are also unresolved and have not been well studied. We investigate batfish relationships with samples from all 10 genera using mitochondrial and nuclear markers. In our study, a phylogenetic tree is constructed to elucidate deep-sea habitat shifts among batfishes, the timing of these events, and the place of Ogcocephalidae within Lophiiformes.

0745 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

Raul Diaz¹, Paul Trainor²

¹La Sierra University, Riverside, CA, USA, ²Stowers Institute for Medical Research, Kansas City, MO, USA, ³Loma Linda University Medical Center, Loma Linda, CA, USA, ⁴Natural History Museum of Los Angeles County, Division of Herpetology, Los Angeles, CA, USA

Playing footsies with Evolution: Development of the arboreally specialized Chameleon hands/feet

Specialization of all members of the family Chamaeleonidae for an arboreal lifestyle across their Old World geographic range has entailed a tremendous suite of novel morphologies (with many associated trade-offs relative to the typical lizard body plan). In particular, one of these modifications encompasses the hands/feet which have become unique across all tetrapods in being not only bifurcated medially, but also maintaining digits united (in syndactyly) around the clefting site. Molecular and morphological examination of Veiled Chameleon (*Chamaeleo calyptratus*) embryos presents a new, and more complex, model for the evolution of this novel morphology and challenges previous dogma for the formation of a cleft.

0487 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Anibal Díaz de la Vega¹, Norberto Martínez², Oswaldo Téllez³, Fausto Méndez¹

¹IB-UNAM, México, Mexico, ²ENCB-IPN, México, Mexico, ³FESI-UNAM, México, Mexico

Ecological Niche of the *Aspidoscelis cozumela* complex (Parthenogenetic Lizards) in the Yucatan Peninsula, México

The geographic species distribution is influenced by ecological, evolutionary and physiological factors, also the capability distribution and the reproductive mode. The ecological requirements of closely related lineages generally are similar; however different lineages could present dissimilar ecological and physiological requirements. The parthenogenetic species generally are considered as colonizing species and can inhabit new environments. The *Aspidoscelis cozumela* complex is formed by three species (*A. cozumela*, *A. maslini* and *A. rodecki*) generated by two independent hybridization events between the same parental species and one post-formational cladogenesis event. We determine that the parthenogenetic species share similar but not identical ecological niche. *A. maslini* presented the widest ecological niche involving *A. cozumela* and *A. rodecki*; however these last species are not ecologically equivalents being ecologically different lineages. These results agree with previous studies and determine affinity between *A. maslini* and *A. cozumela* and conservatism of ecological niche.

0015 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel, Friday 12 July 2013

Alondra M. Diaz-Lameiro, Taras K. Oleksyk, Fernando J. Bird-Pico, Juan Carlos Martinez-Cruzado

University of Puerto Rico at Mayaguez, Mayaguez, PR, USA

Colonization of Islands in the Mona Passage by Endemic Dwarf Geckoes (genus *Sphaerodactylus*) Reconstructed with Mitochondrial Phylogeny

Little is known about the natural history of the *Sphaerodactylus* species endemic to the three islands located in the Mona Passage separating the Greater Antillean islands of Hispaniola and Puerto Rico. In this study, parts of two mitochondrial genes, 16S rRNA and 12S rRNA, were sequenced to determine the relationships between the sphaerodactylids that live in the Mona Passage and other Caribbean species from the same genus. While the main goal was to identify the biogeographical origin of these species, we also identified a genetically distinct type of dwarf gecko that warrants future evaluation as a possible new species. According to the reconstructed phylogenies, we propose a stepwise model of colonization wherein *S. nicholsi* from southwestern Puerto

Rico or a very close ancestor gave rise through a founder event to *Sphaerodactylus monensis* on Mona Island. In a similar fashion, *S. monensis* or a very close ancestor on Mona Island gave rise to *S. levinsi* on Desecheo Island. This study also suggests that the most recent common ancestor between the species from the islands in the Mona Passage and Puerto Rico existed approximately 3 MYA.

0142 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Reilly Dibner¹, Daniel Doak^{1, 2}

¹University of Wyoming, Laramie, WY, USA, ²University of Colorado at Boulder, Boulder, CO, USA

What Limits Horned Lizard (*Phrynosoma hernandesi*) Distribution and Relative Abundance in Wyoming?

Some species occur on every continent while others are restricted to geographic ranges of less than a few hectares in area. Species that are widespread across a broad geographic range are not, however, necessarily common. If they are tied to particular habitat characteristics, these species may be few in number. We classify species as specialists if they are limited along any single niche axis, but this fact does not mean that specialists are necessarily limited along all, or even many, niche dimensions. When species are specialists, disturbance events that change critical attributes of their habitats can threaten those species' existence. To identify potential threats, we need to understand which habitat components are the most important to a species.

We are exploring factors that may limit the population distribution and abundance of the greater short-horned lizard (*Phrynosoma hernandesi*) in Wyoming. Most species of horned lizards have wide distributions, but their actual occurrences are patchy. The one species of horned lizard in Wyoming tends to inhabit arid shrublands with some shrub cover and exposed sandy or loose soil, but it is unclear how important these factors are. Further, while horned lizards are all ant-eating specialists, some species have more specific diets than others. Some of these factors are susceptible to change with increasing development, some are relatively immutable, and the response of other factors is unknown. We will present data on potentially limiting factors from sites across Wyoming.

**0354 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Matthew M. Dickson¹, Sigfrido A. Zimmermann¹, Heather E. M. Liwanag²,
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¹California State University, Northridge, Northridge, CA, USA, ²Aldelphi University,
Garden City, NY, USA

Evolution on Your Porch: Rapid Physiological Adaptation by Mediterranean House Geckos to their Introduced Niches

Adaptation is essential for organisms to persist in changing environments. Physiological adaptations are especially important to ectotherms, which are closely coupled to their abiotic environments. Introduced species are more likely to evolve rapidly to adapt to local climates because of their small founder populations and strong selective pressures in their new environments. To test these ideas, we compared the thermal tolerances (critical thermal minimum, CT_{min} and panting threshold, T_{pant}) and temperature-dependent rates of evaporative water loss (EWL) of Mediterranean House Geckos (*Hemidactylus turcicus*) collected from different climates. These now familiar “porch light” geckos have been widely introduced throughout the New World over the past century after first being recorded in Florida in 1915. Introduced geckos were collected from regions representing three climates throughout the United States: desert (hot/dry), Mediterranean (warm/dry), and semitropical (hot/humid). We hypothesized that geckos from these three climates would exhibit differences in temperature tolerances and EWL consistent with local adaptation. Geckos experiencing lower daytime temperatures had lower CT_{min} compared to geckos from hotter climates, consistent with local adaptation. However, we found no significant differences in T_{pant} among geckos from differing climates. Geckos from arid climates had lower rates of EWL at high temperatures compared to geckos from humid regions, also indicating adaptive evolution. Future studies will include temperature-dependent metabolism and sprint performance. Ultimately these data will be used in a mechanistic niche model to predict the future range expansion of this species in the USA.

0670 Fish Genetics I, Ruidoso/Pecos, Friday 12 July 2013

Casey Dillman¹, Ping Zhuang², Tao Zhang², Longzhen Zhang², Nikolai Muge³, Eric Hilton¹

¹Virginia Institute of Marine Science, Gloucester Point, Virginia, USA, ²Chinese Academy of Fisheries Science, Shanghai, China, ³Russian Federal Research Institute of Fishery and Oceanography (VNIRO), Moscow, Russia

Forensic investigations into a Genbank anomaly: Endangered Taxa and Missing Vouchers

Whole mitochondrial genome (mitogenome) sequences provide a powerful approach for investigating and hypothesizing relationships among species and higher taxa. This approach has been used extensively across fishes, and in addition to supporting long-standing hypotheses of relationships it has also resulted in several new proposals. Mitogenome sequence studies have typically used an exemplar approach wherein one individual is sampled and sequenced. However, as more labs are producing these data taxon sampling within clades is naturally increasing. One such clade is the sturgeons (Acipenseriformes: Acipenseridae). Acipenseridae is constituted by 25 broadly recognized species restricted in distribution to the Northern Hemisphere, and ten species of acipenserids have complete mitogenome sequences available for download and use. Exploration of these sequences indicates that the mitogenome available for *Acipenser sinensis*, the Chinese sturgeon, may either be incorrectly identified or the result of undocumented hybridization with *A. gueldenstaedtii*. Recently, new material with vouchered specimens were collected and investigated with DNA sequence data from 4 mtDNA loci to test whether the published mitogenome of *A. sinensis* was recovered in the same clade with the new vouchered material.

0144 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Drew Dittmer¹, Joseph Bidwell¹, Kerrie Bennison²

¹University of Newcastle, Callaghan, New South Wales, Australia, ²Uluru Kata-Tjuta National Park, Yulara, Northern Territory, Australia

Influences of microclimate and other landscape factors on herpetofauna assemblages adjacent to an iconic Australian Inselberg

Uluru Kata-Tjuta National Park (UKTNP), famous for its namesake inselberg, Uluru, that rises roughly 350 meters in an otherwise topographically plain landscape. As a whole, UKTNP is known to host the most diverse assemblage of reptiles in arid and semi-arid Australia, although previous faunal surveys at the southern face of Uluru have indicated relatively low reptile diversity in this area. These previous surveys did

not sample around the entire base of Uluru, so it is unknown if reduced reptile diversity occurs in other zones adjacent to the inselberg. The landscape surrounding Uluru is dominated by spinifex grasses (genus *Triodia*) and sand dunes. The most obvious differences in habitat near the base of Uluru are the presence of semi-permanent water sources, tall stands of bloodwood trees (*Corymbia opaca*), and shade from the inselberg. Additionally, invasive buffel grass (*Cenchrus ciliaris*), is the dominant vegetation around the base of Uluru, and there is significant infrastructure (car parks, walking tracks, sealed roads) to facilitate the over 200,000 annual visitors. We used a total 26 pitfall grids (234 pitfalls) to sample the herpetofauna around Uluru. We used covered pitfall traps, placing 8 grids at the base of Uluru, 9 at 500 meters distant, and 9 at 1000 meters distant. We placed temperature and humidity data loggers at the pitfall grids to describe changes in micro-climate with increasing distance from the base. Herein we report preliminary data from our first field season describing the relationship between habitats near the base of Uluru and herpetofaunal community structure.

0613 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Tracy Diver, Megan Osborne, Trevor Krabbenhoft, Thomas Turner

University of New Mexico, Albuquerque, NM, USA

The evolution and maintenance of deeply divergent lineages of Red Shiner, *Cyprinella lutrensis*, in the Rio Grande watershed

Cyprinella lutrensis, Red Shiner, is a widespread complex of morphologically variable forms. Early studies of mtDNA variation showed significant phylogeographic structuring of the species across its range. We studied mitochondrial ND4 sequences of individuals collected from the Pecos and Rio Grande in New Mexico, and found two deeply divergent lineages (consistent with genus-level differences) that co-occurred in both rivers. To evaluate the origin and maintenance of this variation we 1) compared mtDNA with nuclear markers and meristic and geomorphometric data to evaluate whether mtDNA lineages were reproductively isolated and 2) quantified levels of genetic diversity within each lineage to understand the probable colonization history of the basin. Recent introduction of a divergent form does not appear to explain the observed pattern because haplotypes are not shared between rivers and appear to have evolved in situ. However, levels of genetic diversity are surprisingly low within each lineage, with measures of mtDNA diversity comparable to endangered species. Low levels of genetic diversity suggest Red Shiner has historically experienced population bottlenecks. Morphological analysis and DNA sequences from the nuclear RAG-1 gene are not correlated to mtDNA haplotypes, suggesting no reproductive isolation between lineages. Likewise, thousands of high-quality SNPs appear to assort randomly with respect to mtDNA. We conclude that the Upper Rio Grande Basin was colonized twice by divergent lineages of *C. lutrensis*, with the first event occurring approximately 4-5 million years ago (mya) during the Pliocene. Subsequently, the Rio Grande and Pecos Rivers were isolated more recently (roughly 1 - 2 mya).

0538 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Graham Dixon-MacCallum

University of Victoria, Victoria, British Columbia, Canada

Habitat use by Northwestern Gartersnakes (*Thamnophis ordinoides*) in Victoria, British Columbia

Understanding a species' habitat requirements is a fundamental concept in conservation biology. Comparing habitat variables measured at locations where animals are found to random locations is one method of understanding how a species uses its habitat. Northwestern Gartersnakes (*Thamnophis ordinoides*) are common in parks in Victoria but their specific habitat requirements are poorly understood. I predicted that substrate temperature and distance to edge would be of greatest importance because of a snake's need to thermoregulate. Victoria's parks vary in habitat composition from mature Douglas-fir forest, to Garry Oak meadow, with open grassy areas, parking lots and patches of dense invasive shrubs. Between May and September 2012 I captured 133 Northwestern Gartersnakes by hand on random transects and habitat edge surveys. At capture locations and random points nearby I measured the composition and structure of vegetation, as well as abiotic factors such as substrate temperature, aspect and slope. I found differential use of habitat between the sexes in relation to the proportion of herbaceous vegetation and organic litter. Snakes were also found at sites that were warmer than random locations. Overall, distance to edge was the most important variable measured as Northwestern Gartersnakes were most often found close to edges. These results support my hypothesis that warm locations that are close to habitat edges are important habitat for Northwestern Gartersnakes.

0182 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

Terry Donaldson, Marylou Staman, Taryn Mesa

University of Guam Marine Laboratory, Mangilao, Guam, USA

The Diversity and Mating of Wrasses in a Spawning Aggregation Site Influenced by Fish Feeding

Various species of wrasses (Labridae) utilize specific sites for courtship and spawning, either in an harem mating system or in temporary resident spawning aggregations. At Apra Harbor, Guam, harem mating sites are distributed along the edge of a reef slope at discrete intervals.

At Finger Reef, a protrusion into the harbor, a resident spawning aggregation site exists for five species of wrasses. The species include *Cheilinus trilobatus*, *Epibulus insidiator*, *Gomphosus varius*, *Hemigymnus melapterus*, and *Thalassoma hardwicke*. All are resident or migrate to the site from adjacent areas. Fish feeding by tourist divers and snorkelers occurs at the site resulting in densities of most wrasse species being greater than along a typical patch of reef. Therefore, the mating systems of typically harem species have changed in response to increased densities. Migration to the site occurs after high tide, from mid-morning through early afternoon, with courtship and spawning occurring from late morning until sunset depending upon the species. Mating systems found include a lek-like system with paired spawning, and group spawning. Streaking by both initial and terminal phase females occurs in both systems. Other species of wrasses, either resident or migrating to the site from adjacent areas, court and spawn at this site but are not considered to form spawning aggregations because of low densities. These species all mate using a single-male multi-female harem system with paired spawning. Courtship of these species appears to be linked to the same tidal state and light levels seen for spawning aggregation species.

0021 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Carlos DoNascimento¹

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Systematics and Phylogenetic Relationships of the Subfamily of Parasitic Catfishes Stegophilinae (Siluriformes, Trichomycteridae)

The Stegophilinae constitutes a remarkable group given its specialized feeding habits (lepidophagy, muciphagy, and necrophagy). Despite its biological interest, its systematics has stayed in an incipient state. Most genera lack a phylogenetic diagnosis, leading to taxonomic instability, and hypotheses about the phylogenetic position of the group have resulted in conflictive scenarios. A phylogenetic analysis of 510 morphological characters for 45 species was conducted. All stegophilinae genera were represented by 21 species. The remaining species corresponding to the outgroup, included representative species of all remainder subfamilies and main genera of Trichomycteridae. Monophyly of Stegophilinae was confirmed, as well as its sister group relationship with Vandelliinae, comprising in turn a clade with Tridentinae. This clade is closely related to "*Trichomycterus*" *hasemani*. A basal dichotomy was identified within Stegophilinae, with *Haemomaster*, *Ochmacanthus* and *Stegophilus* comprising a monophyletic group, and *Haemomaster* and *Stegophilus* as sister groups. *Homodiaetus* and *Schultzichthys* are successive sister groups of a clade informally named *Pareiodon* group. Within this group, *Henonemus* constitutes a clade with *Apomatoceros* and *Megalocentor*, and these two genera are more closely related. *Pareiodon* was corroborated as a member of Stegophilinae, placed in a distal clade as the sister group of *Acanthopoma*. Finally *Pseudostegophilus* also belongs to this clade, with three clearly defined main subgroups,

with *Parastegophilus* considered as a junior synonym. In the light of the phylogenetic hypothesis obtained, the phenomenon of miniaturization is discussed within the family. Likewise some comments about the main cladogenetic events between cis-Andean and trans-Andean components of the clade TSV are provided.

0624 General Herpetology, San Miguel, Monday 15 July 2013

Maureen Donnelly

Florida International University, Miami, FL, USA

Jay M. Savage: His Contributions to Herpetology and the ASIH

Jay M. Savage is one of the most influential living herpetologists. He and his students have contributed to our understanding of ecology, evolution, and basic biology of amphibians and reptiles, particularly in the tropics of Central and South America. I will summarize how Jay came to the study of amphibians and reptiles as a teenager, describe his training at Stanford University, his career at the University of Southern California, his move to the University of Miami, and the role he played in the formation of the Organization for Tropical Studies. Jay has been an active member of ASIH since 1948 and has served the society on several committees, as the Treasurer, President-Elect, President, and life-long member of the Board of Governors. His story is a nice one to tell as we celebrate the 100th year of Copeia.

0317 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Marlis R. Douglas, Michael E. Douglas

University of Arkansas, Fayetteville, AR, USA

Riverscape Genetics of Mountain Sucker (*Catostomus platyrhynchus*): Endemism Amidst Surprising Biogeographic Patterns

An extended drought, in tandem with anthropogenic modifications to hydrology, has brought into focus within southwestern North America two sustainability programs sponsored by the United Nations (i.e., 'Water for Life' and 'Deserts and Desertification'). To discern natural and anthropogenic impacts in the region, we juxtaposed the genetic diversity of Mountain Sucker [*Catostomus platyrhynchus*] against fluvial topography in 57 study sites within the intermountain West (i.e., Colorado River = 51; Bonneville Basin = 5; Columbia River = 1; Missouri River = 1). Mitochondrial DNA sequence analysis (842 base pairs / 447 specimens) defined four ESUs (evolutionarily significant units: Missouri, Bonneville/ Snake, and Colorado River basins, and Price River within the Colorado River drainage). Microsatellite DNA analysis (16 loci / 847 specimens) identified 12 drainage-specific gene pools, but only 9 qualified as demographically

independent management units (i.e., migrants/ generation <10%). Mountain Sucker in the Price River drainage may represent a remnant of ancient Lake Bonneville as it clustered with Bonneville/ Snake basin populations. Extreme endemism in Mountain Sucker is not surprising given its propensity for smaller streams and higher elevations. Although this high-elevation species is less impacted by large-scale water management projects than are large-river congeners, it is clearly much more vulnerable to rapid climate change.

0326 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Michael E. Douglas¹, Marlis R. Douglas²

¹University of Arkansas, Fayetteville, AR, USA, ²Illinois Natural History Survey, Champaign, IL, USA

Use of genetic data to guide management of an historically admixed species complex

Over the last century, freshwater systems in southwestern North America have drastically altered, thus provoked conservation and management issues for endemic fishes. Many of these depleted or extirpated populations are prime candidates for 'supplementation programs' that will augment numbers. To avoid potentially deleterious admixtures, a clear understanding of genetically and demographically distinct lineages is required. This is particularly true in the Colorado River with its endangered Humpback Chub (*Gila cypha*), Bonytail (*G. elegans*), and a species of concern (Roundtail Chub *G. robusta*). Sequence analyses of mitochondrial DNA (1,869 base pairs/ 336 specimens) could not discriminate *G. cypha* from *G. robusta*, although both separate from *G. elegans* at 4.8% sequence divergence. This broad admixture across two species is unusual particularly given their fossil histories and distinct morphologies. In contrast, microsatellite DNA analyses of both (16 loci/ 643 specimens) identified six demographically independent populations that segregate by geomorphology and phenotype. A seventh reflected broad morphological and genetic admixture. Supplementation can be a risky management program within riverine systems depleted by drought, over-allocation, and confounded by historic admixture. Genetic data at several hierarchical levels are essential tools in promoting effective conservation and adaptive management of these faunas.

0236 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Thomas Dowling¹, Thomas Turner², Paul Marsh³

¹Arizona State University, Tempe, AZ, USA, ²University of New Mexico, Albuquerque, NM, USA, ³Marsh & Associates, Tempe, AZ, USA

Molecular markers and management of endemic fishes from the mainstream Colorado River: razorback sucker (*Xyrauchen texanus*) as a case study

The Colorado River basin is characterized by extreme environments and has evolved its own suite of unique, endemic fishes. Human impacts on the basin have resulted in severe reductions in population numbers and sizes for most species, and prompted management actions to protect them. One exemplary species of this fauna is the razorback sucker (*Xyrauchen texanus*), a long-lived, highly fecund catostomid fish. This species was once abundant and distributed throughout the basin, however, loss of available habitat and presence of non-native fishes has led to extirpation of this species from many locations. Characterization of molecular markers (mitochondrial DNA sequence variation and microsatellites) has been used to examine the effect of various management strategies on levels of genetic diversity. Use of large numbers of larvae captured in the wild from Lake Mohave, raised in protective custody, and repatriated to the lake were found to adequately represent genetic variation in the parental population, validating this as an effective strategy for managing endangered fishes.

0673 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Cory Drevecky, Rosanna Falco, Windsor Aguirre

DePaul University, Chicago, IL, USA

Genetic divergence of a sympatric lake resident-anadromous three-spined stickleback *Gasterosteus aculeatus* species pair

Mud Lake, located in Cook Inlet, Alaska, harbors sympatric populations of anadromous and lake resident three-spined stickleback, *Gasterosteus aculeatus*. The two forms differ substantially in morphology and previous indirect evidence suggests that they do not hybridize despite the postglacial origin of the lake. The genetic relationship between the anadromous and lake resident three-spined stickleback in the Jim Creek drainage is examined using nine microsatellite loci and a DNA sequence fragment from the mitochondrial d-loop. Samples of resident stickleback from three sites and anadromous stickleback from two sites in the Jim Creek drainage are included in the analysis, as are samples of three populations from the neighboring Mat-Su Valley, and one sample of a population from the Kenai Peninsula. Resident samples differed substantially from sympatric anadromous samples in the Jim Creek drainage with the magnitude of the

genetic divergence being similar to that between allopatric resident and anadromous populations in other areas. Resident samples were genetically similar within the Jim Creek drainage, as were the anadromous samples surveyed. Neighbor-joining and STRUCTURE cluster analysis grouped the samples into four genetic clusters by ecomorph (anadromous vs. all resident) and geographic location of the resident samples (Jim Creek, Mat-Su, and Kenai). There was no evidence of hybridization between resident and anadromous stickleback in the Jim Creek drainage, which thus appear to be reproductively isolated. Examining how reproductive isolation is maintained between forms in this system may provide a better understand the mechanisms at play during the early stages of speciation.

**0793 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Charles A. Drost, Terence R. Arundel, Ryan P. O'Donnell

U.S. Geological Survey, Flagstaff, Arizona, USA

Upstream and downstream effects of Glen Canyon Dam on northern leopard frogs (*Rana pipiens*)

Large dams and reservoirs profoundly alter river habitats, both upstream and downstream of the dam. Inundation of the main river and tributary streams above the dam is the most obvious effect, but the river below the dam is also altered through changes in seasonal flow patterns, temperature regime, reduced sediment loads, and a variety of more subtle changes. Research on ecological changes produced by large dams has focused attention on effects on fish populations, but virtually the entire community of aquatic and semi-aquatic species in the system is affected. Beyond the immediate loss of aquatic habitats beneath the waters of the impounded reservoir, and the alterations in the downstream mainstem river, dams also result in fragmentation of aquatic habitats in the region. They turn a formerly interconnected river and stream system into isolated tributary stream segments. For some aquatic and semi-aquatic organisms, this fragmentation may result in complete loss of connectivity in formerly extensive populations. We describe and analyze these effects on northern leopard frogs (*Rana pipiens*) in the Colorado River system in the region of Glen Canyon Dam and Lake Powell.

0052 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Jonathan Drumheller, Kyle Learn, John Steffen

Penn State Erie, The Behrend College, Erie, PA, USA

Carotenoid Pigmentation in the Nuptial Coloration of Some Emydid Turtles

Animals use a variety of pigment classes to color their integument. Two classes are carotenoids and drosoppterins. Carotenoids and drosoppterins both color the integument red, orange and yellow, but carotenoids are of interest because a) the animal must ultimately obtain them by eating plants or by eating herbivores which consume plants, and b) they have been shown to have a wide variety of health benefits (including free-radical scavenging). As a result, carotenoid-based integument color indicates something about the bearer's physiological fitness that can be used by others to assess the individual as a potential mate or rival. Drosoppterins, on the other hand, potentially reveal genetic-based information about the bearer's fitness. We used pigment extraction chemistry along with absorption spectrometry to determine the pigmentary basis to shell color in two common North American turtles (the Red Eared Slider, *Trachemys scripta*, and the Midland Painted Turtle, *Chrysemys picta*). The color of the top fractions from extracted pigments were sometimes yellow (and indicated carotenoid pigments), and the color of the bottom fractions were sometimes red (and indicated drosoppterins). Moreover, absorption spectrometry of the top fraction yielded absorption maxima at 446 and 470 nm. These findings are evidence that carotenoids (e.g. lutein and astaxanthin) as well as drosoppterins are responsible for the red, orange and yellow colors in these two turtles. Turtles can now be added to the growing list of animals that use carotenoids to color their integument and future research should investigate the behavioral and physiological roles these pigments serve.

0249 AES Ecology, Mesilla, Thursday 11 July 2013

Marcus Drymon, Laure Carassou, Sean Powers

University of South Alabama, Mobile, Alabama, USA

Multi-scale Investigation of the Factors Affecting the Distribution of Sharks in the Gulf of Mexico

Successful management of marine populations requires a spatial alignment between ecological and managerial scales. This is particularly true, yet difficult, for large, highly migratory fish such as sharks. Catch data from two fishery-independent bottom longline surveys, as well as multiple ancillary datasets representing primary and secondary productivity, physiochemical parameters and forage fish abundance were examined to better understand the mechanisms driving the distribution of sharks in the Gulf of Mexico (GOM). For this analysis, we considered basin-wide (hundreds of kilometers) as

well as regional (tens of kilometers) scales, centered on the 88th W parallel of the Gulf of Mexico. Multivariate statistical tools were used to examine the relationship between shark community structure and location across the GOM (using centered PCA), and primary/secondary productivity and location (using normed PCA). These matrices were then related using a co-inertia analysis. Results from our basin-scale analysis indicated that Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*) were associated with high crustacean biomass, while species such as spinner (*Carcharhinus brevipinna*) and blacktip (*C. limbatus*) sharks were correlated to fish biomass and ChlA concentrations. The same series of analyses were then repeated on a regional scale to examine how spatial scale affects the factors influencing the distribution of these predators in the GOM. Our data suggest the importance of combining and analyzing data spanning multiple trophic levels, and have implications for the spatial scales upon which future elasmobranch management plans should be constructed.

0521 HL Detectability Symposium, Brazos, Friday 12 July 2013

Andrew M. Durso¹, Richard Seigel²

¹Utah State University, Logan, UT, USA, ²Towson University, Towson, MD, USA

Which Snakes Cross the Road and When do They Cross it? Use of a Detectability Analysis on a Long-Term Road Survey Data Set

The use of road-running (also known as road cruising or road surveys) to study spatial and temporal variation in snake abundance and diversity has a long history in herpetology, dating back at least 80 years. Data from such road surveys have been used to study long-term changes in snake abundance and diversity and to examine the impacts of road mortality on snake populations. However, as most herpetologists are aware, variation in the results of road surveys is extremely high, with some species seen quite commonly at one point in time, then not seen again in similar numbers for weeks, months, or even years. Recent advances in the use of detectability analysis may allow a more detailed test of the reasons for such variation, and may help make road surveys a more robust method for studying changes in snake populations. We analyzed a long-term, multi-species data set (18 years, 18 species) from a protected study site at the Kennedy Space Center in central Florida using a multiple-regression (generalized additive model) approach. We found that several temporal covariates explained variation in detectability, including temperature, humidity, and moon phase, and that many of these effects were non-linear and best modeled using splines. Accounting for non-linearity in species responses to environmental conditions, especially as it relates to probability of road mortality, could help wildlife managers and transportation officials selectively mitigate the negative impacts of roads on wildlife.

0699 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Richard D Durtsche, Kris Spicer, Patrick O'Hearn, Hazel Barton

Northern Kentucky University, Highland Heights, KY, USA

Developmental Variation of *Xenopus laevis* in Response to an Anti-fungal White-nose Bat Syndrome Treatment from a Geometric Morphometric Study

White-Nose Syndrome is a bat epidemic that is spreading across North America. Wildlife managers have limited methods of control of this fungal infection. We have found that the responsible fungus, *Geomyces destructans*, is susceptible to a naturally occurring, plant produced, volatile organic compound (Carvone) which is a derivative of spearmint oil. This investigation tested the acute toxicity of Carvone on amphibians (i.e., potential cave aquatic organisms), with Frog Embryo Teratogenesis Assays of *Xenopus laevis* (FETAX). FETAX protocols provide a standardized method for evaluating potentially hazardous materials on the development of vertebrates. Mortality was recorded in replicates through the 96 hour stage of development with FETAX protocols, and abnormalities at non-lethal concentrations were studied with geometric morphometrics. Range-finding concentrations of Carvone established a series of test concentrations that were used to find a sequence of lethal concentrations of this fungicide and the concentrations at which structural abnormalities develop. The LC₅₀ for Carvone tested on *X. laevis* was 12.8 ppm based on a Logistic Regression analyses. Geometric morphometric relative warp grids were used to compare tadpole developmental differences in body shape for individuals in conc. < 0.090 ppm against control individuals. Morphological abnormalities were documented in Carvone concentrations as low as 10-15 ppb. Tests are currently being made to determine if lower concentrations of Carvone are sufficient to retard or eliminate the *G. destructans* growth. By determining if antifungal compounds like Carvone can limited impact on sentinel species like *X. laevis*, we can continue tests on more sensitive cave species.

0271 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Anthony Echelle¹, Michael Schwemm¹, Nicholas Lang², Justin Baker³, Robert Wood³, William Fisher⁴

¹Oklahoma State University, Stillwater, OK, USA, ²Lane Tech College Prep High School, Chicago, IL, USA, ³Saint Louis University, Saint Louis, MO, USA, ⁴Cornell University, Ithaca, NY, USA

Systematics and Conservation Genetics of Least Darter

Disjunct populations at the margins of the distribution of a species are viewed as units of rapid evolution and speciation and as major sources of genetic diversity important for

the long-term survival and adaptive potential of a species. We report unusually high geographic structure in populations at the southern margin of the range of the widely distributed Least Darter (*E. microperca*). We assayed mtDNA (ND2 and *cytb*) and intron 1 of the nuclear *S7* gene from localities across the range of the species. The mtDNA analysis resolved four primary clades: (1) a basal Illinois River clade, (2) a Shoal Creek clade, and (3) an upper Midwest clade that was sister to (4) a Blue River/Ozark clade comprising the remaining Ozark haplotypes and the haplotypes from Blue River (Red River basin). The haplotypes from Blue River form a monophyletic clade that is part of a polytomy with five Ozark clades. Populations in the Arkansas River basin, including those of the divergent Illinois River clade have declined markedly in recent decades and should be given high priority by conservation managers. They appear fixed for different mtDNA clades and represent a high proportion of the genetic diversity of the species. The Illinois River populations deserve especially high conservation priority. The results suggest these populations represent a genetically distinct species. For mtDNA, the group is highly divergent (8.5%) and reciprocally monophyletic with respect to the remainder of the populations, a pattern reflected, albeit weakly supported, by variation in the nuclear *S7* gene.

0265 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Matthew Edwards, Coleman Sheehy, Harvey Lillywhite

University of Florida, Gainesville, Florida, USA

Dehydration and Drinking Response of the Gulf Salt Marsh Snake

We report preliminary investigations into dehydration and drinking behavior of the Gulf Salt Marsh Snake, *Nerodia clarkii*. Despite intensive searching, only four juveniles were collected from the Cedar Keys, Levy County, Florida, during spring, summer, and fall of 2012. We hypothesize that the snakes were much less abundant compared with previous years due to mortality and population declines during an extended drought in the winter and spring of 2012. In the laboratory, we demonstrated that *N. clarkii* drink fresh water, but not seawater, when dehydrated. The mean 'threshold' dehydration at which drinking was first stimulated was a loss of 1.69 ± 0.14 (SE) percent of original body mass, which represents an order of magnitude greater sensitivity than is known for sea snakes. When offered fresh water, snakes drank 197.71 ± 21.01 percent of the mass loss due to dehydration during bouts of drinking spread over 25.47 ± 0.95 hours. After snakes were fully rehydrated and fed small fish to rebuild their mass, they were dehydrated again by exposure to air over a period when water was withheld but fish were offered as food at weekly intervals. Snakes readily ate fish at first, but they ceased eating before dehydration became severe and life-threatening. Snakes resumed eating once again following access to fresh water and rehydration. Thus, consumption of fish does not enable these snakes to remain in water balance without access to fresh water. Funding was provided by NSF grant IOS-0926802 to H.B.L.

0223 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Jennifer Eichelberger

Southern Illinois University, Carbondale, IL, USA

Single Nucleotide Polymorphisms (SNPs) Provide New Insights into Evolutionary Relationships and History of Hybridization among *Scaphirhynchus* Sturgeons.

Pallid sturgeon (*Scaphirhynchus albus*) is a federally endangered species endemic to the Missouri and Mississippi rivers and is found in sympatry throughout its range with the more common shovelnose sturgeon (*S. platorhynchus*). Species discrimination is complicated by the presence of morphological intermediates, allometric growth, and unknown levels of hybridization between species, particularly in the southernmost portions of the shared range. A panel of 19 microsatellite DNA markers is presently employed to confirm species identification and to evaluate relatedness among individuals used in hatchery supplementation programs. Single Nucleotide Polymorphisms (SNPs) have several advantages over microsatellite markers as genetic markers, including increased ease of standardization among laboratories and rapid, cost-effective processing. SNPs are also less subject to homoplasy, making them potentially more informative in reflecting evolutionary relationships among taxa. All sturgeons are known to possess duplicated genomes, and development of genetic markers in *Scaphirhynchus* sturgeons is complicated by cross-amplification of highly similar duplicated loci. SNPs have been identified by 454 sequencing of *Scaphirhynchus* cDNA libraries and subsequent Sanger sequencing of intron regions of selected genes isolated by locus-specific DNA primers. TaqMan assays have been developed for rapid genotyping. In addition to providing an easily standardized and cost-effective tool for species discrimination, these SNP markers provide additional insight regarding the evolutionary relationship and history of hybridization between pallid and shovelnose sturgeon throughout their shared range.

0707 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Iain Emmons, Erika Nowak

Northern Arizona University, Flagstaff, Arizona, USA

Northern Mexican Gartersnake Habitat Selection and Spatial Ecology in north-central Arizona

Northern Mexican Gartersnakes (*Thamnophis eques megalops*) are highly aquatic snakes found in Arizona, New Mexico, and Mexico. The species has experienced significant population declines in the United States and is currently undergoing a status review by the US Fish and Wildlife Service. The only habitat use data for individuals comes from a multi-year study at a highly modified fish hatchery environment in Arizona. We initiated research at two less modified locations in the Verde River watershed in Arizona during 2012 to examine site-specific habitat selection and spatial ecology. Survey methods included Gee minnow traps and visual encounter surveys to capture snakes, radio telemetry with adult female snakes, and random plots paired with occupied sites to determine habitat selection. Preliminary data suggests longer duration of hibernation and larger home range size compared to adult females at the hatchery site. Our research is important because it is the first to detail habitat use in more typical environments still occupied by the species in Arizona, and underscores the need for continued research to determine ecological requirements for the species.

0255 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

Brad Erisman¹, Chris Petersen², Philip Hastings¹, Robert Warner³

¹*Scripps Institution of Oceanography, UC San Diego, La Jolla, CA, USA*, ²*College of the Atlantic, Bar Harbor, ME, USA*, ³*University of California Santa Barbara, Santa Barbara, CA, USA*

Phylogenetic Perspectives on the Evolution of Hermaphroditism in Teleost Fishes

Hermaphroditism is taxonomically widespread among teleost fishes and takes on many forms. The emergence of species-level, phylogenetic reconstructions for many lineages of fishes provides the opportunity to understand fine-scale evolutionary pathways and transformations of sex allocation. Examinations of several fish families with good data on phylogeny, sex allocation patterns, mating systems and with some form of hermaphroditism reveal that the evolution and expression of protogyny and other forms of sex allocation show little evidence of phylogenetic inertia within specific lineages but

rather are associated with particular mating systems in accordance with prevalent sex allocation theories. Transformations from protogyny to gonochorism in groupers (Epinephelidae), seabasses (Serranidae), and wrasses and parrotfishes (Labridae) are associated with equivalent transformations in mating group structure from paired to group spawning and related increases in sperm competition. Similarly, patterns of protandry, androdioecy, simultaneous hermaphroditism, and bi-directional sex change in other lineages (Aulopiformes, Gobiidae, Pomacentridae) match well with particular mating systems in accordance with sex allocation theory. Unlike other animals and plants, we find no evidence that transitions between hermaphroditism and gonochorism require functional intermediates. Two instances where our general conclusions might not hold include the expression of protandry in the Sparidae and the distribution of simultaneous hermaphroditism. Overall, this work strongly supports both sexual lability within teleost fishes and a strong confirmation of evolutionary theories of sex allocation in this group of vertebrates.

0410 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Vinicius Espíndola¹, Marcelo Melo²

¹*Museu Nacional/UFRJ, Rio de Janeiro/RJ, Brazil*, ²*Universidade Federal de São Paulo, São Paulo/SP, Brazil*

Taxonomic revision of the western South Atlantic rabbitfishes (Holocephali: Chondrichthyes) with three new records and an undescribed species

The chimaeras or rabbitfishes (Holocephali: Chimaeriformes) are a group of relatively poorly known cartilaginous fish, with 51 valid extant species, divided in three families: Callorhynchidae, Chimaeridae, Rhinochimaeridae. Four species were previously reported the western South Atlantic (WSA), some of which based literature records lacking a voucher lot: the callorhynchid *Callorhynchus callorhynchus* (Linnaeus, 1758), from off Rio de Janeiro (Brazil) to Patagonia (Argentina); the chimaerids *Hydrolagus matallanasi* Soto & Vooren, 2004 and *H. alberti*, both from southeastern Brazil; and rhinochimaerid *Harriotta raleighana* Goode & Bean, 1895, which often cited from Brazil with a circumglobal distribution. Herein, we provide a taxonomic revision of chimaeras from the WSA. Most specimens were collected by the French R/V Thalassa on the Brazilian continental slope between 11° and 23° S, in depths from 50 to 2300 meters and are deposited at the Museu Nacional; further material and comparative specimens were obtained from other six collections and museums. We confirm the records of the four previously reported species, and add new records of the chimaerids *Hydrolagus affinis* (de Brito Capello 1868) and *H. mirabilis* (Collett 1904), and rhinochimaerid *Rhinochimaera atlantica* Holt & Byrne 1909. The chimerid *Chimaera* sp. is an undescribed species, which is under further investigation. Therefore, the total number of species known from the WSA has now risen to eight, with considerable range extension for the three new records, and the discovery of a new taxon.

**0118 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Luke Etchison, Mark Pyron

Ball State University, Muncie, IN, USA

Fish Assemblages and Side Scan Sonar in the Wabash River of Indiana

Understanding the species-habitat relationships of large river fishes was historically limited by the large size and spatial complexity of river ecosystems. We used a Geographic Information System (GIS) database constructed with spatially explicit physical data and information on occurrences of individual fish in each taxon to detect patterns at reach scales. We tested for variation of assemblage structure among four 10-Km reaches distributed on a 500-km distance.

**0245 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER
HERPETOLOGY AWARD**

Meredith Eyre, Richard Lehtinen

College of Wooster, Wooster, OH, USA

**Exploring the Microhabitats of Marsupial Frogs: A Study of the Forces Driving
Habitat Selection for *Flectonotus fitzgeraldi* on the island of Tobago**

Phytotelm-breeding frogs are often rather specialized for exploiting small aquatic environments, yet few studies have examined what plant features are important for habitat selection. This study examined the forces driving habitat selection for a little-known phytotelm-breeding marsupial frog, *Flectonotus fitzgeraldi*, among phytotelmata in the herbaceous *Xanthosoma jacquinii* (Araceae) on the Caribbean island of Tobago. I examined and measured 106 *X. jacquinii* at two study sites, of which 11 were occupied by *F. fitzgeraldi*. Data were collected for environmental variables (canopy cover, detritus load, invertebrate presence, distance to nearest neighboring plants), morphological characteristics of the plant (height, diameter, length of the longest petiole and leaf, number of leaf axils), and aquatic variables for the phytotelmata within the plants (dissolved oxygen concentration, temperature, pH, and water depth). A multiple logistic regression model found that water depth was the only significant predictor of *F. fitzgeraldi* occupancy in *X. jacquinii* phytotelmata ($p=0.023$). All other measured variables were unimportant, despite the importance of some of these variables in other studies. Therefore, this frog species seems to have a relatively broad ecological niche based on its ability to withstand a large range of ecological conditions. This flexibility may allow the

frog to occupy other types of phytotelmata including tree holes, bamboo stumps, bromeliads, or phytotelmata created by other plants as long as the microcosm provides an adequate water supply. From a conservation perspective, this provides hope for the frog's long term survival despite possible changes to its surrounding environment.

0515 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

Ron I. Eytan¹, Benjamin Evans¹, Alan R. Lemmon², Emily Moriarty Lemmon², Alex Dornburg¹, Peter C. Wainwright³, Thomas J. Near¹

¹*Yale University, New Haven, CT, USA*, ²*Florida State University, Tallahassee, FL, USA*, ³*University of California, Davis, Davis, CA, USA*

A Phylogenomic Approach to Inferring Acanthomorph Interrelationships

The past decade has witnessed remarkable progress in the resolution of the Tree of Life, yet some particular phylogenetic relationships, both at shallow and deep timescales, have proven difficult to resolve. Recently developed methods that allow for the sequencing of a large number of loci from many individuals in a short amount of time hold the promise of generating the data required to solve difficult phylogenetic problems. Here we tested this expectation using anchored phylogenomics to capture over a hundred nuclear loci in 29 species of acanthomorph fishes, with 25 of these species classified in the recently delimited clade Ovalentaria. We applied maximum likelihood, species tree inference, and Bayesian concordance analyses to our dataset to determine if we could resolve nodes near the base of the clade, as well as recover sub-clades that were inferred in previous studies, such as the sister relationship between cichlids and *Pholidichthys*. We found that, owing to the whole-genome duplication event in teleosts, separating out paralogous loci was a non-trivial endeavor, although an achievable one. There were important differences in the phylogenetic results among the different inference methods, and we gained insight into the phylogenetic informativeness of the loci as well as the extent of gene tree heterogeneity in the data. The methods of data acquisition and analytical approaches we employed in this study provide a provisional roadmap for future phylogenomic studies.

**0535 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE
AWARD GENERAL ICHTHYOLOGY**

Rebecca Farr, Asadullah Siddiqui, Kevin Tang

University of Michigan-Flint, Flint, MI, USA

Molecular Phylogeny of Cusk-eels (Teleostei: Ophidiiformes: Ophidiidae)

Cusk-eels (family Ophidiidae) are an enigmatic group of bony fishes that are found predominantly in marine waters around the world. The purpose of this project is to better comprehend the relationships between species of cusk-eels as they are currently poorly understood. A phylogeny of the cusk-eels (family Ophidiidae) will be reconstructed in order to determine their relationship to other fishes in the order Ophidiiformes. Genomic DNA will be extracted from subjects of all four subfamilies. Nine genes from their respective genomes will be amplified and sequenced using standard molecular biology techniques. To generate the tree of relationships, the data will be combined and analyzed using modern phylogeny reconstruction methods. The results of this study will provide an evolutionary framework that will be used to revise the classification.

0293 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Terence Farrell, Jeffrey Klotz, William Richardson, Peter May

Stetson University, DeLand, FL, USA

The Ecology of a Rattlesnake (*Sistrurus miliarius*): Integrating Information from Museum Specimens with a Field Study

We studied pigmy rattlesnakes by comparing data from museum specimens and a field study. We measured and dissected 256 museum specimens collected between 1928 and 1994 from 16 counties in peninsular Florida. The field study was based on over 10,000 observations of snakes in a decade-long study of a single population. Both field and museum data had peaks of activity in fall and the lowest activity in December-February, though the magnitude of difference was far greater in museum specimens. Museum specimens had a strongly male-biased sex ratio among adults while field observations indicated a 1:1 sex ratio. We observed no major sexual size dimorphism in field or museum specimens. The frequency of individuals with recently ingested prey differed between field (12.8%) and museum (6%) specimens, as did the species composition and species richness of prey items. While museum specimens contained centipedes, anurans, lizards and mammals in approximately equal frequencies, field observations showed a predominance of anurans. Museum specimens could be used to accurately estimate growth rates when used in conjunction with information on rattle chains

collected in the field. In most respects, the data from field and museum specimens were in agreement, though sex ratios, activity patterns, and dietary diversity at a population level may be difficult to determine from museum specimens. Museum collections allow a rapid way to evaluate many aspects of snake ecology, particularly if informed by field work, and can also establish the generality of field studies that are conducted over small spatial and temporal scales.

0206 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Amy K. Fehrenbach, Stacy L. McFadden, Peter V. Lindeman

Edinboro University of Pennsylvania, Edinboro, PA, USA

Reproductive Allometry of the Sabine Map Turtle (*Graptemys sabinensis*) in Southwestern Louisiana

Optimal egg size theory states that as females grow larger, they produce more eggs of an optimum size rather than larger eggs. However, many turtle species show a correlation of egg size with female body size. This phenomenon can be explained by the anatomical-constraints hypothesis, under which smaller females are unable to lay eggs of the optimum size because of the restricted size of the caudal gap of the shell and the pelvic aperture. We collected data on female body size, clutch size, and egg width for populations of Sabine map turtles (*Graptemys sabinensis*) in the Mermentau and Calcasieu drainages in southwestern Louisiana. The data were logarithmically transformed to perform correlation analyses addressing isometry and allometry. There was a nonsignificant positive and hypoallometric correlation of clutch size with female body size. Significant positive correlations of mean and maximum egg width with female body size, consistent with the concept of the anatomical-constraints hypothesis, also were hypoallometric (i.e., egg size increased at a slower rate than body size). These results are consistent with studies of other *Graptemys* in showing that as females grow larger, they partition the extra reproductive effort they achieve between increased egg size and increased clutch size, such that neither can increase isometrically. There were significant differences between the two drainages in mean and maximum egg width, with Calcasieu females having wider eggs after statistical correction for the influence of female body size, but whether anatomical differences that facilitate this difference exist between the drainage populations is unknown.

**0556 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD GENERAL HERPETOLOGY**

Jeremy A. Feinberg¹, Catherine E. Newman², Gregory J. Watkins-Colwell³,
Matthew D. Schlesinger⁴, Brian Zarate⁵, Brian Curry¹, H. Bradley Shaffer⁶, Joanna
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Environmental Protection, Clinton, NJ, USA, ⁶University of California, Los Angeles and
La Kretz Center for California Conservation Science, Los Angeles, CA, USA

**A new cryptic leopard frog from the urban northeast and mid-Atlantic US: a
summary of this unexpected discovery and a brief review of the species**

The *Rana pipiens* (= *Lithobates pipiens*) complex has long been a source of taxonomic uncertainty due to cryptic variation between phenotypically similar and morphologically conservative congeners. We review the pending diagnosis and taxonomic description of a new cryptic leopard frog species, *R. sp. nov.*, from the northeast and mid-Atlantic US. Our research employed several lines of evidence including genetic data (nuclear and mitochondrial), bioacoustic signals (pulse number, call length, call rate), and morphology to diagnose the new species and compare it to similar congeners. The new species is distinct genetically and bioacoustically. Despite a coastal distribution endemic to the northern half of the I-95 corridor (Connecticut to Virginia), this frog remained undetected for hundreds of years in one of the most well-studied and heavily populated urban areas on earth. This unique and unexpected discovery poses conservation concerns and underscores the potential for future 'hidden' species in locales rarely associated with contemporary species discovery. It will also create challenges for wildlife agencies as the new species is incorporated into at least seven states, some of which already protect various leopard frog species. Lastly, this discovery provides a cautionary example of unseen risks in terms of species relocations and reintroductions, not only for amphibians, but for all taxa for which cryptic species may exist.

0377 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

Kevin Feldheim¹, Samuel Gruber², Joseph DiBattista³, Elizabeth Babcock², Steven Kessel⁴, Andrew Hendry⁵, Ellen Pikitch⁶, Mary Ashley⁷, Demian Chapman⁶

¹Field Museum of Chicago, Chicago, IL, USA, ²University of Miami, Miami, FL, USA, ³King Abdullah University, Thuwal, Saudi Arabia, ⁴Great Lakes Institute for Environmental Research, Windsor, Ontario, Canada, ⁵McGill University, Montréal, Québec, Canada, ⁶Stony Brook University, Stony Brook, NY, USA, ⁷University of Illinois at Chicago, Chicago, IL, USA

Twenty-year pedigree yields first evidence of geographically precise natal philopatry in sharks.

Geographically precise natal philopatry is not well known in late-maturing marine species, including sharks and their relatives (Class Chondrichthyes). A genetic-based pedigree of lemon sharks (*Negaprion brevirostris*) sampled from 20 consecutive cohorts (1993-2012) at Bimini, Bahamas showed that certain females faithfully gave birth at this site for nearly the entire period. Six females born from 1993-1997 returned to give birth 14-17 years later. This is remarkable considering that only 15 females (95% C.I. 8-25) from these cohorts are likely to have survived to maturity and Bimini represents < 2.5% of available nursery habitat within a conservative estimate of their dispersal range. Long-term fidelity to nursery sites and geographically precise natal philopatry highlights the merits of emerging spatial and domestic conservation efforts for these threatened predators.

0449 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Shobnom Ferdous

Auburn University, Auburn, AL, USA

Molecular phylogeny of the catfish genus *Mystus* Scopoli (Siluriformes:Bagridae)

Catfishes (Order Siluriformes) are a very diverse group of vertebrates with more than 3000 valid living species in 37 recognized families (Sullivan et al., 2006; Ferraris, 2007). Bagridae is the seventh most species-rich catfish family currently recognized, and it includes 144 valid species in 18 genera (Ku et al., 2007). A number of works have attempted to resolve relationships among catfish families and there are many other bagrid genera among which *Mystus* remains a poorly diagnosed group whose monophyly is well supported (Ng, 2003). There has been no phylogenetic study done on the genus *Mystus*. So, species-level relationships among catfish group *Mystus* (Bagridae:

Siluriformes) were investigated by parsimony, maximum likelihood and Bayesian analyses of one mitochondrial gene across 20 catfish species representing one genus *Mystus* Scopoli (Bagridae:Siluriformes). The inferred phylogeny appeared to match major groupings currently recognized in the taxonomy. Analysis of 1154 aligned base of mitochondrial (cytochrome b) sequence found all the *M. gulio* species complex as one monophyletic clade. *M. vittatus* and *M. tengara* came as sister species. The *M. cavasius*, *M. bleekeri*, *M. singaringan*, *M. bocourti* came as one monophyletic clade which has very large adipose fins. Short adipose fin sized *M. wolffii* came as sister to *M. gulio* for Parsimony analysis but differed in Likelihood analysis. Major outcome of this analysis was to find all the *M. gulio* species complex as one species. Adding some nuclear gene in future study and add more species could give us better resolution about the intraspecific relationship of *Mystus*.

0646 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Jennifer Ferington, Cynthia Moulton

Castleton State College, Castleton, VT, USA

Effects of low-dose, short-term exposure to the Herbicide "Roundup" on long-term survival of the African clawed frog, *Xenopus laevis*

Glyphosate is an herbicide that was first created in 1971 and was later registered by the EPA in 1974. The use of glyphosate has grown in recent years with 18.7 million pounds of the product being used annually, mostly in fields ("R.E.D. Glyphosate"). In the U.S. there are now over 750 products that contain glyphosate as an active ingredient including the herbicide Roundup. Most studies have examined glyphosate at high doses to achieve what is known as an LD₅₀ or LC₅₀ toxicity value for a duration of between 48 and 96 hours. While this is important for comparison purposes the criticisms of these studies state that most environmental exposures are at much lower concentrations. In addition, recent toxicological studies with fish and mice reveal that low-dose exposures to contaminants can have long-term developmental consequences. We conducted three separate experiments with tadpoles of the African clawed frog, *Xenopus laevis* exposed to Roundup at three dose levels, all within or below estimated environmental concentrations ranging from 10 ug/l to 100 mg/l. Tadpoles were exposed for 96 hours then monitored for an additional 10 weeks. Our results indicate that there are both short-term and long-term effects in tadpole mortality and weight gains between individuals exposed to Roundup and control tadpoles. Although this study evaluated only one species of frog it reveals the need for more long-term studies on the effects of low-dose contaminant exposures on amphibians in general and how these exposures impact future survival.

0620 Fish Conservation, San Miguel, Sunday 14 July 2013

Daniel Fernando¹, Mohanraj Theivasigamani², Guy Stevens²

¹*Linnaeus University, Kalmar, Sweden*, ²*The Manta Trust, Dorset, UK*

Mobulid Fisheries of South India as an Example of a Problematic Activity

The two genera *Manta* and *Mobula* (family: Mobulidae) of the cartilaginous subclass Elasmobranchii comprise 11 extant species worldwide. Current biological data for all of these species are very limited. Two landing sites in the South of India were surveyed over 207 days and data derived from 565 specimens landed as non-discarded by-catch in the skipjack and yellowfin tuna gill-net fishery. The most abundant species was *Mobula japanica* (n=517; 91.5%), followed by *Mobula tarapacana* (n=35; 6.2%), *Manta birostris* (n=7; 1.2%), *Mobula thurstoni* (n=5; 0.9%) and *Mobula eregoodootenkee* (n=1; 0.2%). Of all the male *Mobula* rays (n=556), a total of n=252 (80%) were immature while only n=63 (29%) were mature adults. Furthermore, all *M. birostris* (n=7: 3 females, 3 males and 1 unknown) were juveniles or sub-adults. Tissue samples collected for population genetics, stable isotope analysis and persistent pollutants study are currently being analysed. Mobulid rays are listed as "Vulnerable" or "Near Threatened" on the IUCN Red List and with few natural predators, slow growth rates, low fecundity and late maturity, threats faced from anthropogenic fishing pressures can have severe impacts on their global populations. The driving forces behind this fishery are the increasing demand for dried mobulid gill plates by the Chinese Medicine trade and while *Manta* recently gained additional trade protection under CITES Appendix II, *Mobula* are still largely unprotected. This data will help improve knowledge on existing stocks and support the implementation of management strategies to ensure conservation of these species and promote sustainable alternatives such as eco-tourism.

0063 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Brenton Fetting, Loren Smith, Scott McMurry, Craig Davis

Oklahoma State University, Stillwater, OK, USA

Amphibian Community Composition in Man-Made Ponds and Natural Wetlands in the Ouachita National Forest

Habitat fragmentation or loss commonly contributes to the decline of amphibian populations, but the construction or restoration of wetlands may provide replacement habitat and improve the persistence of amphibian populations. The Ouachita National Forest in southeastern Oklahoma, USA, is managed to promote amphibian abundance via pond construction, but the amphibian community composition of these man-made ponds is unknown. To evaluate the provisioning of habitat by man-made ponds for amphibians, 26 man-made ponds and 26 corresponding natural wetlands were sampled

using 3 sampling techniques over 3 months in summer 2012. Seining and dip-netting captured larval and aquatic individuals, transects identified adults and juveniles, and call counts indicated the presence of adults that vocalize. Habitat variables were measured to determine what variables influence species distributions and community composition. Man-made ponds harbored more amphibians, supported more vegetation, had greater depth and longer hydroperiods, and were more exposed to open sky. Man-made ponds also had higher overall richness, and the presence of fish did not appear to affect species richness in man-made ponds or natural wetlands. No exotic species were detected in either habitat type. Canonical correspondence analysis suggests that vegetation, substrate type, and ambient air temperature primarily determine species distribution and community composition. Man-made ponds appear to be positively impacting native amphibian diversity in the Ouachita National Forest.

0545 AES Behavior, San Miguel, Sunday 14 July 2013

Jean Sebastien Finger², Tristan Guttridge³, Alexander Wilson⁴, Ned Dochtermann⁵, Samuel Gruber¹, Jens Krause²

¹*Bimini Biological Field Station, Bimini, Bahamas*, ²*Humboldt University, Berlin, Germany*, ³*School of Earth and Ocean Sciences, Cardiff University, Cardiff, UK*, ⁴*Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Department of Biology and Ecology of Fishes, Berlin, Germany*, ⁵*Department of Biological Sciences, North Dakota State University, Fargo, ND, USA*

Investigating personality in juvenile lemon sharks (*Negaprion brevirostris*)

Animal personality has gained a lot of interest in the last decade and it is now clear that most animals (from vertebrates to invertebrates) have personality. Personality in animals represents behavioral consistency, meaning for instance that a bold individual will stay bold in every situation relative to a shy individual. The recent boom in personality studies comes from the far reaching implications from both an evolutionary as well as an ecological point of view. It is therefore important to investigate the presence of personality in elasmobranch fishes. This project is based on behavioral observations in different contexts such as sociability and novel environments in the juvenile lemon shark (*Negaprion brevirostris*). An experimental pen was designed to assess six sharks for these latter tests per day in two nurseries. During the year 2012, lemon sharks (n=121) were tested and among these sharks 80 were retested. Results revealed that juvenile lemon sharks possess a social and explorative personality that stayed consistent over a 6 month period. Furthermore, in one of the nurseries a strong correlation between exploration and sociability was found being the first demonstration of behavioral syndromes in elasmobranchs and illuminating an interesting difference between the two tested populations. In the following year, the large sample size that will be accumulated by this method will allow us to investigate the genetic component of personality and the relationship between personality type, growth rate and survival along with testing personality in their natural environment.

0786 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Robert Fisher¹, Garrett Call², Jan McDowell¹

¹Virginia Institute of Marine Science, Gloucester Point, VA, USA, ²Tufts University, Cummings School of Veterinary Medicine, North Grafton, MA, USA

Reproductive Anomalies in Cownose Rays (*Rhinoptera bonasus*) from Chesapeake Bay

This study marks the first observation of multiple embryos and right uterus functionality in cownose ray, *Rhinoptera bonasus*. The recovery of a three-quarter term albinistic cownose ray embryo through necropsy is also reported. A total of eight episodes of multiple embryos in cownose rays are reported herein. Two sets of twin live births from captive rays and six separate in utero multiple embryos discovered during necropsy of fishery dependent and independent acquired samples were observed. All multiple embryos were developing in the left uterus. Live births occurring in captivity were confirmed to be two sets of twins through direct sequencing a portion of the mitochondrial DNA from the newborn pups and putative mothers. Cownose ray have paired reproductive tracts, and previously functionality was reported only in the left oviduct. This is the first reporting of gestation in the right oviduct in cownose ray, with first quarter and third quarter embryos removed from the right uterus of two female rays.

0514 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Austin L. Fitzgerald, Levi T. Cole, Charles W. Painter

New Mexico Department of Game and Fish, Santa Fe, NM, USA

Effects of Habitat Fragmentation on Community Structure and Diet of Lizard-Eating Snakes

Landscape fragmentation is known to have significant impacts on biodiversity and community structure, and its implications for conservation are well documented. Few studies have been conducted on the effects of habitat fragmentation on snake communities in the arid southwest. From 2009 through 2012, we investigated the abundance and diversity of lizard-eating snakes at sites that were fragmented (n=3) and non-fragmented (n=6) by oil and gas development in southeastern New Mexico. Drift fence arrays were established and monitored for 50 days per year, yielding a total of 19,200 trap days and 950 snake captures and recaptures. We collected fecal samples (n = 177; 2009 - 2011) to determine the lizard diet of selected snake species captured at these

sites. When possible, lizard parts were identified to species via comparison with microscope slides prepared with the scales of known species. Using results from this study we will analyze differences in snake populations, community structure, and diet to make comparisons between fragmented and non-fragmented sites. Our results will provide data that can be used by resource management agencies to make informed decisions regarding the herpetological community in the rapidly changing Mescalero Sands ecosystem.

**0232 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Lee A. Fitzgerald¹, Wade A. Ryberg¹, Daniel J. Leavitt², Charles W. Painter³

¹Texas A&M University, College Station, Texas, USA, ²Arizona Game and Fish Department, Phoenix, Arizona, USA, ³New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA

How and why fragmentation from energy development impacts populations of Dunes Sagebrush Lizard (*Sceloporus arenicolus*)

Why does landscape fragmentation cause population decline? The answer depends on species' life history and behavioral constraints, its ecological role, and its dependence on specific landscape features. Meticulous ecological studies on the endemic habitat specialist, Dunes Sagebrush Lizard (*Sceloporus arenicolus*), reveal mechanisms of population scaling from locally interacting individuals up to the distribution of the species across its range. Dunes Sagebrush Lizards live in "neighborhoods". Larger neighborhoods produce excess recruits that disperse and diffuse across the interconnected landscape. Neighborhood size is correlated with landscape configuration; irregular-shaped (edgy), poor-quality habitats support smaller neighborhoods, where recruitment does not balance mortality. Diffusion-dispersal from large thriving neighborhoods maintains smaller neighborhoods and thus insures population persistence at a regional scale. The Mescalero-Monahans shinnery dune ecosystem, where these lizards and other endemics exist, overlies the Permian Basin, a region beset with extensive fragmentation from oil and gas development. Fragmentation lands a double whammy by disrupting both the geomorphologic processes that maintain dunes and the diffusion-dispersal dynamics that connect lizard neighborhoods. Conservation measures in place for the Dunes Sagebrush Lizard call for localized habitat protection. However, the extent of these measures does not match ecological scaling in this system and may not protect the shinnery dunes from the higher-level problem of fragmentation that drives species disappearance. Mismatch between conservation scaling and ecological scaling is a pervasive challenge to achieving biodiversity conservation. Nevertheless, insights from this case study drive home the importance of conservation research that informs the development of policies that match the ecological scaling of target species.

0494 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Kevin Floyd, Priscilla Duran, Raul Marin, Elizabeth Walsh

University of Texas at El Paso, El Paso, TX, USA

Comparison of road impacts on the population genetic structure of two syntopic lizards in southern New Mexico

Wide-ranging species are expected to incur increased road-related mortality, potentially decreasing population sizes and lowering genetic diversity. Sedentary species are less likely to attempt crossing roads, increasing isolation and genetic differentiation. We tested these hypotheses using two species of lizards: active-foraging western whiptails (*Aspidoscelis marmorata*) and sit-and-wait side-blotched lizards (*Uta stansburiana*). We predicted that populations of whiptails would have decreased genetic diversity while side-blotched lizards would become genetically differentiated. We collected tissue samples along two roads in southern New Mexico, Interstate 10 and State Highway 9, at different distances from each road: 10-20 m, 50-125 m, and 1000 m. We amplified nine microsatellite loci for 371 side-blotched lizards (14 locations) and seven loci for 280 whiptails (11 locations). Genetic diversity was similar at all distances from both roads for both species (mean number of effective alleles per locus, side-blotched lizards: 1.8-2.4, SE 0.4-0.6; whiptails: 3.1-3.7, SE 1.2-1.7). There was no evidence of increased genetic differentiation between populations separated by roads for either species as measured by pairwise F_{ST} values (-0.01-0.03 for each species) or Bayesian clustering using STRUCTURE (K=1 for each species, ln likelihood: side-blotched lizards: -6820; whiptails: 4104.1). The study region is largely undeveloped mesquite sand dunes, save for these two paved roads, and both species are abundant. The large populations and continuous habitat are potentially confounding our ability to detect genetic changes. Alternatively, sufficient numbers of lizards successfully cross each road, maintaining connectivity. We plan to use simulations to further explore these alternatives.

0334 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Sonja Fordham

Shark Advocates International, Washington, DC, USA

Preventing the Predictable Depletion of U.S. Atlantic Cownose Rays (*Rhinoptera bonasus*)

U.S. east coast fishing representatives have devised campaigns to promote local and international consumption of cownose rays (*Rhinoptera bonasus*) taken primarily as bycatch in Mid-Atlantic fisheries. Industry interest in developing new markets for

commonly caught species is bolstered by widespread belief that cownose rays are preying dangerously on commercially valuable bivalves, such as oysters, scallops, and clams. Promoters of cownose ray consumption have used scientific findings on the role of *R. bonasus* in bivalve depletion (which are disputed) to mischaracterize these rays as overly abundant, invasive, nuisance species. Given the extremely low fecundity of cownose rays, fishing mortality must be tightly controlled to avoid overexploitation and population collapse. Yet, years after commercial interest in cownose rays was sparked, there are no U.S. Atlantic cownose ray population assessments or fishing limits. State managers are open to taking conservation action, despite relatively low public pressure to do so, but lack technical advice for basing measures. There is interest in creating incentives for fishery improvement through sustainable seafood initiatives, but specific projects are not progressing as swiftly as planned. The main cownose ray retailer does not sell shark due to sustainability concerns, reflecting significant inconsistencies in public awareness and concern with respect to elasmobranchs. Increased engagement by scientists, conservationists, consumers, and managers is needed to ensure cownose ray fishing is kept to sustainable levels. This presentation will review the recent history of cownose ray characterization and commercialization in the Mid-Atlantic region, and include recommendations for action aimed at a range of interested parties.

0483 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Alicia Fox¹, Aaron Schrey², Henry Mushinsky¹, Earl McCoy¹

¹University of South Florida, Tampa, FL, USA, ²Armstrong Atlantic State University, Savannah, GA, USA

Are roads a barrier to gene flow in a sand burrowing lizard, the Florida Sand Skink, *Plestiodon reynoldsi*?

The scrub of peninsular Florida is a highly imperiled ecosystem and home to numerous federally listed species. Effective conservation of these species will benefit from understanding how anthropogenic habitat modification alters the genetic characteristics of populations. Roads are a common anthropogenic habitat modification, and understanding their effect on local populations is important for management. Our goal is to determine if Florida State Road 40 (SR40), which bisects the Florida scrub habitat of the Ocala National Forest in northern peninsular Florida, is a barrier to gene flow in the threatened Florida Sand Skink, *Plestiodon reynoldsi*. The fossorial Sand Skink requires fine, well-drained sand for locomotion; thus, roads may have a direct impact on individual movement. Construction of SR40 began between 80 and 100 years ago, for which approximately 25-30 generations of the Florida Sand Skink have occurred prior to sample collection. We collected individuals (n = 44) from sites north and south of SR40 and screened them for allelic variation at 8 microsatellite DNA loci and mitochondrial DNA variation at the cytochrome-b gene. Because we know the approximate time SR40 altered the habitat of the Florida Sand Skink, we may be able to calibrate the time required for genetic characteristics of the local populations to change. We will also

compare our findings to those from recent studies of the Florida Sand Skink in the southern extent of its range.

0758 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Stanley Fox, Ariel Richter, David Leslie, Jr.

Oklahoma State University, Stillwater, OK, USA

Using Remote Query of PIT-tagged *Trachemys scripta* to Determine Trapping Dynamics via Conventional Hoop Traps

We captured 50 adult *Trachemys scripta* from Payne County, Oklahoma, in the summer of 2012 and implanted a PIT tag into the upper thigh of each individual. These were released into two adjacent 0.1-ha ponds together surrounded by a turtle-proof fence. We monitored entrances, exits and residence time of 33 turtles for 17 days in two sessions (6-21 July and 13-15 August) by means of a Biomark racket antenna hung in the very center of a hoop trap and adjusted so as to record PIT tags of turtles inside the antenna and a few centimeters outside it, but not to record any PIT tags in turtles outside the hoop trap. Traps were baited daily with previously frozen fish. With this method we remotely recorded the exact time and unique identity of each turtle as it entered or exited the trap. We registered 1965 tag reads and recorded 170 separate entrances into the trap. Surprisingly, turtles did not remain inside the trap for that long; mean residency time was 40.5 minutes (range from 3.5 to 143.4 minutes) for 30 turtles who remained in the trap for at least 1 minute. Although females remained in the trap slightly longer than males, this was not significantly different. We conclude that turtles are not really "trapped" by hoop traps; individuals can rather freely enter and exit the trap at will. Turtles entered the trap significantly more than expected during daylight hours compared to nighttime hours. Other variables relating to trap entrances will be discussed.

**0649 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Benjamin Frable, Brian Sidlauskas

Oregon State University, Corvallis, OR, USA

The Oregon State Ichthyology Collection: rehabilitation and digitization of an exceptional library of fishes

Established in 1935, the Oregon State Ichthyology Collection (OSIC) developed into an important resource for ichthyological research and education in the Pacific Northwest under the curation of Carl Bond and later, Doug Markle. Lack of space and funding hindered expansion and modernization until 2009 when NSF funding allowed us to relocate, rebuild and digitize the collection. Since then, the collection has been relocated to a state of the art, fire and earthquake safe facility with compact shelves and archival tanks for specimen storage. The collection houses the largest collection of Oregonian fishes in the world, is a major repository of specimens from throughout the Pacific Northwest and contains large international holdings from Japan, Iran, Guyana, Peru and India. The OSIC has over 18,800 cataloged lots (and many uncataloged backlog lots), of which over 13,600 (~75%) have been digitized and are now searchable via FishNet2 (<http://www.fishnet2.net/search.aspx?c=OS>). The opportunity to computerizing this medium sized collection allowed for the implementation of innovative bioinformatic tools and the development of workflows for transfer of data from paper card catalog to computer databases and student curatorial training. Future phases of the computerization will georeference and image portions of the collection to support ongoing research and the development of a new online class in fish systematics. Herein, we update the international ichthyological community with an overview of these ongoing developments and introduce the extensive, surprising and previously poorly known holdings at Oregon State University!

0094 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Lilian Franco-Belussi, Juliane S. Freitas, Classius Oliveira

São Paulo State University, São José do Rio Preto, São Paulo, Brazil

Extracutaneous pigmented cells in *Eupemphix nattereri* (Anura:Leiuiperidae) are responsive to α -Melanocytes Hormone Stimulating

Amphibians have melanin-containing cells in visceral organs. Visceral melanocytes are similar to pigmentary cells from the epidermis and both are derived from the ectodermal neural crest. These epidermal cells respond to α -melanocyte stimulating hormone (α -MSH), which is associated to the dispersion of melanin granules within

melanocytes. Therefore, our aims in this study are to test whether the Nle⁴, D-Phe⁷- α -MSH (synthetic, non-biodegradable analogue of α -MSH) changes the superficial pigmentation of organs of *Eupemphix nattereri*. The hormone increases the pigmentation on the surface of pericardium, heart, kidneys, testes, mesentery, nerves of the lumbar plexus, and lumbosacral parietal peritoneum. Pigmentation increased rapidly (after 2 hours) following hormone administration in the heart, testes, nerves of the lumbar plexus, and mesentery. However, this hormone did not change pigmentation on intestine and rectum. Our results demonstrate that the visceral pigmentation is responsive to hormone Nle⁴, D-Phe⁷- α -MSH. Our findings could be explained by similarities between epidermal and visceral melanocytes because both are originated from ectodermal neural crest and the increase in visceral pigmentation may be related to the dispersion of melanossomes within melanocytes.

0042 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Nathan Franssen

University of New Mexico, Albuquerque, NM, USA

Reservoirs as a Model System to Assess Contemporary Evolution in Stream Fishes

Understanding population-level responses to novel selective pressures can elucidate evolutionary consequences of human-altered habitats. Stream impoundments (reservoirs) alter riverine ecosystems worldwide and changes to fish communities in impoundments are well documented. However, little is known of how native stream fishes that persist in reservoirs respond to novel selection pressures imposed by impounded habitats. Assessing phenotypic trait divergence in reservoir habitats will be a first step in identifying the potential evolutionary and ecological consequences of stream impoundments. I assessed morphological variation of stream fishes from stream and reservoir habitats, as well as investigated the relative contribution of flow- and predator-induced phenotypic plasticity to observed variation in the field through common garden experiments. There was significant and replicated trait divergence in five stream fishes that inhabit reservoirs. Portions of phenotypic divergence in reservoirs were similar among species, but unique species-specific changes were also evident. Results from common garden experiments revealed population-level differences persisted in the lab and populations can be phenotypically plastic in response to predators and flow variation. The morphologies of fish reared in flow and no flow conditions suggest flow-induced phenotypic plasticity is not responsible for observed phenotypic changes in the field. These results suggest that, although components of body shape are plastic, anthropogenic habitat modification can drive trait divergence in native fish populations in reservoir-altered habitats.

0066 AES Ecology, Mesilla, Thursday 11 July 2013

Bryan Frazier^{1,2}, William Driggers³, Josh Loefer⁵, Doug Adams⁴, Christian Jones³

¹College of Charleston, Charleston, SC, USA, ²South Carolina Dept of Natural Resources, Charleston, SC, USA, ³National Marine Fisheries Service, Southeast Fisheries Science Center, Pascagoula, MS, USA, ⁴Florida Fish and Wildlife Conservation Commission, Melbourne, FL, USA, ⁵University of South Carolina, Columbia, SC, USA

Validated Age and Growth of the Bonnethead, *Sphyrna tiburo*, in the western North Atlantic Ocean

Age and growth of the bonnethead *Sphyrna tiburo*, was examined in coastal waters off the east coast of the US. Vertebrae were collected and aged from 329 females and 216 males. Sex specific von Bertalanffy growth curves were fitted to length at age data. Female von Bertalanffy parameters were L_{∞} = 1032 mm FL, k = 0.18, t_0 = -1.75, and L_0 =291mm FL. Males reached smaller theoretical asymptotic length, and had a slower growth coefficient, with von Bertalanffy parameters being L_{∞} = 778 mm FL, k = 0.30, t_0 = -1.50, and L_0 = 281 mm FL. Maximum observed age was 17.9 and 12.0 years for females for males. Annual deposition of growth increments was verified by marginal increment analysis and validated through recapture of 13 OTC injected specimens. Annual band deposition was validated for age classes 2.5+ to 10.5+ with times at liberty ranging from 1 to 4 years. Age at 50% maturity was 6.6 years and 3.9 years for females and males. von Bertalanffy growth parameters were compared to growth parameters from bonnethead in the eastern Gulf of Mexico (GOM) to test for differences. Female and male bonnetheads in the SAB had a significantly higher theoretical asymptotic length, lower coefficient of growth, and lower estimated mean size at birth. Maximum observed age and age at 50% maturity were higher for both sexes in the SAB. Significant differences in age and growth parameters and evidence from tagging studies suggest that for management, bonnethead sharks in the SAB and GOM should be considered separate stocks.

0595 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Layla R. Freeborn¹, Wei Zhang², Marcus R. Kronforst², Corinne L. Richards-Zawacki⁰

¹Tulane University, New Orleans, LA, USA, ²University of Chicago, Chicago, IL, USA

A Population Genomic Scan of the Highly Polymorphic Strawberry Poison Frog (*Dendrobates pumilio*) Reveals Markers Strongly Associated with Color Pattern

The strawberry poison frog, *Dendrobates pumilio*, exhibits one of the most extraordinary examples of color polymorphism in nature, particularly in the Bocas del Toro region of Panama where over fifteen color morphs have been described. Because color is important in both mate choice and avoiding predation, finding the genes that underlie this polymorphism will help to clarify the evolutionary mechanisms that drive diversification within and among populations. Little is known about the genes that control skin pigmentation in amphibians, and nothing is known for poison frogs. Until recently, identifying genes affecting morphological traits was a costly and time-consuming undertaking. However, with the advent of next-generation sequencing (NGS), it is now possible to process millions of sequences in parallel in a cost- and time-efficient manner. Using Restriction-site associated DNA (RAD) sequencing, we have conducted a high-resolution population genomic scan of sympatric *D. pumilio* morphs from two polymorphic populations. We identified 18 RAD markers that were strongly associated with color pattern in both polymorphic populations, some of which appear to be located in genes. To identify the regions of the genome that contain these associated markers, we also constructed a genetic linkage map for *D. pumilio* using RAD markers generated from 48 F₁ offspring from 8 families. The results of this study are an important first step towards ultimately identifying the genes that underlie color pattern variation in *D. pumilio* and gaining an understanding of how adaptations arise and spread in natural populations.

0501 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Elyse Freitas, Juan Daza, Aaron Bauer, Todd Jackman

Villanova University, Villanova, Pennsylvania, USA

Osteological Correlates of Orbit Size in Squamate Reptiles

Eye size in squamates is highly variable, ranging from vestigial (e.g., Typhlopidae) to large and protuberant (e.g., Gekkota). As a result of differences in eye size, squamate circumorbital bones exhibit variation in shape, composition, and arrangement. The orbit

varies from having a totally closed rim to being open posteriorly, which can be explained by reduction, loss, and fusion of bones. The limit of the orbit is not easy to determine in squamates with incomplete orbits where the rim is confluent with the temporal openings. Additionally, it is difficult to establish the homology of some bones across groups. The frontal bone, part of the orbital rim, is found as a discrete element in most squamates. We observed that squamates with long frontals generally have large eyes; consequently, the bone is hypothesized to be an indicator of the orbit size. We measured the length of the frontal and of the intact skull of squamates on high resolution CT scans in order to explore the correlation between frontal length, skull length and orbit diameter. Our results indicate that visual specialist groups such as gekkotans and iguanians have a particularly long frontal bone, which is strongly related to the presence of large orbits. Additionally, changes in the size of the frontal help explain shifts in the position of some circumorbital bones and may help to better understand the homology of controversial elements. The results of this analysis are discussed in a phylogenetic context using the two current competing hypotheses of higher order squamate relationships.

0424 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Bryan Frenette, Aaron Geheber, William Matthews, Edie Marsh-Matthews

The University of Oklahoma, Norman, OK, USA

Effects of Predation Pressure on Survival and Recruitment of Red Shiners

Red shiner is a common, widespread minnow native to streams of the central United States, and is highly invasive where it has been introduced. Despite being invasive, red shiners disappeared from native streams in southern Oklahoma where they were historically abundant. Over the period that red shiners declined (1985 to 2005), centrarchid predators increased in these streams, suggesting that predation pressure may have contributed to red shiner decline. Following a major flood in 2007, red shiners re-appeared in Brier Creek, but have failed to become re-established. Mesocosm experiments on factors inhibiting re-invasion of red shiners back into their native habitat suggested sunfish predation as a factor. To directly examine effects of predation pressure on survival and recruitment of red shiners, we conducted a mesocosm experiment in which we varied numbers and types of sunfish in an assemblage of species native to Brier Creek, including red shiners. Under no to low predation pressure, red shiners survived and reproduced. At moderate to high levels of predation, red shiners showed reduced survivorship and no recruitment.

0426 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Bryan Frenette¹, Nicholas Mandrak²

¹The University of Oklahoma, Norman, OK, USA, ²Fisheries and Oceans Canada, Burlington, ON, Canada

The Effects of Turbidity on the Growth of Young-of-Year Spotted Gar

Lepisosteids are top level predators whose populations are in decline across much of North America. In Canada, the Spotted Gar (*L. oculatus*) has been listed as a threatened species. Increasing turbidity in Lake Erie has been suggested as a reason for decline of Spotted Gar in Canada, due to decreased growth rates in more turbid waters, particularly in the first year of life. To examine effects of turbidity on growth rates in the first year of life, I plan to assess rate of growth of young-of-year Spotted Gar over several months under several treatment levels of turbidity. I aim to assess if turbidity does impact the rate of growth in these fish, and at what level an effect begins to manifest. The intent of this poster will be to provide the preliminary results of the ongoing project, providing insight into the effect on growth at very early life history stages, and to outline the future direction of the project.

0764 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Jared Fuller, Richard Kazmaier, Rocky Ward

West Texas A&M University, Canyon, Texas, USA

Effects of catastrophic wildfire on genetic structure of a population of Texas horned lizards (*Phrynosoma cornutum*) in South Texas

In March of 2008 Texas Parks and Wildlife Department's Chaparral Wildlife Management Area experienced a wildfire that burned approximately 95% of the managed land. Mortality during and after the fire is thought to have resulted in a dramatic reduction in Texas horned lizards observed during subsequent monitoring efforts. In order to examine the effects of this putative population bottleneck on genetic structure we recovered genomic DNA from toe clippings collected during post-fire monitoring and from toe clips that had been collected in the years preceding the fire. Allelic variation in eight microsatellite loci was examined to test for reduced heterozygosity or allelic richness. No statistically significant decrease was observed in either measure. Nor were obvious shifts in allele frequency observed when post-fire and pre-fire samples were compared. Our data fail to support the hypothesis that the 2008 wildfire resulted in a genetic bottleneck.

0035 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

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Relative Vulnerability of Sharks to the US Atlantic Pelagic Longline Fishery

Bycatch occurs in virtually all fisheries worldwide, and has been implicated as a major driver of the declines for numerous marine fish stocks, including species of shark that are now classified as threatened. The present study examines the hooking survival (i.e., proportion of live fish upon gear retrieval) of 12 shark species that are routinely caught in the US Atlantic pelagic longline fishery. The data examined were collected by the US NMFS Pelagic Observer program from 2005 to 2012. Logistic regression was used to test the hypothesis that fishery target has no impact on shark hooking survival. Soak time, temperature, hook depth and shark size were included as factors in the regression models. Results suggested significant survival differences according to fishery target for one-third of species with a pattern of greater survival during tuna versus swordfish fishing. Overall, rankings of shark species vulnerability were similar with night shark and scalloped hammerhead being the most and tiger shark being the least susceptible to the longline gear interaction. Results are discussed within an ecological risk assessment framework that considers how species-specific differences in phylogeny, physiology, and ecological and functional specialization may affect survival.

0503 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Aaron Geheber

University of Oklahoma, Norman, Oklahoma, USA

Phylogenetic Structure in Darter Assemblages: Identifying Ecological Processes Through Evolutionary Relationships

Biotic and abiotic processes affect assemblage structure in stream fishes, but the degree of their importance is not well understood. Recently-developed approaches provide tools to estimate relative importance of biotic and abiotic interactions based on phylogenetic relatedness of assemblage members. Because closely related species are more likely to be ecologically similar than distantly related species, processes responsible for assemblage organization will be reflected in phylogenetic structure. I

assessed phylogenetic relatedness in darter assemblages to determine processes (i.e. competition and/or environmental filtering) influential on organization. I hypothesized that assemblages would be non-randomly structured based on phylogenetic relationships. Phylogenetic clustering will result from environmental filtering and phylogenetic overdispersion will result from competitive exclusion. Darters were collected from 270 plots across fifteen riffles in the Duck River, Tennessee. Multiple habitat parameters were also collected from each plot. Phylogenetic relatedness metrics were calculated for assemblages using a phylogeny based on the regional species pool of the family Percidae. Additionally, habitat and morphometric data were used to calculate metrics of inter-specific ecological similarity within assemblages. Assemblage members were more closely related than expected by chance at both the plot and riffle scales. However, there was an increase in relatedness associated with increase in spatial scale. Moreover, assemblages contained ecologically similar species. These results suggest that environmental filtering is important in comparison to competition processes in darter assemblage organization. Implications of these results and the role of spatial scale on organization processes will be discussed.

0381 AES Reproduction, Mesilla, Sunday 14 July 2013

Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Androgen production and function in male elasmobranch reproduction

Because of their phylogenetic position and diverse array of breeding strategies, sharks and their relatives are an interesting taxon for investigating the evolution and function of hormones involved in reproduction. Despite this, however, the reproductive endocrinology of cartilaginous fishes has been poorly studied in comparison with that in other major vertebrate groups, and many of the endocrine pathways typically involved in vertebrate reproduction remain largely uncharacterized in these fishes. In this review, I will discuss the results of our laboratory's efforts to better understand the reproductive endocrinology of male sharks and rays, highlighting research on the role of androgens in reproductive tract function. Topics such as sites of androgen production, circulating androgen concentrations, and androgen receptor distribution in reproductive organs of male sharks and rays will be discussed.

**0746 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

Anthony Geneva, Richard Glor

The University of Rochester, Rochester, NY, USA

Reproductive Isolation in *Anolis* lizards

Although speciation is defined as the evolution of reproductive isolation, our knowledge of how various forms of reproductive isolation accumulate during speciation remains rather limited. Detailed multi-generation experimental studies with a small number of representatives from several major clades - including plants, invertebrates, fish, amphibians, birds, and mammals - suggest that the evolution of reproductive isolation is often characterized by four general patterns: (1) heterogametic hybrids disproportionately suffer the consequences of barriers (Haldane's Rule), (2) asymmetric sterility and/or inviability of hybrids (Darwin's Corollary to HR), (3) prezygotic isolation evolves before postzygotic isolation and (4) hybrid sterility evolves before hybrid inviability.

Here we report the results of a multi-generation reproductive isolation experiment designed to test these patterns with two closely-related species of *Anolis* lizards. Our work is among the largest and most detailed study of its kind on any squamate reptile, a group that accounts for nearly 30% of tetrapod species. Our work is also among the first studies to investigate intrinsic reproductive isolation between closely-related and morphologically cryptic species diagnosed by recent surveys of geographic genetic variation among populations in nature.

0525 Fish Conservation I, Doña Ana/Cimarron, Thursday 11 July 2013

Anna George, Bernard Kuhajda, David Neely

Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA

**Status, Distribution, and Recovery Recommendations for the Laurel Dace,
Chrosomus saylori, Endemic to Waldens Ridge, Tennessee**

The Laurel Dace, *Chrosomus saylori*, is endemic to small headwater streams along Waldens Ridge in Bledsoe, Rhea and Sequatchie counties, Tennessee. It is historically known from only seven streams in the Soddy, Sale, and Piney Creek drainages, all draining eastward to the Tennessee River. It has not been observed in the Soddy Creek system since 2004, and one of the Sale Creek populations is believed extirpated. Preliminary genetic data suggests that two genetically distinct groups occur within this species. Additionally, an introduced population of a closely related congener, Tennessee Dace, *Chrosomus tennesseensis*, occurs in the Piney Creek system (immediately adjacent to

the type locality) and could compromise the viability of this robust subpopulation. All known sites of occurrence were analyzed through a GIS-based predictive model, MaxEnt, to identify areas most similar to the known sites for intensive survey. During Winter and Spring 2013, sites predicted by modeling were surveyed in addition to historical localities to allow assessment of population persistence and site occupancy.

Current distribution of introduced Tennessee Dace (*Chrosomus tennesseensis*) in the Piney Creek system was also assessed during survey work. Laurel Dace were federally listed as endangered in 2011 with critical habitat designated in 2012. Other conservation actions needed for this species include enhanced riparian zone protection and restoration, further creation of forested reserves, and development of propagation protocols including genetic assessment for reintroduction programs.

0332 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Gary Gerald

Nebraska Wesleyan University, Lincoln, NE, USA

Is locomotor performance in *Ophisaurus* lizards convergent with that of snakes?

Limbless, elongated body forms have evolved from limbed ones multiple times within squamates (i.e. lizards and snakes). All snakes are derived from a common limbed lizard ancestor, and this same condition has evolved separately many times within multiple families of extant lizards. This study was designed to compare locomotor performance of *Ophisaurus attenuatus* to that of five species of snakes during several modes of limbless locomotion. Individuals were videotaped while moving at maximum speeds during terrestrial lateral undulation, swimming, and concertina. Speed relationships were assessed using regressions against total body length and total body length/body mass as a measure of body shape. Body length-relative speeds of *Ophisaurus* were very similar to snakes for all modes measured. However, *Ophisaurus* were faster swimmers and exhibited slower speeds for concertina compared to the snakes' speeds. Differences in locomotor performance of terrestrial lateral undulation between lizards and snakes depended on regression models used to assess the relationship. Though performance of snakes mostly reflected patterns of habitat usage, *Ophisaurus* exhibited faster speeds during modes they likely use rarely in nature. This species is a terrestrial species that is often found in fossorial habitats and are rarely observed in or near water. These differences found in *Ophisaurus* likely reflect musculoskeletal differences between this species and snakes.

0175 Reptile Ecology, Mesilla, Monday 15 July 2013

David Germano

California State University, Bakersfield, Bakersfield, California, USA

Growth, Population Structure, Reproduction, and Survivorship of the Western Pond Turtle at a High Elevation Pond in Southern California

Western pond turtles (*Actinemys marmorata*) occur from Washington to Baja California from the coast inland to the Cascade/Sierra Nevada/Peninsular ranges. I trapped pond turtles in 2007 and 2010 at a 1.3 ha pond at the southern edge of the Tehachapi Mountains (1063 m elevation) near the town of Gorman, California. I marked 321 turtles varying in size from 50 to 179 mm carapace length (CL). The percentage of turtles for which age could be estimated (1-14 years) was 46.9% in 2007 and 60.0% in 2010. Juveniles accounted for 17.9% in 2007 and 27.9% in 2010. Males were caught less often than females: sex ratios (M/F) varied from 0.848 in 2007 to 0.531 in 2010. Growth of turtles is rapid at this site, and is similar to growth for a population at Vandenberg AFB and much greater than turtles in northern California mountains and southern Oregon. Turtles reach 120 mm CL in 4 years and 160 mm CL in 10 years. Females were gravid in May through late July but no females were found with eggs in August. Mean clutch size in 2007 was 6.1 eggs (n = 61, range: 1-11) and 6.4 eggs (n = 81, range: 1-10) in 2010. I found 22 cases of second clutches in the two years of study. I estimated survivorship and trapability using program MARK. This small pond has an abundant and thriving population of Western pond turtles close to the densely populated Los Angeles region.

0041 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Marina Gerson

CSU Stanislaus, Turlock, CA, USA

Variation in tail-wagging behavior and associated morphological characteristics in the zebra-tailed lizard (*Callisaurus draconoides*) and its closest relatives within the phrynosomatid sand lizards

The zebra-tailed lizard (*Callisaurus draconoides*) and its sister taxon the greater earless lizard (*Cophosaurus texanus*) are similar in morphology, and both are known to exhibit a tail-wagging behavior. Their relatives, the lesser earless lizards (*Holbrookia* spp.), differ morphologically and behaviorally (e.g., smaller body size, relatively short tails, and not known to wag the tail). I studied zebra-tailed lizards in six localities, two populations of greater earless lizards, and one population of lesser earless lizards. My results indicate that zebra-tailed lizards were more likely to display, had longer tails relative to body size, exhibited more tail bands, and had higher frequencies of individuals with

regenerated tails than did greater earless lizards. Lesser earless lizards had short tails, low frequencies of regenerated tails, and, as expected, exhibited no tail bands nor displays. While data for additional populations of greater earless lizards and lesser earless lizards are needed, the observed variation between populations of a single species combined with the overlap noted between species suggests that while differences in ecological pressures may have led to differentiation between the species, current ecological differences experienced by local populations have likely also played a role in the morphology and behavior documented in this study.

0681 SSAR SEIBERT AWARD CONSERVATION, Galisteo/Aztec, Friday 12 July 2013

Titian Ghandforoush¹, Todd Jackman¹, Aaron Bauer¹, Ross Sadlier²

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Assigning Conservation Priorities to Sites for Threatened Species of Lygosomatine Skinks and Diplodactylid Geckos in the Grand Sud, New Caledonia

Climate change, logging, invasive fire ants, introduced competitors and predators, and forest fires are prevalent threats to the endemic lizard fauna of New Caledonia. Expansion in Goro, an open-pit nickel-mining site situated at the southern extent of the island, is a particular threat. Phylogenetic reconstructions of threatened lygosomatine skink and diplodactylid gecko species occurring in the Grand Sud – the extreme southern portion of New Caledonia – were recovered using mitochondrial (ND2) as well as protein-coding (RAG-1, KIAA1549, KIF24) and 3'UTR non-coding (MSFD4) nuclear genes. Conservation priorities were assigned to geographic sites within the Grand Sud representing recorded specimen localities through use of the Phylogenetic Diversity Index in conjunction with non-phylogenetic qualitative assessments of rarity. The greatest phylogenetic diversity was found in lizard communities in sites within the mining concession and in adjacent areas of the Plaine des Lacs. Diversity values for other sites throughout the Grand Sud were markedly lower, however. These preliminary data suggest that conservation actions need to be taken within the Goro mine site itself to conserve and prevent further fragmentation of remaining habitat. Establishment of conservation strategies for the diverse radiations of endemic geckos and skinks in the Grand Sud may also benefit the diverse, but grossly understudied, invertebrate fauna of the region as well as the highly endemic flora.

0415 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Michael Ghedotti¹, Matthew Davis²

¹Regis University, Denver, Colorado, USA, ²The Field Museum of Natural History, Chicago, Illinois, USA

Evolutionary History of the North American Topminnows and Killifishes (Family Fundulidae, Cyprinodontiformes): The Importance of Morphological, DNA, and Fossil Evidence

The North American topminnows and killifishes (Family Fundulidae) are widely distributed in freshwater, brackish, and coastal marine environments of North America, the Yucatan Peninsula, and Bermuda. In addition, there are multiple fossil species identified from the western United States in areas where extant fundulids are absent. While the Family Fundulidae has been the focus of numerous phylogenetic investigations, the far western fossil members of the group have never been fully included in comprehensive studies of the evolution of this group. In this study we provide a data-inclusive hypothesis of evolutionary relationships for the Fundulidae by including the fossil taxa in an analysis of morphological, karyological, behavioral, and nucleotide data. The relationships recovered largely follow the most recently published study, but the inclusion of both fossil taxa and DNA-sequence data allow hypotheses about the timing of speciation within the Fundulidae to be tested. In addition, we discuss the importance of using morphological datasets in total-evidence phylogenetic analysis.

0778 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Iulian Gherghel

Department of Zoology, Oklahoma State University, Stillwater, OK, USA

Interglaciations as laboratories for new species: using ecological niche models to study incipient evolution in Crested Newts

In the past years it has been repeatedly highlighted that ecology and evolution are two inseparable fields, and explaining ultimate phenomena one without other is impossible. Here, we used as model the Danube Crested Newt (*Triturus dobrogicus*) that has a sympatric haplotype distribution across a range separated by the Carpathian Mountains. This characteristic makes the Danube Newt a good candidate species for testing evolutionary questions related to how evolution occurs within sympatric haplotype distributions. In this study, we employed ecological niche models, environmental similarity measurements, and dispersal models and species haplotype distribution. The influence of rapid climatic changes, increase in climatic suitability for the species from

east to west and previous genetic data all suggests a very rapid dispersal event. Most probably, the sympatric haplotype distribution was maintained by multiple flood events of the Danube River. However, we found significant differences between climatic conditions preferred by each of the groups indicating a classic disruptive pattern, with the potential 'source' group considerably wider in environmental preference. Moreover, ecological models track environmental preferences and distributions of each group until the mid-Holocene when, most probably, the species has crossed the Carpathian Mountains. Differential selection pressures likely acted on each group favoring independent evolution. Previous hybridization studies have revealed higher embryo mortality between Danube Crested Newt groups than between "good" newt species from the same genus. These results suggest that evolution can occur when sympatric haplotype distribution exists, driven by processes of allopatry (at a large scale) and heteropaty (at a small scale).

0715 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Julian Gherghel¹, Tiberiu Constantin Sahlean^{2,3}, Alexandru Strugariu⁴, Stefan Remus Zamfirescu⁴, Monica Papes¹

¹Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, USA, ²Faculty of Biology, University of Bucharest, Bucharest, Romania, ³Department of Terrestrial Fauna, 'Grigore Antipa' National Museum of Natural History, Bucharest, Romania, ⁴Faculty of Biology, Alexandru Ioan Cuza University, Iasi, Romania

Impact of Global Climate Change on Low-Dispersal Organisms: Refining Ecological Niche Models Using GIS Tools

Climate warming is one of the most important threats to biodiversity. Ectothermic organisms such as amphibians and reptiles are especially vulnerable as climatic conditions affect them directly. Ecological niche models (ENMs) are increasingly popular in ecological studies, but several drawbacks exist, including the limited ability to account for the dispersal potential of the species. In this study, we use ENMs to explore the impact of global climate change on the Caspian whip snake (*Dolichophis caspius*) as model for organisms with low-dispersal abilities and to quantify dispersal to novel areas using GIS techniques. Models were generated using Maxent 3.3.3k and GARP for current distribution and future climatic scenarios. A cost-distance analysis was run in ArcGIS 10 using geomorphological features, ecological conditions and human footprint as "costs" to dispersal of the species to obtain a Maximum Dispersal Range (MDR) raster. All models developed are statistically significant ($p < 0.05$) and the models recover the current distribution of *D. caspius*. Models projected on future climatic conditions using Maxent predict a doubling of suitable climatic area, while GARP gives a more conservative expansion. Both models agree on an expansion of suitable area northwards, with minor decreases in southern distribution limit. The MDR area calculated using the ENMs generated in Maxent represents a third of the total area of the

projected model. The MDR based on GARP models recovers only about 20% of the total area of the projected model. Thus, incorporating measures of species' dispersal abilities greatly reduce estimated area of potential future distributions.

0388 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

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***Lyciasalamandra* genus- A status review**

The native amphibian fauna of Turkey consists of 34 amphibian species, including 18 salamanders and 16 anurans. Of these taxa, the Lycian salamander genus, *Lyciasalamandra* has had a particularly convoluted history. The distribution of *Lyciasalamandra* is restricted to a region approximately 350km by 50km in southwestern Turkey between Muğla and Antalya, plus three offshore Greek islands. The Turkish Lycian salamanders are currently classified as nine allopatric species: *L. antalyana*, *L. arikani*, *L. atifi*, *L. billae*, *L. fazilae*, *L. flavimembris*, *L. irfani*, *L. luschani* and *L. yehudahi*. The tenth described species, *L. helverseni* inhabits the Greek islands of Karpathos, Kasos and Saria opposite the westernmost Anatolian species. Most of the Anatolian taxa were formerly considered to be a subspecies of *Mertensiella luschani*, which were described based on color pattern. In 2001 the species shifted from genus *Mertensiella* to *Salamandra* based on mitochondrial DNA. Later, most of the subspecies were elevated to full species and re-assigned to the new genus *Lyciasalamandra*. Very recently three more new *Lyciasalamandra* species have been described mainly based on morphological characteristics. No analysis has yet been conducted that includes all described species, or that includes comprehensive geographic or genetic sampling. In conservation genomics, *Lyciasalamandra* stands out as a case study that desperately needs additional analysis. All of the previously recognized seven species were classified as threatened by the IUCN Red List of Threatened Species in 2012. According to IUCN more research is needed on the distribution ranges of all *Lyciasalamandra* species.

0039 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

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Ecological and Evolutionary Consequences of Fragmentation of River Networks

Fragmentation poses one of the greatest threats to freshwater fish biodiversity through multiple stressors including limiting dispersal that is necessary to fulfill important life stages, exacerbating negative species interactions, and inhibiting recolonization following disturbance. Barriers to movement isolate small populations leading to reduced genetic diversity and potentially compromise long-term population persistence. Empirical evidence suggests stream fish communities can exhibit threshold responses to fragment size, but these responses can vary with system disturbance regime. In addition, both ecological and genetic consequences of fragmented are variable across species and within populations that exhibit alternative movement strategies. We argue that ecological theory that considers both dispersal dynamics and ecological traits of species will help predict community response to fragmented systems. For a species to persist in a fragmented habitat they will have to contend with restricted habitat heterogeneity and potentially increased interactions with other species. Whereas the persistence of many native species will depend on their intrinsic life history traits or ability to adapt to fragmented riverscapes, current conservation goals should begin a trend of restoring connectivity of aquatic habitats on global, national and watershed scales.

0212 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

J. Tomasz Giermakowski¹, Erika M. Nowak²

¹The University of New Mexico, Albuquerque, NM, USA, ²Northern Arizona University, Flagstaff, AZ, USA

Consequences of Climate Change for the Arizona Black Rattlesnake (*Crotalus cerberus*), a Southwestern Endemic

Southwestern USA is expected to experience substantial changes in both temperature and precipitation in the future, bringing likely changes to landscapes and the composition of their fauna and flora. By combining field observations with data from other sources, including natural history museums, state wildlife agencies, and federal monitoring efforts, we developed ecological niche-based models that predict current extents of occurrence of *Crotalus cerberus*, the Arizona Black Rattlesnake. Using downscaled global circulation models of future climates, we then projected these models

into the future at different time intervals, as far as year 2099. The results indicate considerable and progressive decreases of suitable areas in the future, particularly for the low-elevation populations and regardless of assumptions about dispersal capacities or vegetational composition. Our results highlight the importance of climate in the extent of this rattlesnake's patchy distribution, and are also consistent with predictions for overlapping distributions of ponderosa pine forests and pinyon-juniper woodlands. Given these results and predictions, management of this montane rattlesnake must be based on continued monitoring of population trends and detailed understanding of its distribution.

0554 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Charles Gilbert, Carolina Lema, Robert Kirken, Carl Lieb

The University of Texas at El Paso, El Paso, Texas, USA

In vitro response of Human Myoblasts and Myocytes to the Whole Venom of *Crotalus viridis viridis*

Snakebite with envenomation remains a serious world problem. Antivenom is still the treatment of choice; however, its efficacy in mitigating local effects, i.e., myonecrosis, is limited. Searching for therapeutically active plant substances is critical in order to improve snakebite treatment. Although local tissue necrosis is observable after the bite of a venomous snake, the mechanisms involved in cellular damage have not yet been elucidated. In the present study we applied two *in vitro* approaches: the differential nuclear staining (DNS) and the MTS cell proliferation assays to assess the cytotoxic effects of whole venom from *Crotalus viridis viridis*, previously reported to contain a potent myotoxin. Human skeletal muscle (HuSKM) myoblasts and/or myocytes were exposed to whole venom (from 5 - 100 µg/mL) at varying 24h intervals up to 96h. Myoblasts exposed to whole venom up to 96h showed negligible cytotoxic effect as assessed by the DNS assay at the highest venom concentration. However, a dose-response was observed using the MTS assay over a 24-72h period in both myoblasts and myocytes. The preliminary results of this *in vitro* study showed that venom-induced necrosis of HuSKM was limited and that HuSKM were quite resistant to venom treatment as measured by the loss of cell membrane permeability. These results indicate that the mechanism of whole venom myotoxicity may be more complicated than originally appreciated, especially since cellular necrosis was not the expected observed endpoint. More experiments are needed to elucidate the mechanisms underlying the myotoxic effects that occur during snakebite envenomation.

0748 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Jennifer Gillette

University of Canterbury, Christchurch, New Zealand

Interspecific Interactions Between an Endemic Fish (*Neochanna burrowsius*) and an Invasive Frog (*Litoria ewingii*): a Benign Invader?

Invasive species commonly have substantial impacts (usually detrimental) on native species. In New Zealand, two species of Australian frogs introduced in the late 1800s (*Litoria ewingii* and *L. raniformis*) are now widely distributed. These two species are sympatric with the endemic Canterbury mudfish, *Neochanna burrowsius*, currently listed as vulnerable on the IUCN Red List. Habitat requirements for *N. burrowsius* and the *Litoria* frogs are similar, but interactions between the frogs and the mudfish have not been studied. My research, therefore, examined interactions between *N. burrowsius* and *L. ewingii* in order to quantify impacts that one species may have on the other. Specifically, I tested the following hypotheses in laboratory studies: (1) adult mudfish show no preference when offered a variety of food items including tadpoles; (2) tadpole behavior is not affected by adult mudfish presence; (3) larval mudfish activity levels and foraging behavior are not affected by the presence of tadpoles; and (4) over a 12-week period, tadpoles housed with mudfish (in physical but not visual or chemical isolation) show no growth or developmental differences compared to tadpoles housed without mudfish. Results suggest that, at least at the developmental stages that I tested, tadpoles of *L. ewingii* have no effect on larval mudfish. Adult mudfish, however, preyed on *L. ewingii* tadpoles, and preliminary results suggest that tadpole growth may be negatively affected by the presence of adult mudfish. In this case, the invasive species appears to have a potentially positive impact on the native species by providing a food source.

0025 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER HERPETOLOGY AWARD

Nichole Ginnan, Kent Hatch

Long Island University- Post Campus, Brookville, New York, USA

The Effects of Toe-Clipping on Leopard Frogs (*Rana pipiens*) and American Toads (*Bufo americanus*)

With amphibian populations declining, mark-recapture studies are often performed to assess the health of populations by determining population size, immigration rates, emigration rates, recruitment and death rates. The most common way to individually mark frogs and toads is with toe-clipping. While evidence exists that toe-clipping affects

recapture rates, it is not known if this is due to decreased survival rates of toe-clipped individuals, or merely their avoidance of recapture. Nor has the effect of toe-clipping on growth rates been adequately studied. It is important to understand the effects of toe-clipping in case they violate the assumptions of mark-recapture models or otherwise adversely affect the animals. In this study we looked at the effects toe-clipping has on the survival, growth, and recapture rates of leopard frogs (*Rana pipiens*) and American Toads (*Bufo americanus*). We found that toe-clipping has no significant effect on the frogs' or toads' growth rates. However, our results did show that clipping the toes of toads has a negative effect on their survival rate. While this study shows that toe-clipping can affect survival rates in a way that may yield spurious population estimates, it also shows that this negative effect does not occur for all species. We therefore suggest that toe-clipping may be an appropriate marking technique for some species, but not others. Each species should be assessed individually regarding the appropriateness of employing toe-clipping in mark-recapture studies.

0482 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Melissa Giresi¹, R. Dean Grubbs², David Portnoy¹, John Gold¹

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Morphologically conserved, genetically diverged; A key to distinguish among smoothhound sharks in the U.S. Atlantic

Smoothhound sharks (Family Triakidae, Genus *Mustelus*) are found circum-globally and represent one of the most speciose genera among extant sharks. Although many of these species are morphologically conserved, advances in molecular methods and increased interest in biodiversity over the last decade, have led to the description of twelve new smoothhound species since 2005. Consequently, verifying the distribution of individual species, as well as articulating strategies for their management and conservation, remains problematic. Here, we discuss the use of both molecular and morphological markers to assess differences among smoothhound species in the U.S. Atlantic and present a reliable morphological key to distinguish among the smoothhound species (*Mustelus canis*, *Mustelus norrisi*, and *Mustelus sinusmexicanus*) in the Gulf of Mexico.

0607 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Kenneth Goldman

Alaska Department of Fish and Game, Homer, AK, USA

An update on the thermal physiology and reproductive biology of salmon sharks, *Lamna ditropis*

Salmon sharks, *Lamna ditropis*, belong to the Family Lamnidae; a small group of sharks that possess vascular counter-current heat exchangers (*retia mirabilia*) allowing retention of metabolically generated heat, resulting in elevated body temperatures. Recently, deep red muscle temperature data have been obtained to enhance our understanding of the thermal capacity of this species. Data show that free-swimming adult salmon sharks maintain a specific body core temperature independent of changes in ambient temperature through a combination of physical and physiological means, and essentially function as homeotherms. Current work on their reproductive biology provides further evidence of a two year reproductive cycle with an approximately nine month gestation period in the reproductive year.

0368 NIA BEST STUDENT POSTER, Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

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¹Laboratório de Ictiologia - Campus Heróis do Jenipapo - Universidade Estadual do Piauí, Campo Maior/PI, Brazil, ²Campus Professor Alexandre Alves - Universidade Estadual do Piauí, Parnaíba/PI, Brazil

Ichthyologic Diversity of Poti River, Paraníba River Basin, Northeastern Brazil

Little is known on the ichthyofauna of the Parnaíba River Basin. The aim of the present study was to carry out a survey of ichthyologic diversity in the Poti River, and adjacent areas in Pedra de Castelo Municipal Park in the city of Castelo do Piauí (5°11'28.62"S-41°42'39.00"W). Seven sampling was performed at five sites, with six different fishing gears. A total of 65 specific morphotypes were identified, distributed among five orders: Characiformes (9 families and 29 species); Siluriformes (5 families and 19 species); Perciformes (2 families and 9 species); Gymnontiformes and Clupeiformes (1 family and 3 species each); and Myliobatiformes (1 species). Between the principal genus and species: *Astyanax aff. bimaculatus* and *Cichlasoma* occurred in seven samplings; *Steindachneria notanota* and *Hypostomus* occurred in six samplings; *Serrasalmus rhombeus* and *Hemiodus* occurred in five samplings; and *Crenicichla*, *Hyphessobrycon*, *Leporinus* and *Prochilodus lacustres* occurred in four samplings. Due to the scarcity of previous

ichthyologic information, it was once believed that the fish fauna of the Parnaíba Basin was mainly composed of species considered primarily of Amazonian origin. However, approximately 30% of the species identified in the present study can be considered endemic to the Parnaíba Basin, whereas only approximately 13% are shared with the Amazon River Basin. The present findings demonstrate that the region studied has a considerable diversity of fish. Further studies should be carried out to gain a better understanding of these species in terms of biogeography, systematics and evolution as well as for conservation purposes.

0453 SSAR EVOLUTION, SYSTEMATICS, AND GENETICS BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Paulette Gonzalez¹, Yong-Chao Su¹, Arvin Diesmos², Anthony Barley¹, Cameron Siler³, Rafe Brown¹

¹Biodiversity Institute and Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS, USA, ²National Museum of the Philippines, Rizal Park, Padre Burgos Avenue, Ermita 1000, Manila, The Philippines, ³Department of Biology, University of South Dakota, Vermillion, SD, USA

Common mechanisms of diversification in co-distributed island archipelago tree frogs?

We studied multilocus phylogeography and patterns of geographical genetic structure in two co-distributed forest obligate tree frog lineages (*Rhacophorus appendiculatus* and *R. bimaculatus*) in the Philippines. Both species are distributed across five hypothesized barriers to dispersal and gene flow along the eastern island arc of the Philippine archipelago. Results of our phylogeographic analyses using two mitochondrial genes and two nuclear genes suggest notable differences between the two species. Whereas *Rhacophorus appendiculatus* populations are strongly structured across the archipelago, *R. bimaculatus* seems almost genetically uniform across the same distribution. We suspect differences in the natural history of the species (pond versus stream breeding) may be related to the genetic differences detected here. Finally, we aim to elucidate the relative timing of diversification events for both co-distributed clades.

0478 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Melissa Gonzalez De Acevedo¹, Jim Gelsleichter¹, Bryan Frazer², Carolyn Belcher³

¹University of North Florida, Jacksonville, Florida, USA, ²Department of Natural Resources, Charleston, South Carolina, USA, ³Department of Natural Resources, Brunswick, Georgia, USA

Preliminary Characterization of reproduction in bonnethead sharks (*Sphyrna tiburo*) from the southeastern U.S. Atlantic coast

Bonnethead sharks (*Sphyrna tiburo*) are a component of the small coastal shark (SCS) fishery complex, and are caught regularly in recreational and commercial fisheries. Despite being well studied in the Gulf of Mexico, little is known about bonnetheads that reside on the U.S. Atlantic coast. The main goal of this study is to improve management of U.S. Atlantic bonnethead populations so they do not become overexploited. To contribute to this, my objective is to obtain critical information on reproductive biology of these populations. To accomplish this, male and female bonnetheads are being collected monthly through combined efforts of UNF, SCDNR, and GADNR along with commercial fishers from South Carolina and Florida waters. Reproduction stage is assessed using morphological, histological, and endocrinological analysis. Preliminary data suggests that follicular development occurs in females between the months of January and early April followed by ovulation, which appears to take place in mid-to late April. Sperm storage appears to occur in the oviducal gland between late September to this same period based on histological analysis. Ova or pups were present in the uteri of mature females between late April to early September, suggesting that gestation is slightly greater than 4 months. Spermatogenesis in males appears to peak around late August/early September, based on testis morphology and histology. Further investigations will use plasma sex steroid hormone concentrations throughout reproductive events to validate characterization of reproductive patterns. Resulting data will provide comparisons of reproductive cycles and seasonality between Atlantic and Gulf of Mexico bonnethead populations.

0627 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Millke Jasmine Arminini Morales¹, Claudio Oliveira¹, Fernando Fernandes Mendonça¹, Rui Coelho², Miguel Neves Santos³, Fausto Foresti¹

¹Instituto de Biociências, UNESP, Botucatu, São Paulo, Brazil, ²Centro de Ciências do Mar (CCMAR), Universidade do Algarve, Faro, Algarve, Portugal, ³Instituto Português do Mar e da Atmosfera (IPMA, I.P.), Olhão, Algarve, Portugal

Population genetic structure of the bigeye thresher shark, *Alopias superciliosus*, using mitochondrial DNA control region, in a comparison between the Atlantic and Indian Oceans

The bigeye thresher shark, *Alopias superciliosus*, is a highly migratory species that occurs in oceanic and coastal areas of all Oceans, particularly in tropical regions. It is currently assessed as globally “Vulnerable” by the IUCN (International Union for the Conservation of Nature) because of its population declines in the past years. Considering the scarcity of information regarding the biology and population genetics of this species, the current study sought to characterize the genetic population structure of *A. superciliosus*, comparing samples from the Atlantic and Indian Oceans. Sequences of mitochondrial DNA from the control region (D-loop) were used, with 913 bp (base pairs) analyzed from 122 specimens from the Atlantic and 11 specimens from the Indian Ocean. Considering all the samples, both from the Atlantic and Indian Oceans, only eight haplotypes were found, with one of the haplotypes shared by 93.2% of the analyzed sharks. These results suggest a very low genetic variability ($\pi = 0.00121 \pm 0.00042$ and $h=0.131 \pm 0.040$), no population structure (no significant Φ_{ST} value), and an intense gene flow across the studied areas, even between the two Oceans. Therefore, for fisheries management and species conservation purposes, a single *A. superciliosus* stock should be considered in the entire sampled area, with this low genetic variability suggesting a natural fragility of the species. Furthermore, it seems the bigeye thresher sharks have the ability of migrating between those two regions of the Atlantic and the Indian Oceans.

0022 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Dom Gonzalez-Jurado

UCLA, Los Angeles, CA, USA

Seasonal, Geographic, and Ontogenetic Feeding Ecology of Eastern Pacific Angel Sharks

Angel sharks are primarily benthic dwelling sharks found mainly in temperate and subtropical parts of the Atlantic and Pacific Oceans. Their primary method of capturing

prey is by ambushing anything small enough to be swallowed by rapidly lunging from a sedentary position on the sea floor. In the eastern North Pacific angel sharks are thought to be generalist predators that exhibit geographic variation in their diet compositions in different environments across their range. In the Southern California Bight blacksmith (*Chromis punctipinnis*) are the most prevalent prey and in the Southern Gulf of California jack mackerel (*Decapterus macrosoma*) are the most prevalent prey item. Curiously, no significant ontogenetic shifts in diet have been previously documented, which would suggest that the sharks might exhibit a local preference for a particular species. In this study the stomach contents of 71 angel sharks from across the Pacific Ocean and the Gulf of California surrounding the Baja California peninsula were examined and used to describe patterns of seasonal, geographic, and ontogenetic feeding habits of these sharks across their range.

0390 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

John Gorsuch, Patrick Owen, Amy Miller

University of Cincinnati, Blue Ash, OH, USA

Effects of Exotic Earthworm Infestation on the Microbiota of Salamander Habitats and Cutaneous Epiflora

Changes in the species composition of bacterial communities in woodland salamander habitats have the potential to impact their cutaneous epiflora and, thus, their vulnerability to pathogenic fungi and bacteria. Infestations of nonindigenous Asian earthworms, which are aggressively invading much of the eastern United States, have been shown to alter the composition of bacterial communities at the soil surface. In order to determine the impact of these changes upon the cutaneous microbial composition of woodland salamanders, we designed a series of soil microcosm experiments using salamanders of the genera *Plethodon* and *Desmognathus*. Results indicate that Asian earthworm infestation leads to an increase in the occurrence of Gram negative colony-forming units in soil microcosms, a trend which was not observed in soils processed by European earthworms. Because amphibians have been shown to refresh their cutaneous microflora during skin sloughing, and because these bacteria play an important immunological role in salamanders, changes in soil bacterial communities could have implications for the long-term resistance of salamander populations to pathogens in habitats disturbed by Asian earthworms.

**0512 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Levi Gray¹, Robbie Burger²

¹University of New Mexico; Museum of Southwestern Biology, Albuquerque, NM, USA,

²University of New Mexico, Albuquerque, NM, USA

Do allometries reveal evolutionary constraints in *Anolis* lizards?

Adaptive radiations can offer unique insights to the evolutionary and macroecological processes shaping morphological diversification. *Anolis* lizards exhibit evolutionary radiations in both mainland and island environments, resulting in comparable ranges in body size. Given that selection pressures are expected to vary greatly in the diverse environments inhabited by anoles, it seems unlikely that universal patterns of allometry would emerge. Here, using data from 292 species of anoles, we demonstrate universal scaling in two ecologically relevant traits: head length and hindlimb length. These allometries reveal statistically identical slopes and intercepts for both island and mainland groups, regardless of ecomorph status or environment. These shared patterns suggest fundamental evolutionary constraints to morphology and thus ecology in the *Anolis* radiations.

**0479 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, AES CARRIER
AWARD**

Teagen Gray¹, Andrea Bernard¹, Shelley Clarke², Demian Chapman³, Rory McAuley⁴, Pascal Geraghty⁵, Mahmood Shivji¹

¹Save Our Seas Shark Center, Dania, FL, USA, ²Oceanic Fisheries Programme, Secretariat of the Pacific Community, BPD5 CEDEX, Noumea, New Caledonia, ³School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY, USA, ⁴Department of Fisheries, Government of Western Australia, Hillarys, WA, Australia, ⁵Department of Primary Industries, Cronulla Fisheries Research Center of Excellence, New South Wales, Australia

Global population structure of the dusky shark and geographic sourcing of shark fins from commercial markets - Updated results

The dusky shark, *Carcharhinus obscurus*, is a globally distributed, coastal- pelagic species subject to an apparent high level of exploitation. The International Union for the Conservation of Nature (IUCN) lists this species as "Vulnerable" globally, and "Endangered" within western North Atlantic and Gulf of Mexico waters due to an over 80% decline in this region, with no evidence of population recovery. The extensive exploitation of dusky sharks may partly be attributed to the high market value of its fins,

but the contribution of individual dusky shark stocks to the fin markets is unknown. This knowledge would be helpful to detect if specific stocks are experiencing disproportionate levels of exploitation. Due to its susceptibility to overfishing, current dire conservation status and need for additional information on its population dynamics, we analyzed the genetic population structure and genetic diversity of the dusky shark (n = 421) across 11 globally distributed locations utilizing 10 nuclear microsatellite loci. The nuclear marker analyses support and extend previously published mitochondrial marker work, identifying a strong divergence among Atlantic and Indo-Pacific samples. Furthermore, nuclear marker results indicate the presence of five genetically discrete management units for dusky sharks, with significant genetic differentiation between the western North Atlantic, South African, and each of three Australian site collections (N, E and W coasts). Discovery of these nuclear microsatellite-defined, smaller geographic scale management units provides a basis for the assignment of market-derived fins to their population of origin with the use of genetic assignment techniques.

0481 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Teagen Gray¹, Dewayne Fox², Brad Wetherbee³, Andrea Bernard¹, Mahmood Shivji¹

¹*Save Our Seas Shark Center USA and Guy Harvey Research Institute, Nova Southeastern University, Dania, FL, USA*, ²*Department of Agriculture and Natural Resources, Delaware State University, Dover, DE, USA*, ³*Department of Biological Sciences, University of Rhode Island, Kingston, RI, USA*

Effective population size and genetic diversity of a species of concern, the sand tiger shark (*Carcharias taurus*) in Delaware Bay, USA

Genetic assessments can provide a conservation and management relevant perspective on the status of imperiled species including sand tigers, (*Carcharias taurus*). Sand tigers within the western North Atlantic were listed as a Species of Concern and thus prohibited from recreational and commercial fisheries in 1997 by the National Marine Fisheries Service. A previous global population study of sand tigers revealed the genetic isolation of individuals inhabiting the western North Atlantic from the remainder of this species' distribution. Here, we assess the genetic status, including effective population size and genetic diversity of sand tigers from an area of known high abundance: Delaware Bay (n=557). Eleven species-specific microsatellite markers were used to analyze temporal variation in effective population size and genetic diversity of sand tigers collected from 2007-2012. Total length was used to back-calculate age estimates for each sex using data from a previous age and growth study on sand tigers within this region. Individual sharks of similar estimated age were grouped together to form year classes. Preliminary results indicate little genetic differentiation among year classes with respect to genetic diversity and effective population size, suggesting relatively stable,

recent temporal population dynamics for Delaware Bay sand tigers. Estimates of genetic diversity (allelic richness) of sand tigers captured within Delaware Bay were greater than the previous survey within the western North Atlantic, suggestive of recovery in this previously exploited population.

**0257 NIA BEST STUDENT POSTER, Poster Session II, NW Exhibit Hall,
Saturday 13 July 2013**

Damian Green¹, Valerie Derouen², Tiago Carvalho¹, Victor Tagliacollo¹, Prosanta Chakrabarty², James Albert¹

¹*University of Louisiana at Lafayette, Lafayette, LA, USA*, ²*Louisiana State University, Baton Rouge, LA, USA*

Community phylogenetics and comparative phylogeography of the Fitzcarrald fish fauna, southwestern Amazon

Community ecology investigates the formation of local species assemblages and regional species pools through ecological, evolutionary, and stochastic processes. If closely related species have similar ecological traits (niche conservatism) species in a given habitat should be phylogenetically underdispersed (clustered), as compared to faunas assembled randomly from a regional pool. However, competitive exclusion predicts coexisting species should be less related than random (phylogenetically overdispersed). Here we used phylogenetic diversity indices in Phylocom 4.2 (phylobetadiversity, net relatedness, nearest-taxon analysis) to evaluate phylogenetic clustering among 274 fish species in 156 genera from four river basins (Ucayali, Yurua, Purus, Madre de Dios) of the Fitzcarrald region of southwestern Amazonia. We also used two mitochondrial markers (16S and COI) to study the phylogeography of 16 of these species, and univariate metrics of geographic separation (beta diversity) to evaluate taxonomic composition and turnover. Results show that basin-wide assemblages do not differ from a random sampling of the phylogenetic tree; i.e. they are neither clustered nor anti-clustered. None of the migratory riverine species haplotypes shows geographic structure between basins, but some non-migratory species do. Habitat assemblages (i.e. in river channels, floodplain lakes, and non-floodplain streams) are strongly clustered phylogenetically, each being over-represented by certain genera. The results suggest multiple independent colonization events in all four basins, and little or no speciation arising from between-basin geographic isolation or within-basin habitat partitioning. Results indicate dispersal is more important than ecological interactions in forming basin-wide assemblages in the Fitzcarrald, and habitat filtering helps structure species composition in many local assemblages.

0364 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

David Green, Katharine Yagi

McGill University, Montreal, Canada

Movement Ecology and Habitat Use by Fowler's Toads, *Anaxyrus fowleri*

The behavior and ecology of animals residing in natural and relatively intact habitats is the necessary starting point for investigating their behavior in fragmented and degraded habitats. We used radio-telemetry to examine movement patterns and habitat use of Fowler's toads, *Anaxyrus (Bufo) fowleri*, during late summer in a relatively undisturbed lakeshore dune and beach habitat at Long Point, Ontario. Eleven adults were tracked using small radio transmitters and were fitted with an external harness made from fine, surgical plastic tubing wrapped around the body behind the front limbs. Toads were tracked morning and evening; precise locations were recorded using GPS. During the day, the toads were located on the upper beach or in the dunes, either dug in under the sand or hiding beneath debris, but in the evening, the toads were generally active on the lower beach close to the waterline. The occurrence of a storm event coincided with the onset of cooler autumn weather and was found to cause the animals to move further away from the water line, curtailment of nightly activity and deeper retreat in the sand.

0517 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

David M. Green

McGill University, Montreal, Quebec, Canada

Sex Ratio in Toads

Sex ratios among anurans at breeding sites are routinely observed to be skewed towards males. Understanding how accurately this observed sex-ratio observed reflects the operational sex ratio, and how much each may differ from the population's true adult sex ratio, is important information for testing hypotheses about mating strategy and for understanding population viability. Using intensive capture/recapture methods, I estimated abundances of both sexes of Fowler's Toads in a population at Long Point, Ontario, over a span of 14 years (1998 to 2011, incl.). Although males greatly outnumbered females at breeding sites, persisted there for longer periods of time and were more readily re-captured, both sexes could be found in their lakeshore non-breeding habitat with equivalent reliability. Estimates of abundance were calculated for each sex based on 3,162 total captures of 686 females and 982 males. The abundances of males and females each year were not significantly different, consistent with a 1:1 physical sex ratio. Both sexes also exhibited large, but strongly correlated, variations in their abundance over the 14 yrs. Only 39% of total estimated males were found at

breeding sites. The ratio of males at breeding sites to total males declined significantly over the 14-year study, in parallel with a diminishing availability of breeding sites.

**0215 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Sarah Green, Brian Crother

Southeastern Louisiana University, Hammond, LA, USA

Diet and head shape in snakes: Is there a correlation?

It has long been thought that there is a correlation between diet and head shape in snakes. The more constrained the diet is, the more constrained the head shape should be. This study tested three different groups of dietary feeders, two specialists and a generalist. The species used were the four species of the *Regina* complex as well as *Lampropeltis getula* and *Lampropeltis nigra*. Geometric morphometric techniques were used to evaluate the head shape of the specimens. PCA, CVA, and DFA were used to analyze the degree of shape difference. There were distinct differences in head shape between dietary groups. *Regina* is comprised of hard shelled crayfish specialists and soft shelled crayfish specialists and there were shape differences between the two feeding strategies. There was overlap in head shape between the generalists, *Lampropeltis getula* and *Lampropeltis nigra*. These differences in head shape may be associated with evolutionary history. They could be the result of phylogeny but more work needs to be done to determine this. They could also be the result of competition but this seems the less likely explanation.

0160 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Eli Greenbaum, Nancy Conkey, Rachel Romero

The University of Texas at El Paso, El Paso, TX, USA

Phylogenetic Relationships of the African Treefrog Genus *Afrivalus* (Anura: Hyperoliidae)

The genus *Afrivalus* is a relatively small (40mm max. SVL) treefrog with 32 recognized species. The genus is distributed throughout sub-Saharan Africa in a wide array of habitats ranging from savannahs to tropical rainforest. A DNA-based phylogeny focusing on only this genus has never been attempted, but some species have been included in other studies of higher-level relationships of frogs. We sequenced DNA from 24 samples representing 10 available species; two mitochondrial fragments from the genes 16S and *cyt b* (approximately 1200 bp together) and two nuclear fragments from

RAG1 and RHOD (approximately 1200 bp together). The DNA was analyzed with maximum parsimony (MP), maximum-likelihood (ML) and Bayesian inference (BI) optimality criteria with the programs PAUP* 4.0b, RAxML v.7.2.6 and MrBayes v.3.1, respectively, after appropriate models of nucleotide substitution were identified in the program jModelTest. The MP and ML analyses were evaluated with 1000 bootstrap replicates to assess node support, and BI analyses were run for 20,000,000 generations. Results indicated that *Afrivalus* is monophyletic, and cryptic diversity was present in the paraphyletic taxon *A. laevis* (this species might in fact be three). Further measurement comparisons and statistical analyses are currently in progress to further support these data.

0508 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Brian Greene, Rhyan Friesen

Missouri State University, Springfield, MO, USA

Spatial and associative learning using landmarks in the Cottonmouth (*Agkistrodon piscivorus*)

Spatial learning has considerable importance for animals in their natural environments. In particular, the ability of animals to remember the location of essential resources and associate environmental cues with food availability can have important fitness consequences. Although spatial learning processes have been documented in many reptiles, snakes are proportionately underrepresented and most snake studies have involved colubrids as subjects. We presented captive cottonmouth snakes with two types of learning challenges. In a spatial learning experiment, snakes demonstrated a 50% reduction in time and distance travelled to a shelter across a series of training trials. In a second experiment, snakes were trained to feed on live minnows provided in a water-filled bowl associated with a cue card landmark. After six training sessions, hungry snakes given a dichotomous choice between two water bowls containing only fish chemical cues were significantly more likely to set up ambush postures at bowls associated with the cue card stimulus rather than the control. Untrained snakes presented with the same challenge showed no preference for either option. Our results suggest that pit vipers are capable of using visual cues to accomplish important learning tasks.

0504 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Brian Greene, Daniel Schepis

Missouri State University, Springfield, MO, USA

Spatial ecology and habitat selection of Mudsnakes (*Farancia abacura*) in southeast Missouri

Knowledge of spatial patterns, habitat use, and resource requirements is essential to the ecology of mobile animals and may importantly inform management decisions for species with a conservation status. We used radiotelemetry to investigate the spatial ecology and habitat use of 21 adult Mudsnakes (*Farancia abacura*) near the northwestern range limit for the species in southeastern Missouri. Seasonal activity was unimodal, peaking in summer for both sexes. Movement patterns were characterized by many short (< 50m) movements punctuated by occasional long movements of 600-1200 m which resulted in the snake occupying a new core area. Mean 95% kernel estimates of ranged from 24-46 ha with males moving less frequently over shorter mean distances and occupying smaller home ranges than non-reproductive females. A single reproductive female remained with her eggs until hatching and occupied a 95% kernel area of 0.12 ha. At the landscape level, snakes located their home ranges in association with aquatic habitats, especially marshes and ditches which were used in disproportion to their availability. Within home ranges, flooded forests and marshes accounted for more than 80% of snake locations. Mudsnakes were extremely secretive and were only visible on < 1% of relocations. Microhabitat analyses revealed Mudsnakes typically selected areas in or close to water under canopy cover. Females attending eggs were the most specialized in habitat selection, selecting more open sites away from water.

0010 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

David Greenfield

California Academy of Sciences, Pacific Grove, CA, USA

The Dwarfgoby Genus *Eviota*: An Update (Teleostei: Gobiidae)

The Indo-Pacific dwarfgoby genus *Eviota* includes 76 described species and many more yet to be described. The small species in the genus are known to be the shortest lived of any vertebrate and are abundant both in the plankton and in inshore waters. The history of the study of the genus will be reviewed and characters used to recognize its species discussed. Attempts to recognize relationships as well as future directions in the study of the genus will be presented.

0139 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Patrick Gregory

University of Victoria, BC, Canada

The Relationship Between Body Size and Cover Use in Five Species of Natricine Snakes

Cover plays an important role in the lives of snakes, providing shelter from the elements and predators and also providing thermoregulatory opportunities. If cover use is an anti-predator behaviour, then it should be especially important for the most vulnerable individuals, such as small snakes. In this study, I test for a negative relationship between frequency of cover use and body size in 5 species of natricine snakes at three sites (southern Ontario and central Alberta in Canada, southeastern UK). Cover objects were most abundant at the Ontario site, where most snakes were found under rocks; by contrast, cover objects (all artificial) were scarce at the UK site, where most snakes were found in the open. Nonetheless, there was a significant trend across all sites for smaller snakes to be more likely to be found under cover. Furthermore, in all but one species, the significant size-cover use relationship held up in all months of the active season. In two species, gravid females were significantly more likely to be found in the open than other snakes, presumably reflecting the priority that gravid snakes place on thermoregulatory basking. Differences between small and large snakes in frequency of cover use also might reflect thermoregulatory differences, but evidence suggests that small snakes often trade off thermoregulatory benefits for the safety of hiding under cover.

0753 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY, Galisteo/Aztec, Friday 12 July 2013

Eric Gren¹, Wayne Hodgson², Rachelle Kornhauser², Carl Person¹, Wayne Kelln¹, William Hayes¹

¹*Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA, USA,* ²*Monash Venom Group, Department of Pharmacology, Monash University, Victoria, Australia*

Geographic Variation of Venom Proteins and Neurotoxicity in the Southern Pacific Rattlesnake (*Crotalus oreganus helleri*)

Snake venoms are comprised of complex protein arsenals capable of inducing a range of physiological effects upon envenomation. Although snakes generally exhibit species-specific venom protein profiles, venom components can also vary significantly within a species. Intraspecies venom variation is often seen among geographically separate

populations and can also occur among individuals within a population or even within individuals over time. The Southern Pacific rattlesnake (*Crotalus oreganus helleri*) has traditionally been characterized as having primarily proteolytic venom; however, neurotoxicity has been documented in some populations. A previous study reported Mojave toxin (MT), a pre-synaptic neurotoxin, in the venom of some *C. o. helleri* individuals. Mojave toxin, though, fails to account for all *C. o. helleri* neurotoxicity, as neurotoxic envenomations have been documented in individuals shown not to possess MT. In the present study, gel electrophoresis and liquid chromatography were used to obtain venom protein profiles for individual *C. o. helleri* collected across the species' geographic range. Chick biventer cervicis nerve-muscle preparations were used as non-specific physiological assays of venom samples for neurotoxic activity. Simulated envenomations of venom samples were also conducted in mice. Chromatography peak fractions were trypsin digested and analyzed using liquid chromatography-mass spectrometry. Resulting peptide amino acid sequences were searched against published databases for protein family identification. Several basic peptides occur in the ~4-7 kDa range which appear exceptionally abundant and variable compared to venoms of other rattlesnake taxa. These small basic peptides may account, at least in part, for the non-MT neurotoxicity observed in some *C. o. helleri*.

0588 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Jose Griego

New Mexico Highlands University, Las Vegas, NM, USA

Leopard Frog Population Structure in Dynamic Environmental Conditions

Riparian areas in Northern New Mexico had suffered great environmental degradation due to over grazing and deforestation. At present most habitats have been severely degraded and fragmented. Leopard frog populations (*L. pipiens* & *L. blairi*) that inhabit New Mexico persist in these habitats that have dynamic conditions, due specifically to drought. Habitat fragmentation may affect the habitat usage strategies of leopard frog populations inducing the congregation of separate populations which can alter population structure and gene flow. The potential for hybridization between *L. pipiens* and *L. blairi* may be heightened due to strong environmental pressures and limited reproductive windows of opportunity from harsh seasonality and fragmented habitat. This study will investigate leopard frog populations and hybridization using microsatellites, nuclear genes, and mitochondrial genes. The level of structure of the populations will be related to the type of habitat that samples are taken from (fragmented or healthy). Also, species will be screened using the nuclear and mitochondrial genes to determine if differential mating is occurring in the form of hybridization in the different habitat types. Combined, these will provide data regarding genetic and behavior patterns in habitats subject to frequent change due to various levels of drought.

0056 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Kerry Griffis-Kyle

Texas Tech University, Lubbock, Texas, USA

Ecological Traps for Amphibians in Sonoran Desert Constructed Wildlife Waters

Wildlife waters are an important part of how wildlife managers support resources for populations of game as well as threatened and endangered species. In the southwestern United States, waters have been established for Desert Bighorn, Sonoran Pronghorn, and other species. To assess the impact these managed waters have on amphibians, we surveyed tinajas (natural or modified rock pools) and artificial catchments in southwestern Arizona using multiple methods for sampling amphibians. We quantified habitat quality by measuring chemical attributes and physical characteristics of the site. We found significantly more individuals and more species of amphibians at natural waters than at constructed catchments. Natural waters tended to have larger basins with more shading. Water quality was variable, but the most striking finding was that ammonia concentrations were extremely high in most of the catchments; above the freshwater criteria for maximum concentration set by the U.S. EPA. The potential sources of the nitrogen in these catchments are fecal contamination from wildlife, decomposition of organic material, and fixation of atmospheric nitrogen. The reason that the levels of ammonia are so much higher in the constructed catchments is likely that the natural tinajas are often associated with ephemeral streams that experience flash floods which scour out debris from the basin. The constructed catchments are built to reduce evaporation and catch and contain as much water as possible and have no mechanism that clears debris. Because of this design, they are at best inhospitable and at worst ecological traps for amphibians.

0641 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Ashley Grimsley

University of Arkansas, Fayetteville, AR, USA

Correlation of Habitat Factors on the Presence or Absence of Eastern Collared Lizards (*Crotaphytus collaris collaris*) in Arkansas

Eastern collared lizards (*Crotaphytus collaris collaris*) and glade habitats are rare and of special concern in the state of Arkansas. Glades are imperiled due to various factors including habitat fragmentation and tree encroachment. My project aimed to determine

differences in environmental variables, habitat variables, tree community structure, and lizard body condition across glade sites in Arkansas. I sought to discover differences in these factors in 17 historical *C. c. collaris* glade sites (8 with lizard presence and 9 with lizard absence) and determine if the differences were correlated with the presence or absence of *C. c. collaris* populations. Environmental variables were not related to the presence or absence of *C. c. collaris*, indicating a habitat phenomenon rather than environmental. Lizard presence was correlated with habitat structure, as indicated in the ground and canopy cover surveys. Present sites had a positive correlation with rock and soil cover and a negative correlation with coarse woody debris (CWD), vegetation, and canopy cover; whereas absent sites had a positive correlation with CWD, vegetation, and canopy cover and a negative correlation with rock and soil cover. Present and absent sites were significantly different in tree community structure. Absent sites had significantly larger trees and a higher frequency of trees compared to present sites. Lizard body condition was associated with the quality and openness of the glade. These data will prove useful in conservation efforts aimed at *C. c. collaris* recovery in Arkansas and other glade habitats in the Ozarks.

0616 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Dan Groebner

Arizona Game and Fish Department, Pinetop, AZ, USA

A Multi-species Herp and Mollusc Refugia

Rare riparian montane species in the Southwest include narrow-headed gartersnakes (*Thamnophis rufipunctatus*), California floaters (*Anodonta californiensis*), northern leopard frogs (*Lithobates pipiens*), and Three Forks springsnails (*Pyrgulopsis trivialis*). Habitat loss and non-native predation are likely causes for many of the population declines of these species. A constructed wetland and riparian area is being built to provide a herp and mollusc refugia in optimal habitat free from predation by non-native species such as bullfrogs (*Lithobates catesbeianus*) and crayfish (*Orconectes spp*). Springsnail habitat will be provided throughout an artificial spring complex in a constructed mound, fed by cold water pumped from the bottom of a nearby pond. Spring water then flows through a meandering stream in a wetland area with an elevated water table, engineered with ground contouring and a pond liner. The stream will support native fish, which in turn will feed gartersnakes. This stream will drain into an 8 foot deep pond, surrounded by a grassy meadow, which will provide foraging and breeding habitat for leopard frogs and California floaters and is the water source for the spring snail mound. The entire area will be surrounded by a 4 foot high solid fence to discourage movement of refugia species out of the area and prevent non-avian predators from entering the refugia. Optimal growing conditions in this refugia may produce enough surplus animals for future reintroduction programs. Funding is provided by the Natural Resource Conservation Service, the Arizona Heritage Fund and the Arizona Game and Fish Sport Fish Conservation and Management Program.

0644 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Kelly Gronemeyer, Yaritbel Torres-Mendoza, Erin Johnson, Ralph Saporito

John Carroll University, University Heights, OH, USA

Antimicrobial function of alkaloids in geographically different populations of *Oophaga pumilio* (Dendrobatidae) and *Melanophryniscus simplex* (Bufonidae) frog skin

The presence of alkaloids in the granular glands of poison frogs is a commonly studied topic. Poison frogs sequester alkaloids from an arthropod diet, and, since diet varies geographically and temporally, individual frogs vary in their alkaloid composition. The most well-known function of these alkaloids is as defense against predation, but some studies have also demonstrated that poison frog skin secretions may have antimicrobial properties. This study examines the effect of alkaloid defenses from various populations of two poison frog species, *Oophaga pumilio* and *Melanophryniscus simplex*, on the growth of bacteria and fungi. In particular, alkaloids were tested against the gram-positive bacteria *Bacillus subtilis*, the gram-negative bacteria *Escherichia coli*, and the fungus *Candida albicans*. In most cases, when a higher concentration of alkaloids was present in the culture, microbial growth decreased. In addition, alkaloid extracts from certain populations inhibited more microbial growth than alkaloid extracts from other populations, suggesting that variations in alkaloid composition may lead to differences in antimicrobial activity. Overall, the results of this study indicate that poison frog alkaloids have antimicrobial properties, suggesting that they function as both antipredator and antimicrobial defenses.

0561 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Iwo Gross¹, Corissa Lennon¹, Meagan Thomas¹, Andrew Durso², Stephen Mullin¹

¹*Eastern Illinois University, Charleston, Illinois, USA*, ²*Utah State University, Logan, Utah, USA*

Patterns of Snake (Colubridae: *Storeria*) Movement and Mortality during Seasonal Migrations Between Habitats

Roads are among several anthropogenic structures that can have negative impacts on a landscape. In addition to road surfaces altering and fragmenting habitat, organisms crossing them experience direct mortality from vehicles in transit. Mortality rates are typically greater when a roadway passes between distinct habitat types used

differentially by individuals within a single year. Our study quantifies spatial and temporal patterns of Midland Brownsnakes (*Storeria dekayi wrightorum*) that biannually cross a 2.4-km stretch of park road separating over-wintering sites from summer activity areas. We collected both live and dead-on-road individuals using a combination of visual encounter surveys and nine 100-m drift fence-pitfall trap arrays outfitted with adjacent cover objects and funnel traps. We recorded morphometric, behavioral, life-history, and GPS location data for all individuals, and uniquely marked each snake prior to its release. Male snakes incur higher mortality than females within and between years. When returning to over-wintering sites each Autumn, peaks in migratory activity tend to coincide with periods of highest traffic volume along the park road. Further analyses using GIS also indicated that snake movements across the road follow specific corridors associated with temporary streambeds and other areas of low slope topography. Limiting vehicular access to the park road during the second half of October, or adding culvert structures, would improve survivorship for this population, and other snake species in this ecosystem.

0289 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Gary Grossman

University of Georgia, Athens, GA, USA

Consequences of flow and habitat alterations and fragmentation on stream fish assemblage structure and population dynamics

Fish populations in the temperate zone typically are affected by both density-independent and density-dependent processes. As climate change increases we expect increases in environmental variability such as temperature, precipitation and flow. Consequently, the availability of fish habitat may vary considerably in the future. In this paper I explore the literature on habitat selection and population control in temperate stream fishes to make a variety of predictions regarding the effects of environmental variability on both fish populations and their habitats.

0164 AES Stingray Symposium, Mesilla, Friday 12 July 2013

R. Dean Grubbs¹, Robert Fisher²

¹Florida State University Coastal and Marine Lab, St. Teresa, Florida, USA, ²Virginia Institute of Marine Science, Gloucester Point, Virginia, USA

A review of the life history of the cownose ray, *Rhinoptera bonasus*: Is a directed fishery sustainable?

Cownose rays (Rhinopteridae) are large, coastal batoids that migrate in very large schools and they are conspicuous predators on invertebrates where they occur. Their diets are varied, consisting primarily of relatively weak-shelled mollusks and crustaceans. However, predation on bivalves of commercial importance has drawn the ire of commercial fishers for more than two centuries. Along the East Coast of the U.S. there have been calls to develop fisheries for cownose rays since the 1970s, but the absence of viable markets limited development. Recently, highly publicized but weakly supported claims that dramatic increases in cownose ray populations, mediated by declines in shark populations, led to collapses in commercial bivalve stocks have renewed fishery development efforts and generated significant public support for cownose ray fisheries. An unregulated fishery for cownose rays, accompanied by a marketing campaign, has operated in Chesapeake Bay since 2007. Based on ~700 cownose rays collected from Chesapeake Bay, we estimated the age at maturity is 6-7 years for males and 7-8 years for females. Cownose rays grow rapidly during the first year of life resulting in relatively high growth coefficients (males, $k=0.2741$; females, $k=0.1931$). The maximum age observed was 21 years. Cownose ray fecundity is among the lowest of all vertebrates. Females typically produce one offspring following a gestation of eleven months, suggesting lifetime fecundity is 10-15, roughly an order of magnitude lower than most large elasmobranchs. These life history characters suggest cownose rays may be highly susceptible to over exploitation and developing fisheries should be monitored closely.

0639 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Mónica Guerra, Michael Ryan, David Cannatella

University of Texas at Austin, Austin, Texas, USA

Ontogeny of Sexual Dimorphism in the Larynx of the Túngara Frog, *Physalaemus pustulosus*

In most frogs, males but not females produce vocalizations to attract mates. Sexual selection can influence the evolution of these vocalizations by modifying frog's morphology. The larynx is the main organ responsible for sound production; thus it

constitutes a target of selection. Our goal in this study was to determine qualitatively and quantitatively the sexual differences in a developmental sequence of *Physalaemus pustulosus* larynges. We examined larynges of individuals ranging in size from recently metamorphosed to adults. We provide quantitative measurements of larynx area and volume, vocal cords and Fibrous Mass 1 (FM1); and qualitative descriptions of the origin of vocal cords and FM1. Larynges of small male and female juveniles (<16 mm SVL) are similar, both externally and internally. The larynx of small juveniles is small, with an area of no more than 1 mm², no vocal cords or FM1 are present in either sex. In individuals larger than 16 mm SVL, there is a marked divergence in relative larynx size between sexes. The male larynx begins to exhibit a strong positive allometry until it reaches a plateau at 24 mm SVL. Also, at 16 mm SVL, the vocal cords and FM1 begin to appear as distinctive outgrowths on the wall of the arytenoid cartilage in male larynges. Female growth rate of the larynx, however, is isometric throughout their ontogeny. Female vocal cords and FM1 are barely noticeable as adults, and never attain the size and mobility that those structures have in adult male larynges.

0373 AES Behavior, San Miguel, Sunday 14 July 2013

Tristan Guttridge¹, Nathan Bass³, Joanna Wiszniewski⁴, Samuel Gruber², Culum Brown¹

¹Cardiff University, Cardiff, UK, ²University of Miami, Florida, USA, ³Macquarie University, NSW, Australia, ⁴Taronga Zoo, NSW, Australia

Novel Acoustic Technology for Studying the Social Behaviour of Free-Ranging Sharks by Recording Individual Interactions

Group behaviours are widespread among fish but comparatively little is known about the interactions between free-ranging individuals and how these might change across different spatio-temporal scales. This is largely due to the difficulty of observing wild fish groups directly underwater over long enough time periods to quantify group structure and individual associations. Here we describe the use of a novel technology, an animal-borne acoustic proximity receiver that records close-spatial associations between free-ranging fish by detection of acoustic signals emitted from transmitters on other individuals. Validation trials, held within enclosures in the natural environment, on juvenile lemon sharks *Negaprion brevirostris* fitted with external receivers and transmitters, showed receivers logged interactions between individuals regularly when sharks were within 4 m (4 body lengths) of each other, but rarely when at 10 m distance. Field trials were conducted on 5 juvenile lemon sharks in Bimini, Bahamas implanted with receivers lasting 17 days and 2 adult Port Jackson sharks *Heterodontus portusjacksoni* in Jervis Bay, Australia with external receivers for 30 days. Association data were recorded successfully for both species and these data were analysed using social network theory. This study describes the use of acoustic underwater proximity receivers to quantify interactions among wild sharks, setting the scene for new advances in understanding the link between social behaviour and space use of marine animals.

**0183 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Jacquelyn Guzy¹, Steven Price², Stephanie Hunt¹, Brian Halstead³, Evan Eskew⁴,
Michael Dorcas¹

¹Davidson College, Davidson, NC, USA, ²University of Kentucky, Lexington, KY, USA,

³Western Ecological Research Center, U.S. Geological Survey, Dixon, CA, USA,

⁴University of California, Davis, CA, USA

Response of Riparian Reptile Communities to Damming and Urbanization

Various anthropogenic pressures, including habitat loss, threaten reptile populations worldwide. Riparian zones are critical habitat for many reptile species, but these habitats are also frequently modified by anthropogenic activities. Our study investigated the effects of two riparian habitat modifications – damming and urbanization – on overall and species-specific reptile occupancy patterns. We used time-constrained search techniques to compile encounter histories for 28 reptile species at 21 different sites along the Broad and Pacolet Rivers of South Carolina. Using a hierarchical Bayesian analysis, we modeled reptile occupancy responses to a site's distance upstream from dam, distance downstream from dam, and percent urban land use. The mean occupancy response by the reptile community indicated that reptile occupancy and species richness were maximized when sites were farther upstream from dams. Species-specific occupancy estimates showed a similar trend of lower occupancy immediately upstream from dams. Although the mean occupancy response of the reptile community was positively related to distance downstream from dams, the occupancy response to distance downstream varied among species. Percent urban land use had little effect on the occupancy response of the reptile community or individual species. Our results indicate that the conditions of impoundments and subsequent degradation of the riparian zones upstream from dams may not provide suitable habitat for a number of reptile species.

0728 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Bryan Hamilton¹, Beverly Roeder², Alyssa Leano², Jen Brockbank², Anneke Baldwin²

¹Great Basin National Park, Baker, Nevada, USA, ²Brigham Young University, Provo, Utah, USA

Short Distance translocation of Great Basin Rattlesnakes: Valid Management Strategy?

Rattlesnakes in areas of human use are often relocated short distances. Short distance translocations do not affect rattlesnake survival but rattlesnakes may return to their capture sites, potentially endangering humans. We tested the prediction that rattlesnakes relocated short distances would return to their capture sites. We implanted 26 Great Basin rattlesnakes (*Crotalus lutosus*) with radio transmitters in Great Basin National Park. Mean translocation distance from capture sites was 25.1m (range 0 - 242m). Following translocation nine snakes were detected within 10 meters of their capture site (35%), 10 within 30 meters (38%) and 15 within 100 meters (58%). We recorded 27 instances of recidivism at 10 meters, 32 at 30 meters and 60 at 100 meters. Sex and distance to hibernaculum were the best predictors of recidivism across scales. While short distance translocations alleviate the immediate danger of a rattlesnake, they do not eliminate the possibility that a translocated snake will return to its capture site. The likelihood of recidivism can be very high particularly if the capture site is near a hibernaculum or rookery. Human acceptance of rattlesnakes in conjunction with short distance translocation is the best way for coexistence to occur.

0632 AES Ecology, Mesilla, Thursday 11 July 2013

Ian Hamilton, Mark Abrahams, Ian Fleming, Edd Brooks

Memorial University, St. John's, Newfoundland, Canada

Examining the Parameters Affecting the Distribution of Juvenile Lemon Shark Populations in Mangrove Creek Systems

Lemon sharks use coastal inlets (creeks) as nursery habitats, with females entering these creeks in the spring to give birth to live young that spend their first years of life in these locations. While this phenomenon is well known, the mechanism by which females select such locations for their young is not. Given that lemon sharks are most vulnerable to predation at this stage, we reasoned that females are selecting nursery habitats in a way that integrates both predation risk and growth rate on their offspring. We thus undertook to quantify population differences among nurseries and assess how food availability and risk shape patterns of use. Seine nets were used to capture and tag

juvenile lemon sharks and potential prey items, in 9 mangrove creeks in South Eleuthera, The Bahamas. Drum-lines were used as a means of ascertaining predator abundances outside of each system. The results indicate a strong relation between lemon shark and prey abundance, and a weaker one in relation to predator abundances. Given the philopatric nature of juveniles, our results suggest that adult females are making habitat selection decisions on the island scale. These results highlight the importance of mangrove creek ecosystem conservation both locally and regionally.

**0463 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD GENERAL HERPETOLOGY**

Maggie Hantak, Daniel Paluh, Ralph Saporito

John Carroll University, University Heights, OH, USA

**The Role of Chemical Compounds in the Defense Against Predation of Two
Neotropical Anurans, *Dendrobates auratus* and *Rhaebo haematiticus***

Alkaloids that are obtained through dietary items appear to provide poison frogs with chemical defenses. These chemical defenses vary greatly between and among poison frogs due to a variable diet, and it is unknown if color-blind predators prey on poison frogs that contain fewer defenses. In this study, I performed predation trials with adult and juvenile *Dendrobates auratus* to determine if they are chemically protected from predation. Trials were performed with naturally collected frogs and with frogs that contained a reduced amount of alkaloids. Reducing alkaloid amount was accomplished with an alkaloid removal device, transcutaneous amphibian stimulator (TAS). In addition to predation trials with *D. auratus*, I was also interested in whether a toxic, cryptically colored toad, *Rhaebo haematiticus*, is protected from predation. Predation trials were performed with the color-blind invertebrates, *Paraponera clavata* and *Cupiennius coccineus*. All predation trials demonstrated that both *D. auratus* (adult and juvenile) and *R. haematiticus* were protected from predation by these two predators. The TAS treatment did not appear to affect the predation rates by these two predators. These results suggest that *D. auratus* and *R. haematiticus* are chemically defended from predation and these two predators are unable to detect differences in the amount or type of defenses that these frogs contain.

0630 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Maggie Hantak, Ralph Saporito

John Carroll University, University Heights, Ohio, USA

Dietary Alkaloid Sequestration in a Bufonid Poison Frog: An Experimental Test of Alkaloid Uptake in *Melanophryniscus stelzneri* (Bufonidae)

The term 'poison frog' is used to describe specific lineages of brightly colored anurans capable of sequestering alkaloid-based chemical defenses from dietary arthropods. Currently, certain members of Dendrobatidae, Mantellidae, Myobatrachidae, Bufonidae, and Eleutherodactylidae are considered poison frogs. The ability to sequester alkaloids from dietary arthropods has been experimentally demonstrated in most poison frog lineages, but has not been examined in eleutherodactylid or bufonid poison frogs. As with other poison frogs, members of the genus *Melanophryniscus* (Bufonidae) have alkaloid defenses and consume mainly mites and ants, suggesting that they also sequester defenses from dietary arthropods. To test this hypothesis, we performed two alkaloid-feeding experiments with the bufonid poison frog, *Melanophryniscus stelzneri*. In both studies, experimental frogs were fed fruit flies dusted with alkaloid-vitamin powder mixtures. The alkaloids 5,8-disubstituted indolizidine **235B'** and decahydroquinoline were utilized in the first experiment, whereas the alkaloids 3,5-disubstituted indolizidine **239Q** and decahydroquinoline were utilized in the second experiment. Control frogs were fed fruit flies dusted only with vitamin powder. On the basis of both studies, we provide experimental evidence that *M. stelzneri* is capable of sequestering alkaloids from diet. The frogs did not chemically modify any of the alkaloids; however, 3,5-I **239Q** was sequestered more efficiently than decahydroquinoline, suggesting selectivity in the alkaloid uptake system of bufonids, which has also been shown in other poison frogs. The findings of our study provide the first experimental evidence that bufonid poison frogs sequester alkaloid-based defenses from dietary arthropods.

0247 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Koujiro Hara, Keisuke Furumitsu, Atsuko Yamaguchi

Graduate School of Fisheries Science and Environmental Studies, Nagasaki University, Nagasaki, Nagasaki, Japan

Age, growth, and size at sexual maturity of Kwangtung skate *Dipturus kwangtungensis* in the East China Sea

Kwangtung skate *Dipturus kwangtungensis* is distributed along the Japanese coast and areas around the East China Sea, Yellow Sea, and South China Sea. This species has

relatively high commercial value in Japan and is mainly caught by bottom trawl fisheries. Despite its commercial importance, the life history of kwangtung skate remains poorly understood. This study aimed to determine the age, growth, and sexual maturity of kwangtung skate. A total of 260 specimens (137 males and 123 females) were collected using trawl survey of a university training ship from April 2009 to September 2012. Age determination was conducted by vertebral centrum analysis; the vertebrae between the 20th and 25th were sectioned at a thickness of approximately 0.5 mm along the central longitudinal axis. Annual band pair deposition was determined by marginal increment analysis. The von Bertalanffy growth model was fitted to the observed length-at-age data for each sex (males, $L_{\infty} = 765.8$, $k = 0.11$, $t_0 = -1.37$; females, $L_{\infty} = 814.8$, $k = 0.10$, $t_0 = -1.30$). Parameter estimates suggested that females attain greater asymptotic total length than that by males. Further, growth until 6 years was similar in both sexes, but after 6 years, females tended to grow larger than males. The observed maximum ages were 13 years for males and 15 years for females. Size and age at 50% sexual maturity were 501 mm TL, 7.9 years for males, and 579 mm TL, 9.9 years for females.

0194 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Nicole Harings, Wiebke Boeing

New Mexico State University, Las Cruces, NM, USA

Desert Anuran Occurrence and Detection in Artificial Breeding Habitats

One-third of known amphibian populations have become extinct; habitat loss and degradation being the leading causes in the United States. Site occupancy has been suggested as one of the most effective state variables in describing population declines. The objectives of this study were to determine occurrence estimates of five southwestern desert anurans accounting for imperfect detection and determine the main factors impacting detection. We conducted call and visual surveys on three consecutive nights after rain events at 21 breeding sites for New Mexico Spadefoot (*Spea multiplicata*), Plains Spadefoot (*S. bombifrons*), Couch's Spadefoot (*Scaphiopus couchii*), Great Plains Toad (*Anaxyrus cognatus*), and Green Toad (*A. debilis*). We used occupancy models to estimate occurrence probabilities for all species. *Spea multiplicata* and *A. debilis* were most abundant, followed by *A. cognatus*, *S. bombifrons*, and *Sc. couchii*, respectively. In addition to the inclusion of repeated site surveys to decrease bias, incorporating visual surveys greatly improved occurrence estimates for southwestern desert anurans. Detection was highest on survey night one for *S. multiplicata*, *S. bombifrons* and *Sc. couchii*. Warmer air temperature improved detection of *A. cognatus*, while detectability of *A. debilis* was not influenced by predictor variables. Immediate surveys after rain events and the combination of call and visual surveys are critical to increase accuracy when studying desert anurans.

0777 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

George Harper

Hendrix College, Conway, AR, USA

Evolution of the Phospholipase A2 venom gene in the five subspecies of copperhead, *Agkistrodon contortrix*

Venomous snakes rely upon their venom for food procurement, and use it as a defense against predators. The central importance of venom to the survival and reproduction of these snakes should subject the components of venom to strong selective pressure, and the large geographic and physiographic ranges of some species make it likely that selective pressures on the venom of a given species vary due to different suites of prey and predators in various parts of the range. Copperheads, *Agkistrodon contortrix*, occur in the United States from Southern New England to the Big Bend area of Texas and have been divided into five subspecies based largely on geographic variation in color patterns. Phospholipase A2 (PLA2), an important enzyme and toxin in many snake venoms, is a myotoxic component of copperhead venom and a good candidate for study. We isolated and sequenced multiple copies of the PLA2 gene from individuals of all five subspecies, and found large levels of variation in the nucleotide and amino acid sequences. A phylogenetic analysis of the sequences did not support the current subspecies designations. Rather, it separated this species into two groups, an Eastern clade and a Western clade. Evidence for intergradation between the two groups was found in animals from the Ozark Plateau of Arkansas. Our data suggest that the PLA2 gene is evolving rapidly within this species.

0318 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Sean Harrington

San Diego State University, California, USA

Inferring Basal Snake Phylogenetic Relationships Using Molecular, Morphological, and Fossil Data

Snake fossils can shed key insights on snake evolution and diversification. However, relationships among fossil and extant snakes are uncertain, and must be resolved before inferences about patterns of evolution can be drawn. In this study, I have combined DNA sequence data from 44 nuclear loci from Wiens et al. (2012) with morphological data from Zaher and Scanferla (2012) and Scanferla et al. (2013) to infer the phylogenetic placements of nine important fossil taxa within snake phylogeny. I gathered new morphological data for the "scolecophidian" families Typhlopidae, Leptotyphlopidae,

and Anomalepididae, rather than pooling these families together, because molecular evidence supports scolecophidian paraphyly. I also collected new morphological data for several iguanians, as molecular analyses support Iguania (along with Anguimorpha) as closely related to Serpentes. The combined data were analyzed using Bayesian phylogenetic inference. As expected due to the large amount of molecular data, relationships among extant clades exactly matched those of Wiens et al. (2012). However, unlike Zaher and Scenferla (2012), my analyses reveal a sister relationship between the extinct Madtsoiidae and a clade composed of extinct, secondarily marine snakes (the pachyophiids). *Dinilysia patagonica* was placed outside of the crown Serpentes, as in Zaher and Scenferla (2012), but the new analyses support a sister relationship with the extinct *Najash rionegrina*, which possessed robust hind limbs. The position of these extinct species as sister taxa outside of the crown Serpentes has not previously been identified, and has particularly important implications for early snake evolution.

0383 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday 13 July 2013

Jeremy Harris¹, Terry Grande²

¹University of Washington, Seattle, WA, USA, ²Loyola University of Chicago, Chicago, IL, USA

ETOL: The Comparative Anatomy of the Free Pectoral Rays in Scorpaenoid Fishes

The majority of teleost fishes utilize their pectoral fins to assist in swimming locomotion, but many benthic taxa have modified their fins to interact with the substrate. This pattern is particularly evident in a number of scorpaenoid fishes including sea robins (Triglidae), armored searobins (Peristediidae), ghost flatheads (Hoplichthyidae), waspfishes (Apistidae), and some stonefish relatives (Synanceiidae). In these groups, between one and three of the pectoral fin rays have become separated from the main fin, thereby allowing them to operate as an independent appendage. These "free rays" possess the ability to move independently, have a wide range of motion, and are strongly flexible. The anatomical structure of these "free rays" was investigated using triglids as a model and the investigation was extended to the other families. This presentation will illustrate several novel features of the musculature and osteology of the free rays, including unique subdivisions of the adductor muscles and modifications to the bony processes at the base of each ray. Although externally similar, dissection revealed numerous variations in the internal structure of this trait when compared across taxa. Geometric morphometric analysis of the hemitrichia of the free rays was used to highlight areas of the bone that show variation between taxa and suggests that each family is associated with a specific shape. The significance of these findings are considered with respect to published observations of behavior in these fishes, and some

potential consequences for pectoral fin function and the homology of fin rays are discussed.

0233 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Jeremy P. Harris, Katherine P. Maslenikov, Theodore W. Pietsch

The University of Washington, Seattle, WA, USA

Revival and New Directions for a Historic Otolith Collection Transferred to the UW Fish Collection

While species identification and age-and-growth estimation and validation have been the predominant uses of fish otoliths, an astonishing array of applications and research directions have recently been developed that go beyond fisheries biology. New advances in imaging and preparation allow for enhanced studies of otolith structure and function, and isotopic techniques enable otoliths to serve as biological tracers of change in diet and habitat, and environmental indicators of temperature and climate change. Otoliths are of enormous realized and unknown potential value. Approximately 1.67 million pairs of otoliths, representing 83 species of teleosts in 41 genera and 17 families, have been collected by Alaska Fisheries Science Center personnel over the past 40 years through North Pacific Groundfish Observer programs and annual shelf and slope surveys along the west coast of the U.S. and Alaska, with new material collected annually. The collection was disorganized, unavailable electronically, underutilized, and presented a serious safety and environmental compliance issue. The University of Washington Fish Collection was recently awarded NSF funds to (1) transfer the collection to the UW campus; (2) repackage and rearrange the collection in suitable permanent storage space; (3) curate, catalog, and fully integrate the collection; (4) make the collection available to researchers via an on-line search interface; (5) create an on-line image gallery of eastern North Pacific fish otoliths; and (6) feature the collection in our active public outreach program. Here we present progress and point to ways in which this unique resource is being put to scientific use.

0083 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Lindsay Harris¹, Christine Bedore², Stephen Kajiura¹

¹Florida Atlantic University, Boca Raton, Florida, USA, ²Duke University, Durham, North Carolina, USA

Electroreception in the obligate freshwater stingray, *Potamotrygon motoro*

Elasmobranch fishes (sharks, skates, and rays) use electroreception to detect environmental electric fields, particularly the minute bioelectric fields produced by potential prey. Conductivity (e.g. salinity) dictates how bioelectric fields propagate, and thus influences how they are detected and localized by predators. A single elasmobranch family (Potamotrygonidae) is composed of obligate freshwater (FW) stingrays endemic to the Amazon River. A strictly FW existence has imposed morphological adaptations on their electrosensory system due to life in a high impedance medium. Because their electrosensory morphology differs from their marine relatives, FW rays may demonstrate corresponding differences in behavioral sensitivity. Little work has investigated whether the reduced sensitivity reported is due to the electrical properties of the FW medium, or to a marine-tuned sensory system attempting to function in a high impedance FW environment. The objective of this study was to quantify behavioral sensitivity of the obligate FW stingray *Potamotrygon motoro* to prey-simulating electric fields. The voltages produced by common teleost prey of *P. motoro* were measured and replicated for behavioral trials. The maximum orientation distance to the dipole center for any ray was 10.62 cm, and the smallest voltage gradient detected was 0.05 mVcm⁻¹. This sensitivity is five orders of magnitude less than marine batoids (skates and rays). A euryhaline batoid species with marine-type ampullary morphology demonstrated a reduced sensitivity in FW compared to seawater; the FW values were similar to *P. motoro* which suggests that the conductivity of the medium, more so than ampullary morphology, dictates sensitivity of the elasmobranch electrosensory system.

0574 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Holly Hawk, Larry Allen

California State University, Northridge, Northridge, CA, USA

Age, Growth and Genetic Diversity of Giant Sea Bass, *Stereolepis gigas*

The giant sea bass, *Stereolepis gigas*, is the largest predatory fish that inhabits the southern California kelp forest community. Growing to lengths of at least 2.2 m and 227 kg, it is estimated to reach at least 62 years of age. Giant sea bass were commercially and recreationally sought after for most of the 20th century and may still be brought to

market as by-catch. Fisheries provide a valuable food commodity; however overexploitation of a single fish threatens not only that species but the biodiversity of the marine ecosystem the species inhabits. Management and conservation of marine fisheries requires the consideration of many factors and consequent comprehensive data collection. *S. gigas* is a critically endangered species. A more complete knowledge of its life history of this once commercially viable fish is necessary for a comprehensive management strategy. I used sagittal otoliths to determine the age, growth, and mortality of giant sea bass based on 61 specimens landed as incidental catch and obtained through fish markets. I then determined the genetic diversity in the existing stock of giant sea bass, which should lead to a better understanding of the genetic impact of overexploitation in this species and to what extent current populations should continue to be protected.

0045 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Malorie Hayes, Jonathan Armbruster

Auburn University, Auburn, AL, USA

A Preliminary Phylogeny of West African '*Barbus*' (Cyprinidae)

Of the over 800 species of *Barbus* within Cyprinidae, more than 300 species are attributed to the sub-Saharan '*Barbus*' group. Despite the large number of species within this region, little is known regarding the relationships within the genus, and taxonomic revision is necessary to distinguish the group from the Eurasian *Barbus*. Recent work has separated *Pseudobarbus* and *Labeobarbus* from the '*Barbus*' group in Africa, but additional taxonomic resolution within the genus is needed. In this study, over 25 species of '*Barbus*' from West Africa are analyzed using the mitochondrial marker cytochrome b. A preliminary phylogenetic framework for the relationships within the '*Barbus*' of West Africa is constructed using maximum likelihood and Bayesian inference. The monophyly of the group is tested as well as the relationships of the '*Barbus*' to other closely related genera.

0511 Herp Systematics, San Miguel, Friday 12 July 2013

Matthew Heinicke¹, Juan Daza², Eli Greenbaum³, Todd Jackman², Aaron Bauer²

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Phylogeny, Taxonomy, and Biogeography of a circum-Indian Ocean Clade of Leaf-toed Geckos

Geckos with a leaf-toed morphology (undilated digits with a single pair of enlarged terminal adhesive pads) occur on six continents as well as many islands. For many decades most leaf-toed geckos were lumped in the genus *Phyllodactylus*, but subsequent work has shown that leaf-toed geckos are found in numerous unrelated lineages, and *Phyllodactylus* now includes only New World species. In the Old World, recent phylogenetic studies have supported the monophyly of a group including four genera from disparate regions: the southern African genera *Afrogecko* and *Cryptactites*, the Madagascan genus *Matoatoa*, and the Australian genus *Christinus*. We obtained molecular and/or morphological data for most species in these four genera to estimate evolutionary relationships among constituent species and infer broad historical biogeographic patterns in the group. Our results show that *Afrogecko* is not monophyletic, and is in fact comprised of three distinct lineages, each of which is distinct in external morphology and osteology from one another and from *Matoatoa*, *Christinus*, and *Cryptactites*. Based on these data, we propose a new classification for circum-Indian Ocean leaf-toed geckos. Molecular clock analyses suggest that divergences are too late for vicariance to account for distributional patterns in the group. Ancestral area analyses suggest a clade origin in southern Africa, but cannot exclude Madagascar. Notwithstanding this distinction, there is strong support for dispersal from southern Africa to Australia. Potential dispersal routes compatible with molecular clock results are discussed and compared to those of other clades distributed around the Indian Ocean rim.

0769 Fish Biology, Doña Ana/Cimarron, Sunday 14 July 2013

David Heins, Kelly A. Barry, Laura A. Petrauskas

Tulane University, New Orleans, LA, USA

Host Responses to Parasitic Infection in the Threespine Stickleback Fish Infected by the Diphyllbothriidean Cestode *Schistocephalus solidus*

Among different populations of the threespine stickleback in Alaska, female fish infected by the diphyllbothriidean cestode *Schistocephalus solidus* have been shown to have two different responses to infection: loss of fecundity due simply to nutrient theft

and fecundity compensation. Fecundity compensation is inducible, adaptive response allowing female fish to increase fecundity before the full effects of parasitism occur. This report is based on a multi-year study of these responses to infection. Empirical questions about these responses will be addressed for a better understanding of the interplay between host and parasite.

0581 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Dean Hendrickson, Adam Cohen, Ben Labay

University of Texas Austin, Austin, Texas, USA

Fishes of Texas Project: compilation, normalization and quality control of museum data

The Fishes of Texas Project (www.fishesoftexas.org) compiled Texas fish species occurrence records from 42 museum collections and applied rigorous quality control and data normalization/standardization to result in 124,415 specimen-based records collected between 1851 and 2010 by 5,924 collectors. 88,348 records from 7,868 unique Texas inland localities were manually georeferenced with placement error estimates. 8,460 Gulf of Mexico records and 18,923 inland records from neighboring Mexican and U.S. states have been partially processed. Georeferenced records were plotted and 4,107 geographic outliers flagged as potential identification or location errors. Most flagged specimens, and often related original documentation, have now been examined and identifications corrected or confirmed. The value of such specimen-based vouchering of collections and compiling and normalizing large data sets was quickly demonstrated by discovery of 31 species occurrences in major river basins where they were previously not believed to occur. The online database can be queried in diverse ways, mapped, and records downloaded. Also online are a large set of high quality fish images, original field notes, specimen photos, detailed species distribution models based on the data, accounts of species' biology and ecology, video time-lapse distribution maps, and digital identification keys.

0049 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Catriona Hendry¹, Timothy Guiher², R. Alexander Pyron¹

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Ecological Divergence and Sexual Selection Drives Sexual Size Dimorphism in New World Pitvipers (Crotalinae)

Hypotheses for the origin and maintenance of sexual size dimorphism (SSD) fall into three primary categories: (i) sexual selection on male size, (ii) fecundity selection on female size, and (iii) ecological selection for gender-specific niche divergence. We investigate the impact of these forces on SSD in New World pitvipers (Crotalinae). We reconstruct a phylogeny from up to 8 genes (7 mitochondrial, 1 nuclear) for 104 species of NW crotalines. We gathered morphological and ecological data for 82 species for comparative analyses. There is a strong signal of sexual selection on male size in driving SSD, but little evidence for fecundity selection on female size across lineages. Support for allometric scaling in SSD (Rensch's rule) in NW crotalines is mixed. Interestingly, arboreal lineages experience higher rates of SSD and a pronounced shift to female-biased dimorphism. This suggests that fecundity selection on arboreal females exaggerates ecologically mediated dimorphism, while sexual selection drives male size in terrestrial lineages. We find that increasing SSD in both directions (male- and female-biased) decreases speciation rates. In NW crotalines, it appears that as inter-sexual morphological disparity increases due to sexual, fecundity, and ecological selection, intra-specific differentiation results in lower rates of speciation at higher magnitudes of SSD.

0579 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Sharon Hermann¹, Craig Guyer¹, Geoff Sorrell²

¹Auburn University, Auburn, AL, USA, ²The Nature Conservancy, Ft. Benning, GA, USA

Improving Conservation Efforts for the Gopher Tortoise (*Gopherus polyphemus*)

Gopher tortoises are of high conservation concern in much of the lower US Coastal Plains. The species is federally listed in three states and a candidate species elsewhere in its range. On-going management is necessary for this species because it is endemic to habitats that require frequent fire. Prior assessments suggest that tortoises respond to differences in large-scale habitat structure but despite conservation efforts, there are concerns that habitat quality may be declining across the range. To address this issue

we used burrows as surrogates for tortoise use and sampled habitat structure in 0.04 ha plots centered on active burrows and evenly-spaced points across the landscape, excluding areas of inappropriate soil type. Our goal was to evaluate evidence that tortoises select a subset of available areas based on small-scale habitat characteristics.

Results indicate that small-scale differences are important to tortoises and that burrows occur in sites with lower canopy cover, fewer small woody midstory stems, lower densities of small woody stems in the groundcover, and more exposed soil. Although we cannot rule out the possibility that tortoise activity created exposed soil, the other small-scale habitat characteristics may be important for basking and nest incubation and so are likely to be selected by tortoises. These factors can be managed with improving effects of prescribed fire. By assessing small-scale habitat characteristics associated with burrows we can guide forest management and consequently enhance site quality for gopher tortoises.

0061 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Ariana Hernández-Muñoz, Hector Espinosa

Instituto de Biología, UNAM, México, D.F., Mexico

Analysis of the Stomach Contents of the Fish Fauna of the Freshwater Spring in the Cienega Churince Cuatrociénegas, Coahuila

The Cienega Churince, in Cuatrociénegas, Coahuila, is classified as a high priority wetland for conservation, because of the large number of endemic species that live there and the dynamics of its hydrological system. This ecosystem is currently affected by water demand, used for livestock and agriculture, which has caused the reduction of the distribution of native fish fauna, and the introduction of exotic species, such as the African jewel (*Hemichromis guttatus*). The aim of this study was to analyze the feeding behavior of the fish species that inhabit the freshwater spring in the Cienega Churince, and evaluate the dietary overlap between species. Eight samplings were taken between February 2011 and October 2012, along with physicochemical parameters at each site. The stomachs of four species (three families) were extracted, weighted and analyzed for its content, visually identifying the food items to the lowest possible taxonomic level. The food items are mostly represented by crustaceans and plants in *Hemichromis guttatus* and *Cyprinodon bifasciatus*, although *Herichthys minckleyi* consumes mostly larval insects and *Gambusia marshii* consumes mostly algae. According to the Morisita index, there is an overlap in the seizing of resources, and the introduced fish species (*H. guttatus*) shares food items with two of three native species (*G. marshii* and *H. minckleyi*), indicating that there is high interspecific competition in this spring due to the exotic species.

0319 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

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Resolving the identity of Texas *Desmognathus*

The identity of Dusky Salamanders (*Desmognathus* sp.) in East Texas has recently come into question. Most authors have long considered Texas dusky salamanders to be Southern Dusky Salamanders; however, a study using mtDNA to better understand the relationships of dusky salamanders from the Coastal Plain of the Southeast restricted the distribution of the Southern Dusky Salamander to areas of Florida and Georgia. At that time samples from Texas were not included because specimens could not be found. Samples from Louisiana all were genetically identified as *Desmognathus conanti*, therefore all Texas specimens were assigned as that species. We surveyed for dusky salamanders in East Texas in 2009-2011 at known localities and other sites that appeared to be suitable habitat. We collected tissue samples from specimens at three localities. Analysis of mtDNA sequences compared to those samples used in previous studies confirms the assumption that dusky salamanders in Texas are in fact *Desmognathus conanti*. Interestingly deep divergences exist between the Texas specimens and those *D. conanti* from farther east. Also, the populations in Texas on either side of the Neches River show deep divergences indicating that large rivers are likely genetic barriers.

0298 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Cari-Ann Hickerson, Maggie Hantak, Daniel Paluh

John Carroll University, University Heights, OH, USA

A comparison of the diets of erythristic and striped phenotypes of red-backed salamanders, *Plethodon cinereus*

Polymorphic species may experience different selective pressures, which could lead to reproductive isolation and potential divergence of phenotypes. Eastern Red-backed Salamanders (*Plethodon cinereus*) exhibit three different phenotypes, although localities in which all three occur are rare. In Ohio, the erythristic (red) phenotype is the least common, and most often occurs in sympatry with the striped phenotype. Although mounting evidence suggests that there has been some degree of ecological divergence within populations of striped and unstriped *P. cinereus* in Ohio, there have been no studies examining the potential for such separation in dimorphic populations of the erythristic and striped phenotypes. In this study, we assessed potential niche partitioning in diet between erythristic and striped *P. cinereus* by comparing the stomach

contents of these two phenotypes from a single locality in northeast Ohio. We counted and identified 546 prey items, representing 14 taxonomic categories. The number of prey items per stomach did not differ between phenotypes, suggesting that specialization on particular prey items is not occurring in this population. There was however a difference in the total volume of prey items between phenotypes, in which erythristic salamanders consumed larger prey. These findings suggest that niche divergence between phenotypes may be occurring based on food quality. If larger prey items represent higher quality prey, then the erythristic phenotype may be a more efficient forager than the striped. A more detailed determination of prey quality will be necessary to better understand the degree of niche separation in this population.

0675 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Beckett Hills, Zach Parker, Josh Lynn, Scott Parker

Coastal Carolina University, Conway, SC, USA

Where to dig? Modeling Potential Diamondback Terrapin (*Malaclemys terrapin*) Nest Sites at North Inlet, SC, Using a Geographic Information System (GIS)

Analysis of ecological characteristics using a geographic information system (GIS) is an increasingly powerful way to understand spatial questions about the distribution and areal extent of critical nest habitat within an aquatic reptile's home range. Diamondback terrapin require upland habitat for construction of nests and egg incubation, and the composition of the site characteristics can be used as constraints to identify sites containing optimal nesting conditions. Combining life history patterns and habitat preferences with geospatial data sets is a novel application of a GIS for terrapin nesting ecology. I created a GIS model coordinating measurements (distance to vegetation, % ground cover, vegetation type, distance to high tide shoreline) taken at actual ($n_a=104$) and random ($n_r=104$) nests in the summer of 2012 with public GIS data sets. Nest points were used to extract classification values from public raster and vector data sets. Land use, land cover, wetland, and soil type classifications were obtained from shapefiles provided by the SC Department of Natural Resources, and values of elevation, slope, and aspect were calculated from Light Detection and Ranging (LiDAR) data from 2006. The model will be ground truthed using a grid overlay and randomly chosen cells to survey during 2013 nesting season. I predict the model will identify optimal areas of terrapin nesting habitat in coastal South Carolina. This model may be a helpful tool for conservation managers because it can identify critical habitat features likely to be associated with terrapin nesting that may warrant further protection.

0459 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Eric Hilton¹, Casey Dillman¹, Tao Zhang², Longzhen Zhang², Ping Zhuang²

¹Virginia Institution of Marine Science, College of William & Mary, Gloucester Point, VA, USA, ²East China Sea Fishery Research Institute, Chinese Academy of Fishery Science, Shanghai, China

Skeletal anatomy of the head of the Chinese sturgeon, *Acipenser sinensis*

The Chinese sturgeon, *Acipenser sinensis*, inhabits the Yangtze River and near-shore environments of coastal China. This is a relatively large species, with a maximum size of over three meters in length. As for most sturgeons, its skeletal morphology is poorly known. As a first step to close these data gaps, five specimens (354-670 mm SL) of *A. sinensis* were dissected and prepared as dry skeletons. All dermal bones are highly ornamented on their exposed surfaces. Central ridges are variably developed on the first dorsal scute, median extrascapular, parietals, posttemporals, dermopterotic, dermosphenotic, and jugal; the two largest specimens examined lacked ridges. In two specimens the branching of the occipital, supratemporal, and lateral line sensory canals occurs in the lateral extrascapular, as in *Pseudosaphirhynchus* spp. and *A. stellatus*. The parietals and frontals are separated by a median fontanel. Unlike most sturgeons, there is no distinct ventral supraorbital process and the dermosphenotic and postorbital are variably fused. *A. sinensis* is unique among sturgeons in having a single large triangular dorsal rostral bone. Up to two lateral rostral bones were found on each side anterior to the horizontal arm of the jugal. There was found to be one or two ventral rostral bones. The palatopterygoid has distinct anterolateral and anteromedial arms, the anteromedial of which is particularly broad in *A. sinensis* relative to other acipenserids. The palatal complex appears to be relatively narrow compared to that of other acipenserids. We make preliminary comparisons to other species of sturgeons.

0456 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Eric Hilton, Nalani Schnell, Peter Konstantinidis

Virginia Institution of Marine Science, College of William & Mary, Gloucester Point, VA, USA

Morphology of Fishes: Life at the Intersection of Staunch Tradition and Cutting-Edge Approaches

Morphology has a long and rich history, leading to the perception of it being an elderly field - one that is to be politely revered but often is cast aside. The anatomical study of fishes has been at the center of inquiry and advancement from the very beginning of this history. Reflected in this history is the adaptability and power of morphological

approaches. Morphology has seen its successes not only by providing the hierarchical systematic framework for understanding the evolution of fishes, but also providing unique insights into structural, functional, and behavioral aspects of phenotypes. We will present examples of our morphological studies demonstrating the varying avenues that morphology can lead the course of study. From work on a wide range of taxonomic groups, including sturgeons, gars, bonytongues, basal neoteleosts, and percomorph fishes such as eelpouts and pufferfishes, we will present examples of the application and results of traditional morphological methods (descriptive osteology), as well as recently developed approaches for investigating anatomy (antibody staining of muscles and micro-CT scanning and soft-tissue reconstruction of larvae). Even so-called traditional approaches resulting in descriptive, paleontological, and ontogenetic studies have undergone recent developments, allowing new discoveries, interpretations, and advancements in understanding the evolutionary biology of fishes. The fundamental conclusions we offer are that the questions worthy of morphological exploration are limitless, the techniques of study, analysis, and dissemination of these data are undergoing a modern revolution and synthesis, and that morphology is a vibrant growing field, still firmly in its youth.

0089 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Christopher Hoagstrom¹, Visotheary Ung², Kathie Taylor³

¹Weber State University, Department of Zoology, Ogden, Utah, USA, ²UPMC, Université Pierre et Marie Curie, Centre de Recherche sur la Paléobiodiversité et les Paléoenvironnements, Paris, France, ³Argenta Ecological Consultants LLC, Salt Lake City, Utah, USA

Tertiary Origins of Fish Endemism in North American Highlands: Parallel Evolution, Taxon Cycles, and Human Intrusions

North American highlands provide a valuable theater for studying biogeography. Although eastern-interior and southwestern highlands are often studied separately, some fish clades range from the northeastern Appalachians to the southwestern Mesa Central. Recent phylogenies for six such clades (*Campostoma*, *Cyprinella*, *Moxostoma lachneri* group, *Micropterus*, *Etheostoma* subgenera *Microperca-Oligocephalus*, *Percina* subgenus *Pileoma*) provide an opportunity for continental-scale, comparative analysis. We identified 22 highland areas that harbor endemics, used three-item analysis to discover area relations, and used up-to-date geological evidence to interpret them. Major divisions among areas correspond to Late Miocene river drainages. Minor divisions relate Miocene-age highlands to proximate areas of more recent origin, consistent with molecular estimates of cladogenesis. Middle Miocene events facilitated colonization of uplands draining to the Atlantic and Gulf of Mexico coasts. Uplift and denudation of highlands with cores of rock created rock-dominated (sediment starved) streams in emergent areas. These were colonized by upland fishes. Widespread, disjunct adaptation to rocky-highland habitats created parallel speciation. Aridity and

alluviation isolated rock-adapted endemics in the Late Miocene-Pliocene, whereas fishes of alluvial uplands dispersed. Later, Pleistocene drainage rearrangement encouraged dispersal while climate change intensified highland erosion. This rescued and expanded persisting rocky habitats and created new highlands from alluvial deposits on the Gulf Coastal Plain. A new round of parallel speciation followed, but Miocene endemics persisted where refugia allowed. The cycle continues as some modern upland taxa have dispersed across alluvial uplands and deglaciated regions, but humans now mediate this process by altering dispersal corridors, translocating taxa, and modifying habitats.

0703 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Alyssa Hoekstra, Vince Cobb

Middle Tennessee State University, Murfreesboro, TN, USA

Effect of Habitat Fragmentation on the Body Temperatures of Timber Rattlesnakes

Fragmented habitats commonly are implicated as a negative environmental feature of many snake ecology studies. An ambush predator, such as the timber rattlesnake, is not only limited to the types of habitat it can use for foraging but must also be able to select appropriate thermal environments. Therefore, we predicted that timber rattlesnakes would exhibit daily body temperature patterns with characteristics of a thermoconformer. Additionally, fragmented habitats would likely make such behavior more difficult. In a rural and habitat-fragmented setting, we examined the effect of habitat edges on thermal habitat availability. Using radio telemetry and miniature data loggers we monitored the hourly body temperatures of free-ranging timber rattlesnakes during their active season. We also used operative snake models to monitor the thermal characteristics of different habitats as well as the effect of habitat edges. We show that timber rattlesnakes are selective in choosing macrohabitats because of limitations in the thermal environment due to abundant open canopy habitats. Also, we show that snakes must be selective in their microhabitat use because their daily body temperature patterns indicate a level of thermoconformity. We discuss how habitat choices influence both daily and seasonal body temperature patterns.

0337 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

Kendra Hoekzema, Erin Peterson, Brian Sidlauskas

Oregon State University, Corvallis, OR, USA

Morphometrics, meristics, microsatellites and molecular phylogenetics clarify divergence and taxonomic status of Speckled Daces (*Rhinichthys osculus*) throughout Oregon's Great Basin

The Speckled Dace (*Rhinichthys osculus*) is one of the most ubiquitous fishes in the American West and occurs in all major Oregon drainages, including those of the Great Basin. Prompted by the presence of a putative undescribed and threatened subspecies inhabiting a tiny isolated water body within Oregon's Warner Varney (Foskett Spring), we investigated the distinctiveness and diagnosability of Speckled Daces throughout Oregon's Great Basin. Very deep phylogenetic divisions cross this region and suggest the presence of at least three major clades. While morphologically distinctive and possessed of a unique microsatellite signature, Foskett Spring daces are intermixed with Warner and Lake Abert daces phylogenetically and are clearly conspecific. Conversely, phylogenetics, microsatellites and morphology easily separate daces from Stinking Lake Spring from all other examined daces, including those from the Malheur drainage that surrounds the spring. Stinking Lake Speckled Daces appear to meet all criteria necessary for recognition as full species under phylogenetic, evolutionary or morphological criteria. Our results illustrate that the present concept of *Rhinichthys osculus* merits revision, and that phylogeographic studies of North American freshwater fishes continue to hold major relevance to systematics and conservation biology.

0325 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Hillary Hoffman, Daniel J. Leavitt

Arizona Game and Fish Department, Phoenix, AZ, USA

Sonoran Desert Tortoise (*Gopherus morafkai*) Activity Patterns In and Around Desert Washes and Potential Effects of Off-Road Traffic on Tortoise Movement on the Barry M. Goldwater Range East

The Barry M. Goldwater Range East is located within a large expanse of Sonoran Desert that includes deeply incised desert washes. Sonoran desert tortoise (*Gopherus morafkai*) habitat selection within the Sonoran Desert is highly correlated with proximity to these washes. As well as providing movement corridors, desert washes also offer nest sites and refugia from predators and extreme temperatures. Washes also serve as transportation corridors for human foot and vehicle traffic. In order to understand

movement patterns and habitat use in desert washes, we tracked a total of 17 desert tortoises via VHF and GPS transmitters. Tortoise movement patterns and shelter site use in washes were compared to habitat use in surrounding areas. These results will help to inform recommendations for site selection of further military activity on the Range in order to reduce the effects of this activity on tortoise populations.

0043 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Nancy I. Holcroft

Johnson County Community College, Overland Park, KS, USA

The Posttemporal–supracleithrum Articulation: An Untapped Resource for Morphology-based Phylogenetic Investigations of Euteleosts

The euteleost pectoral girdle comprises both chondral and dermal elements. The chondral elements, located more ventrally within the girdle, include the scapula, coracoid, proximal and distal radials, and fin rays. The posttemporal, supracleithrum, cleithrum, and one or more postcleithra make up the dermal portion of the pectoral girdle. The pectoral girdle as a whole has been largely ignored as a source of morphological characters for systematic investigations of euteleosts. A survey of the articulation between two of the dermal elements, the posttemporal and supracleithrum, across 240 species in 40 orders and 166 families of euteleosts suggests that pectoral elements have the potential to yield a wealth of phylogenetic information. This articulation varies in the basic nature of the articulation (e.g., laminar, condylar, point-to-point, etc.), the number of distinct articulation points, and the relative location and orientation of these articulation points. Several examples of posttemporal-supracleithral articulation patterns representing possible synapomorphies for various euteleost clades will be presented.

**0197 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Matthew Holden

University of Arkansas, Fayetteville, AR, USA

The Synergistic Effects of Multiple Stressors on Amphibian Larvae

Amphibian population declines have occurred worldwide over the past few decades, with several potential causes being implicated. Several studies have examined the effects of individual stressors on amphibian populations; however, few studies have determined the interactive effects of multiple stressors on amphibian populations. The

current study investigated the individual and combined effects of a major environmental contaminant (Glyphosate, commercial Roundup®), increased temperatures, and predatory cues on *Anaxyrus americanus* tadpole survival, growth, and development. Results showed that glyphosate reduced survival, growth, and development in *A. americanus*. The observed interaction between glyphosate and temperature indicated that increased temperature reduced survival at glyphosate concentrations higher than 5.0 mg/L; however, results also showed that higher temperatures increased growth and development in *A. americanus*. Accelerated growth and development may ameliorate the adverse effects of glyphosate by reducing the larval period and exposure time to toxins, increasing size at metamorphosis, and providing survivors with a competitive advantage. Increased temperatures also caused significant anatomical shape variation in *A. americanus*, which may lead to further developmental and behavioral abnormalities. Predatory cues had no effect on *A. americanus* survival, and only decreased growth and development at intermediate glyphosate concentrations and temperatures. The observed interaction suggested that the effects of temperature and glyphosate concentration may have been enhanced by the presence of predatory cues. The study highlighted the importance of examining the interactions between multiple stressors on amphibian populations, and further studies will be needed to better comprehend the synergistic effects of multiple stressors on global amphibian declines.

0412 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Lisa Hollensead¹, R. Dean Grubbs¹, John Carlson², Dana Bethea²

¹Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA, ²NOAA National Marine Fisheries, Panama City, FL, USA

Analysis of small scale and daily movement patterns of juvenile *Pristis pectinata* within a nursery habitat

Habitat use studies can be used to both investigate ecological and behavioral patterns of animals and serve as useful management tools for conservation planners. However, specific habitats essential to survival can be difficult to determine for highly mobile marine animals, especially when these species are rare. While critical habitat has been very broadly delineated for the endangered smalltooth sawfish (*Pristis pectinata*), essential fish habitat within the nursery has not been fully described. Telemetry methods were used to determine daily activity spaces and Rates of Movement (ROM) of juvenile *P. pectinata* in a nursery in southwest Florida. Seven animals ranging in size from 85 - 175 cm fork length were tagged in 2011. Activity spaces were quite small and ranged from 0.07 - 0.17 km² using 95% Minimum Convex Polygons (MCP), 0.01 - 0.16 km² based on 50% Kernel Density Estimates (KDE), and 0.08 - 0.68 km² based on 95% (KDE). Average ROM ranged from 2.4 to 6.1 meters/min. Activity space and ROM reflected the morphology of the bay in which the animal was tracked such that fish in small bays had

small activity spaces and ROM. Activity space decreased and ROM increased at night indicating possible foraging behavior at night. A home range (0.17 km²) was calculated for one animal. Daily asymptotes in space used were reached for all other tracks suggesting daily activity spaces were determined despite relatively short tracking durations. Comparisons of tracked animal locations and 100 random locations suggested there was selection for proximity to mangrove shoreline.

0650 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Phillip Hollingsworth Jr.¹, Andrew Simons², James Fordyce¹, Darrin Hulse¹

¹University of Tennessee, Knoxville, TN, USA, ²University of Minnesota, St. Paul, MN, USA

Explosive diversification following a benthic to pelagic shift in freshwater fishes

Evolution along a benthic to pelagic axis is ubiquitous in freshwater fishes inhabiting depauperate, lentic environments. To test the importance of this bottom to mid-water habitat axis in a more diverse, lotic radiation, we constructed phylogenies for eastern North America's most species-rich freshwater fish clade, the open posterior myodome (OPM) cyprinids. We then used ancestral state reconstruction to identify the earliest benthic to pelagic transition in this group and generated fossil-calibrated estimates of when this shift occurred. This transition could have represented evolution into a novel adaptive zone, and therefore, we tested for a period of accelerated lineage accumulation after this historical habitat shift. Our results strongly suggest that a burst of diversification followed the earliest benthic to pelagic transition during the radiation of OPM cyprinids in eastern North America. As such, the benthic/pelagic habitat axis has likely influenced the generation of biodiversity within ecologically disparate freshwater ecosystems.

0472 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Daniel Holt, Carol Johnston

Auburn University, Auburn, AL, USA

Soundscapes of *Cyprinella venusta*: Describing the Natural and Unnatural in Small Freshwater Streams

The ability to communicate effectively is a critical aspect for any sexually reproducing organism, and requires not only the ability to produce and detect signals, but also an

environment which supports the detection of those signals. Although acoustic signals are a common mode of communication for both marine and freshwater fishes, and have been described for a large number of species in both environments, little attention has been paid to the potential effect of anthropogenic noise in small, freshwater systems. Elevated noise levels can be a potential barrier to acoustic communication by decreasing signal-to-noise ratios or masking signals altogether. One potential noise source that is relatively common to small streams is a bridge crossing. Despite their occurrence in virtually every drainage, no literature currently exists describing the propagation of such noise in streams, or the impact it may have on fish populations. The aim of this study is to characterize the noise, and propagation of noise produced by trucks and trains passing over small streams in eastern Alabama. We also investigate the relationship between vocalizations of the Blacktail shiner (*Cyprinella venusta*), the natural ambient soundscape of its environment, and the impact bridge crossings may have on the ability of *C. venusta* to communicate in these systems.

0722 SSAR Effects of Energy Development on Herps Symposium, Galisteo/Aztec, Saturday 13 July 2013

Jessica Homyack¹, Zachary Aardweg², Thomas Gorman³, David Chalcraft²

¹Weyerhaeuser Company, Vanceboro, NC, USA, ²East Carolina University, Greenville, NC, USA, ³Virginia Tech, Blacksburg, VA, USA

Effects of Woody Biomass Harvesting and Intercropping Switchgrass in Pine Plantations on Herpetofauna

Managed forests may provide several types of biofuels feedstocks, including woody debris and perennial grasses, which could help meet government mandates for electricity and liquid transportation fuels produced from renewable sources. However, information on potential effects on wildlife populations from forest-based biofuels is limited, and effects on amphibian and reptile populations have received even less attention. Therefore, we compared effects of a woody biomass harvest, intercropping switchgrass (*Panicum virgatum*) between rows of recently established crop trees, and combinations of treatments to traditional pine management on herpetofauna in intensively managed loblolly pine (*Pinus taeda*) forest in North Carolina. We predicted that changes in habitat characteristics associated with production of biofuels feedstocks would reduce herpetofauna diversity and relative abundance. Across our randomized and replicated field experiment, we used drift fence arrays during April-July, 1 and 2 years after treatment establishment and had 425 captures of 15 species of amphibians and reptiles. In contrast to our prediction, harvesting woody debris and intercropping switchgrass did not have detectable effects on abundance of common species of herpetofauna or diversity for 2 years after treatment establishment. Captures of southern toads (*Anaxyrus terrestris*), however, were lower in treatment plots with only switchgrass compared to pine plantations intercropped with switchgrass, and Simpsons index of diversity was greater in switchgrass plots compared to pine plantations in year

2. Our results indicate that the potential biofuels production regimes we examined are unlikely to have negative short-term effects on herpetofauna when compared to traditional intensive pine production.

0724 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Jason Hoverman¹, Pieter Johnson²

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On the making of a superspreader: Experimental assessment of the factors driving parasite aggregation and infection heterogeneity

Parasite aggregation is one of the more pervasive patterns in disease ecology, yet surprisingly few studies have experimentally explored its underlying drivers. Here, we combined large-scale field assessments of parasite distributions within amphibian host populations with a novel experimental approach to assess the relative influence of host size, behavior, and immunity on parasite aggregation. Among 227 field sites and 2,468 examined hosts, infections were strongly aggregated within host populations. In experimental trials, hosts with reduced immunity and especially those with impaired behavior exhibited increased infection, leading directly to greater parasite aggregation. The effects of immunity were significant only in the absence of behavioral manipulations, and changing the size distribution of hosts did not appreciably affect aggregation. Integrating field and laboratory data, we found that only treatments involving behavioral reductions achieved aggregation values within the range expected for natural host populations. Thus, despite the short-term nature of these manipulations and the lack of additional effects associated with multiple exposure events, acquired immunity, and spatiotemporal variation in infection risk, our experimental treatments recreated field patterns of parasite aggregation, emphasizing the importance of host behavior in affecting parasite exposure and aggregation. Continued integration of infection heterogeneity research across space, among host species, and over time (transmission) has important implications for understanding and managing infectious diseases of humans and wildlife.

**0563 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Christopher Howey¹, Willem Roosenburg¹, Matthew Dickinson²

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Snake on Fire: Habitat Use, Energy Expenditures, and Body Condition of Black Racers in Burned and Unburned Landscapes

Understanding how a reptile is affected by a disturbance, such as prescribed fire, sometimes requires biologists to go beyond abundance data and determine how interactions with the changed landscape can affect the animal, its use of the landscape, and its overall well-being. It was the objective of this project to understand how prescribed fire alters the landscape and how these alterations affected the Black Racer (*Coluber constrictor*). Racers were radio-tracked throughout the 2012 field season in burned and unburned landscapes. In both landscapes, Racers preferred areas with more forbs, grasses, and less canopy cover, leaf litter, and overstory trees; characteristics made more available by prescribed burning. Racers in burned areas moved shorter distances (54.0 ± 15.4 m/d) than Racers in unburned areas (62.5 ± 13.1 m/d). However, Racers in burned areas were found to be more active (41% of locations) compared to Racers in unburned areas (34%); suggesting that although they moved shorter distances, Racers in burned sites moved more often. Additionally, racers maintained higher field metabolic rates in burned areas ($1,832.67 \pm 857.92$ ml CO₂/day vs. $1,086.74 \pm 351.14$ ml CO₂/day) and were found to be in lower body condition, which may be due to the greater amount of energy expended on movements and other daily activities.

**0569 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER
AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013**

Christopher Howey¹, Willem Roosenburg¹, Matthew Dickinson²

¹Ohio University, Athens, OH, USA, ²US Forest Service, Delaware, OH, USA

The Effects of Prescribed Burning on the Landscape and Reptile Abundance

Prescribed burning has become a popular management tool throughout North America; a tool that creates a landscape representing an earlier successional forest. However, little is known regarding how reptile abundances may respond to these landscape changes. Over the past three years, we measured structural and thermal characteristics in addition to the abundance of reptiles in four burned and four unburned plots at Land-Between-The-Lakes NRA, Kentucky. We compared reptile abundances and habitat characteristics within plots between years and among plots within years using nonmetric multidimensional scaling and ADONIS. We determined that habitat

characteristics differed between burned and unburned sites for all comparisons ($P = 0.001$). Reptile abundances also differed between treatments (burn vs. unburned; $P = 0.029$) and between years within the burn treatment ($P = 0.010$), but not between years in the unburned landscapes. As abundance of leaf litter and percent canopy increased, abundance of *Agkistrodon contortrix*, *Thamnophis sirtalis*, *Pantherophis spiloides*, and *Scincella lateralis* increased. Additionally, as percent canopy and vegetation density decreased and percent grass, bare ground, and ground temperatures increased, abundance of *Diadophis punctatus*, *Storeria dekayi*, and *Sceloporus undulatus* increased. These changes also correlate to preferred body temperatures for reptiles measured in the lab and in other studies. We suggest that reptiles may not necessarily respond to the actual disturbance, but to the changes in habitat characteristics within the landscape. If specific habitat characteristics can be maintained in disturbed landscapes, then species that prefer those characteristics may be maintained as well.

0759 AES Behavior, San Miguel, Sunday 14 July 2013

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Horizontal and Vertical Movements of a Satellite-tagged Longfin Mako (*Isurus paucus* Guitart Manday, 1966) in the Northwestern Atlantic Ocean

The longfin mako (*Isurus paucus*) is a poorly known oceanic shark captured in pelagic longline fisheries throughout its cosmopolitan distribution. With fins of moderate quality and meat of low market value, bycatch of this species may be under-reported due to finning and discard at sea and misidentification as shortfin makos. For the first time for this species, a pop-up archival satellite tag (PSAT) was successfully deployed to document the longfin mako's horizontal and vertical movements and habitat. A mature male (237 cm TL) was captured by pelagic longline in the northeastern Gulf of Mexico (GOM) and fitted with a 90-day PSAT. The shark's Most Probable Track showed movements from the GOM to the Straits of Florida along the northwest coast of Cuba, through the Bahamas, and into the open Atlantic Ocean east of the Chesapeake Bay, an estimated total distance of 6,192 km requiring an average rate of horizontal movement of 69 km day⁻¹. The shark demonstrated a diel pattern of vertical movement characterized by greater time in the mesopelagic zone during the day and a shift into epipelagic waters during the night. Depth and temperature ranges during the track were 6-952 m and 4.6-28.8° C, respectively. Extended periods in cold water were observed with 19.5% of the time spent in temperatures ≤12° C. On the northwestern coast of Cuba, the longfin mako is the second most abundant shark caught in nearshore pelagic fisheries. Our satellite tag data demonstrate the interconnectedness of U.S., Cuban and Bahamian waters for this species.

0461 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Ryan Hunt, Mark Jordan

Indiana University Purdue University Fort Wayne, Indiana, USA

***Ambystoma* Species and the *A. jeffersonianum*-hybrid Complex: A Comparison of Abundance in Established and Restored Wetland Habitats**

Ephemeral wetlands in the United States are under threat from human encroachment. Amphibians that use these habitats, including *Ambystoma* salamanders, are forced to inhabit areas of decreasing size and quality. The goal of this research is to provide insight into how different *Ambystoma* species respond to disturbed habitat. We trapped and recorded *Ambystoma* species and hybrids that occur in two neighboring properties that are divided by a railroad track: Fox Island, a county park with a relatively wide area of forested wetlands expected to be suitable to *Ambystoma* and Eagle Marsh, a private land preserve that also has forested wetlands but primarily consists of emergent wetlands that were reestablished following decades of agriculture. Tissue samples were collected from all individuals and microsatellite loci were used to confirm the hybrid status of individuals identified as *A. jeffersonianum* complex in the field. We compared the abundance of each species/hybrid in the range in the available habitats and assessed their likelihood for navigating the railroad barrier. The genetic analysis confirmed hybrid identifications in all cases and the hybrids were predominately a combination of *A. laterale*, *A. texanum*, and *A. jeffersonianum* (LTJ). Initial results of habitat association show strict aversion to emergent breeding pools in *A. texanum* while others, *A. tigrinum* and *A. LTJ*, showed lower numbers within such habitats but an ability to make use of them. Our preliminary analysis suggests greater plasticity in habitat use found in *A. tigrinum* and *A. LTJ* while *A. texanum* demonstrates high fidelity to forested wetlands.

0211 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

Joseph Iafrate¹, Stephanie Watwood¹, Eric Reyier², Steven Crocker¹, Matt Gilchrest¹

¹Naval Undersea Warfare Center, Newport, RI, USA, ²Kennedy Space Center Ecological Program, Kennedy Space Center, FL, USA

Behavioral Response of Select Reef Fishes to Pile Driving

The potential effects of pile-driving on fish populations and fisheries have received significant attention with the prevalence of construction at in-shore areas throughout the world. In this study, the movement and survival of free-ranging reef fish in Port Canaveral, Florida, in response to in-situ pile driving for 35 days at an existing wharf was examined through the use of acoustic telemetry. Twenty-seven sheepshead

(*Archosargus probatocephalus*) and 13 mangrove snapper (*Lutjanus griseus*) were captured at two locations and monitored for approximately 11 months. Underwater acoustic receivers were deployed within Port Canaveral to complement an existing array of compatible receivers spanning 300 kilometers along the east coast of Florida. Baseline residency and diel patterns of movement were compared for fish in two adjacent locations with and without disturbance before, during, and after the event. There was a significant decline in residency index for mangrove snapper at the construction wharf during pile-driving compared to before the event. Long-term survivorship was demonstrated, with 16 of 25 fish tagged at the construction wharf detected three months post-tagging, and 11 fish detected six months post-tagging. Although there was no apparent impact on patterns of distribution for these two tagged species, alterations on behavior of individual fish were noted, including displacement.

0466 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Johanna Imhoff, Dean Grubbs

Florida State University, Tallahassee, FL, USA

Mercury Contamination in Sandbar Shark Muscle: A Thirty Year Comparison

The presence of mercury, particularly methylmercury, is of concern in aquatic systems because it is a neurotoxin that damages the central nervous and endocrine systems in humans and wildlife, including fishes. Mercury can biomagnify in species occupying high trophic levels and cause severe neurological and reproductive problems, including birth defects, in animals that consume these taxa. There is interest in understanding patterns of mercury contamination of fishes on decadal time scales. Most studies focused on freshwater fishes and a few focused on marine teleost fishes. However, there have been no studies investigating changes in mercury contamination of any shark species over multiple decades. Sandbar shark (*Carcharhinus plumbeus*) muscle tissue and embryos were collected from nearshore Hawaiian waters in the early 2000s to compare with published data from samples collected in the early 1970s, presenting a unique opportunity to investigate changes in mercury contamination over a thirty year period. Data on litter sizes and rates of stillborn shark pups were also collected. Average litter sizes in the early 2000s were similar to average litter sizes in the early 1970s (5.5 and 5.68, respectively), but rates of observed stillbirth increased from 2.2% of litters and 0.04% of embryos in the 1970s to 26.1% of litters and 5.3% of embryos in the 2000s. Quantification of mercury in tissues of stillborn shark pups and their mothers may provide insight as to why the rate of stillborn sandbar sharks in the early 2000s was higher than that in the early 1970s.

0551 NIA BEST STUDENT PAPER, NIA Oral Papers, Doña Ana/Cimarron,
Monday 15 July 2013

Spencer Ingley, Jerald Johnson

Brigham Young University, Provo, Utah, USA

**Predator Driven Divergence Along the Speciation Continuum in
Brachyrhaphis Fishes: Insights from Behavior, Genes, and Morphology**

Natural selection often results in profound differences among populations from divergent selective environments. Predation is a well-studied driver of divergence, with predators having a strong effect on the evolution of prey body shape and behavior, especially for traits related to predator escape. Comparative studies, both at the population level and between species, show that the presence or absence of predators can alter these phenotypic traits. Although this pattern is well documented in various species or population pairs, few studies have tested for similar patterns of morphological and behavioral evolution at multiple stages of divergence within a taxonomic group. Here, we examine divergence in morphology and behavior associated with predation environment in the livebearing fish genus *Brachyrhaphis*, both between populations of *B. rhabdophora* from different predation environments and between *B. roseni* and *B. terrabensis* (sister species) from predator and predator free habitats, respectively. We found that in each lineage, body shape differed between predation environments, consistent with the hypothesis that locomotor function is optimized for either steady swimming (predator free) or escape behavior (predator). We found compelling evidence that personality traits diverge in populations or species from different predation environments such that populations that experience predation are more bold, active, and prone to explore than those that do not experience predation. We discuss the implications of the observed predator driven divergence on speciation within this group. Our findings are important because they provide evidence that the same source of selection can drive similar phenotypic divergence independently at multiple divergence levels.

0560 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Frances Irish, Lauren Molchan, Victoria Womer, Kyle Goodbred, Amarnath Kandallu

Moravian College, Bethlehem, PA, USA

Snout and Jaw Mobility in Sand Boas: Balancing Conflicting Functional Demands

In snakes, the snout and upper jaws are movably attached to the braincase. The snout is tied to the upper jaws by soft tissues and passively tracks their movements. A mobile snout is an integral part of the unilateral snake feeding mechanism, but sand boas use their snouts for burrowing as well as feeding. Published skull descriptions suggest that snout mobility is constrained for digging. How do sand boas balance the conflicting demands of feeding and burrowing? To describe feeding kinematics in these snakes, we used digital video at 60 fps and 500 fps to quantify snout and upper jaw movements during prey capture and transport in three species of erycines, *Eryx colubrinus*, *E. johnii*, and *E. conicus*. Our preliminary data suggest that, contrary to our expectations, the snout and upper jaws do not closely track each other in these snakes. In both prey capture and transport, at the end of jaw opening, when the snout is maximally elevated (10° - 20°), the maxilla is depressed as much as 25° -i.e., snout and upper jaws move in opposite directions. Analysis of variance found significant differences between species in snout elevation during prey transport, but not in maxillary depression or snout twisting (rotation around a longitudinal axis). Snout elevation in erycines is comparable to meager published records for non-burrowing snakes, but snout twisting is not. Our data suggest that in *Eryx*, the snout and upper jaws show surprising independence of movement and the snout may be more mobile than previously thought.

0626 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Danielle Iulucci, Joel Snodgrass

Towson University, Towson, Maryland, USA

Amphibian Productivity in a Restored Wetland Landscape in Maryland, USA

Wetlands provide habitat, food, and nursery areas for wildlife and have been drained historically to convert saturated soils into farmland. Restoration projects are frequently undertaken to restore the ecological functioning of destroyed or degraded wetland landscapes, but examinations of post restoration function are limited. In 2003, The Nature Conservancy restored a 75-ha parcel of farmland within a 255-ha preserve in Caroline County, Maryland. The preserve currently supports more than 40 wetlands

that differ in physical features and hydrology, thereby having the potential to support a diverse assemblage of amphibian species. We operated drift fence arrays and pitfall traps around 13 of the wetlands to estimate the relative production of amphibian metamorphosis and evaluate the degree to which the landscape of restored wetlands supported a diversity of amphibian life histories. Data collected in 2012 were analyzed using an information theoretic approach where 76 candidate models were generated *a priori* and evaluated. The top model for total metamorph abundance, richness, and individual species included hydroperiod, wetland landscape (natural or restored), Julian date as a second order polynomial, and precipitation, and explained substantial amounts of variation (59% to 86%). Although natural wetlands produced more metamorphs of some species, some species were only produced successfully from restored wetlands and the restored wetlands produced metamorphs of a greater number of species. Our preliminary results suggest the restoration project has been successful from the standpoint of pond-breeding amphibian production.

0294 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Grant Izzo, Joel Snodgrass

Towson University, Towson, MD, USA

Investigating the Potential of Adaptations in Stream Salamanders to Road Salt in Urban Watersheds: The Role of Storm-Water Management Practices

In recent years, the application of road salt as a deicing agent has increased extensively and the impact it has on stream salamanders has yet to be investigated. Modern stormwater management practices are designed to mitigate the impacts of pollutants associated with roads on stream systems and therefore, should affect the delivery of ions associated with road salts to aquatic systems. We used bioassays and field-deployed data loggers to investigate potential road salt toxicity to two widespread species in the eastern United States, the Northern Dusky Salamander (*Desmognathus fuscus*) and Northern Two-Lined Salamander (*Eurycea bislineata*), in streams draining watersheds with and without modern stormwater management practices (primarily stormwater management ponds). Streams draining stormwater ponds force chloride ions into the groundwater, yielding elevated conductivity levels throughout the year. Unmanaged streams did not have increased conductivity peaks during the winter. Stream salamanders were relatively tolerant of road salts, not exhibiting any lethal effects until conductivity levels exceeded 14 mS/cm and conductivity peaks in all streams did not exceed these levels during the winter of 2011-2012. Our results suggest road salts are not having acute lethal effects on salamanders in the streams we studied. However, chronic and indirect effects require further study.

0199 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Zeehan Jaafar, Loke Ming Chou

National University of Singapore, Singapore, Singapore

Systematic Revision of Catch-All Gobiid Genus *Acentrogobius* Bleeker 1874

The family Gobiidae, with approximately 2000 species, is one of the largest marine fish families. The highest diversity occurs in the near shore habitats within the Indo-Pacific especially in the mangroves and coral reefs. Members of this family are typically small and cryptic, and have evolved through osteological modifications and reductions. Much progress was achieved in stabilizing the taxonomy and resolving relationships within the gobies over the past three decades. Yet, many taxa remain undiagnosed. The genus *Acentrogobius* Bleeker 1874, is one such example. This genus is commonly encountered primarily as a result of it serving as a catch-all group for small, brown and non-descript near-shore goby species. A systematic revision of this genus was carried out, and sixty nominal species were considered in the study. Results from morphological examination suggested that *Acentrogobius* Bleeker 1874 sensu lato comprised of at least three genera. Revised genera were tested for monophyly using three mitochondrial genes. Phylogenetic trees were reconstructed using Maximum Parsimony and Bayesian Inference analyses. Two of the three genera were shown to be monophyletic under both analyses.

0623 Herp Systematics, San Miguel, Friday 12 July 2013

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¹*Villanova University, Villanova, PA, USA*, ²*University of California, Berkeley, Berkeley, CA, USA*

Implications of the New Caledonian Diplodactylid Gecko Radiation for Coalescent and Concatenated Analyses

The radiation of Diplodactylid geckos on New Caledonia offers an ideal opportunity to compare coalescent and concatenated methods of phylogenetic reconstruction. Using a multilocus dataset (5,235 base pairs) with both mitochondrial (ND2+5tRNAs) and nuclear loci (KIF24, KIAA1549, RAG1, MXRA5, and PDC) we infer an early burst of speciation with short, poorly supported branches deep the tree, about 15 million years ago. This early burst of speciation produced most of the variation in body size and adaptive differences observed today. The results of concatenated and coalescent approaches differ primarily in the topology of these short, poorly-supported branches. Species relationships in the genus *Diergecko* show conflicting differences between mitochondrial and nuclear gene tree topologies. The remaining species relationships are

largely consistent between the two approaches. Monophyly of the genus *Bavayia* is either poorly-supported or absent in all of the individual gene trees, but is well-supported in both concatenated and coalescent analyses. To test the degree to which disagreement between gene trees for *Bavayia* monophyly is due to lineage sorting, we simulated data on a single topology and subsampled the resulting simulated DNA sequences. The results of these simulations suggest that disagreement between gene trees with respect to the monophyly of *Bavayia* are largely due to a lack of data rather than incomplete lineage sorting producing conflicting gene trees.

0587 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Laura Jackson, Mary White

Southeastern Louisiana University, Hammond, LA, USA

Primordial Germ Cell Development: An Evolutionary Approach to Genes and Morphology

Primordial Germ Cell (PGC) determination is one of the most important feats of vertebrate embryonic development because it allows the continuation of life among future generations. In vertebrates, at least two different mechanisms exist that allow species to develop cells that later form the eggs and sperm. In the predetermined mechanism of PGC development, cells are specified by maternal determinants that are located within the germ plasm. In the induced mechanism, cells must be induced by external regulating factors that initiate germ cell development. Preliminary evidence suggests that different groups of fish may use different mechanisms of PGC development.

Currently *oct-4*, a germ-cell specific gene, has been identified only in animals with the induced mechanism of PGC development. Therefore, using phylogenetic analysis of the gene family, we can hypothesize whether a species will have the induced or predetermined mechanism based on presence or absence of the *oct-4* homolog. The data will also be used to test whether there is a correlation between body patterns, specifically fin position, and mechanism of germ cell determination.

0285 AES Reproduction, Mesilla, Sunday 14 July 2013

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Reproductive biology of a central California skate assemblage

Skates are subject to targeted and incidental fishing pressures worldwide, but most species have limited life history data available to help elucidate their population status. Additionally, skate landings are at best unreliable since they are rarely sorted to individual species, thus prohibiting accurate estimation of species-specific fisheries impacts. To remedy the lack of available data for eastern North Pacific skates we have systematically researched the life histories of 18 skate populations in this region. Here we report on the reproductive biology of four common central California rajid species: *Beringraja binoculata*, *Raja inornata*, *R. rhina*, and *R. stellulata*. Specimens were collected from 2002 to 2005 during trawl and longline surveys conducted in Monterey Bay by NOAA Fisheries. Total length (TL) at 50% maturity for females was estimated at 126.6 cm, 57.8 cm, 93.1 cm, and 63.1 cm for *B. binoculata*, *R. inornata*, *R. rhina*, and *R. stellulata*. Total length at 50% maturity for males was estimated at 100.5 cm, 50.1 cm, 83.0 cm, and 60.3 cm respectively. Females attained 50% maturity at 75% to 86% of the maximum TL, while males attained 50% maturity at 72% to 79% of the maximum TL. None of the species exhibited sex, size, or maturity segregation by depth. The maturity estimates and depth distribution of these species provides important insight into population dynamics of the central California skate assemblage.

0072 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Fernando C. Jerep, Richard Vari

Division of Fishes, Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

Revisionary study of the African genera *Nannocharax* Günther, 1867 and *Hemigrammocharax* Pellegrin, 1923 (Teleostei: Characiformes: Distichodontidae)

The genera *Nannocharax* and *Hemigrammocharax* are small sized distichodontids distributed in the Nile River and the streams and rivers of sub-Saharan Africa with the genera traditionally distinguished by the extent of poring of the lateral line (incomplete in *Hemigrammocharax* versus complete in *Nannocharax*). *Nannocharax* and *Hemigrammocharax* form a natural lineage in the Distichodontidae; however, the monophyly of each genus has been questioned and requires reassessment. Preliminary

results of an analysis of the species-level diversity in this lineage show it to be notably greater than the 28 species of *Nannocharax* and eleven species of *Hemigrammocharax* now considered valid. Hidden diversity has been identified in two species complexes in *Nannocharax* centered on *N. fasciatus* and *N. taenia*, with this particularly pronounced in headwaters of the main tributaries of the Congo River. Additionally, a new species, apparently related to *Hemigrammocharax ocellicauda* and *Nannocharax maculicauda*, has been identified in Congo basin. The Atlantic coastal drainages of Cameroon include two new species in addition to *N. reidi* and *N. rubrolabiatus* and a new form of *Nannocharax* sympatric with *N. parvus* occurs in coastal rivers from Gabon and Republic of the Congo. Within *Hemigrammocharax* a complex of species composed by *H. machadoi*, *H. minutus*, *H. monardi*, *H. multifasciatus* and *H. wittei* with vertically barred coloration was found to be distributed in headwaters of the southern portions of the Congo River basin and the Okavango and Zambezi River basins.

0178 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Gustavo Jiménez-Velázquez

Universidad Autónoma de Querétaro, Querétaro, Mexico

Diversity and Composition of Wetland Herpetofauna in Agricultural and Urban Landscape in the Neovolcanic Belt

Distribution patterns of herpetofauna in wetland systems in agricultural and urban landscapes and the identification environmental factors that influence the ecology of these organisms is vital to developing conservation strategies. This paper describes the richness, abundance and diversity of amphibians and reptiles in agricultural and urban landscape of the southern portion of the state of Querétaro and surrounding regions. The influence of wetland area on ecological attributes of communities was compared for three size categories: small, <10 ha; medium, 10-37 ha; and large, > 37 ha. We investigated the local and regional environmental factors influencing alpha diversity and describe the beta diversity at different spatial levels. We registered 1014 individuals belonging to 24 species, 7 amphibians and 17 reptiles. Twelve of these have some level of protection and 14 are endemic to Mexico. Richness patterns were similar for amphibians and reptiles, in small wetlands can often hold more species than larger wetlands. Higher abundances were observed for reptiles in large wetlands and for amphibians in small wetlands. Medium and large wetlands were more similar in composition than when compared to small wetlands. Beta diversity contributed approximately 80% of gamma diversity with greatest beta diversity occurring in between wetlands sites and in lesser degree between transect and wetlands categories. This work shows that small water bodies are of vital importance to the conservation of amphibians and reptiles in these landscapes, and programs to promote high quality wetland systems should also promote the presence of local and landscape level native vegetation.

**0580 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Denim Jochimsen

University of Idaho, Moscow, ID, USA

**The Impacts of Oil and Gas Development on Herpetofauna, with Particular
Attention to Reptiles in Wyoming**

As the US seeks to reduce its dependence on overseas sources of fossil fuels, the search for new reserves and domestic production has greatly increased. The activities associated with the expansion and consequent establishment of energy production sites have adverse effects on wildlife. There are a number of factors, such as limited dispersal capability and dependence on specific habitats that vary seasonally and are often patchily distributed that make amphibian and reptile species particularly vulnerable to these effects. Here, I present a general overview of how activities associated with oil and gas development, including the construction of attendant infrastructure (e.g. roads and power lines), impact species of herpetofauna and discuss ways that these impacts could be lessened or avoided using Wyoming as a case study. In addition to direct mortality from vehicles or construction at energy sites, habitat conversion and fragmentation resultant from infrastructure and site development serve to reduce population connectivity across the landscape, which may negatively impact persistence. As a particular example, the state of Wyoming possesses rich mineral reserves and its economy is consequently driven by extraction and production. Many of the reptile species that are considered to be of greatest conservation need according to the Wyoming Department of Game and Fish occur in sagebrush (*Artemisia* spp.) steppe, an ecoregion that is under a great deal of pressure for oil and gas development and expansion. Yet, the state has been proactive in providing recommendations to developers that may serve to reduce impacts on reptile communities.

0698 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

G. David Johnson

NMNH, Smithsonian Institution, Washington, DC, USA

Morphology and Evolutionary History of Teleosts: Progress and Prospects

Until the mid-1960's, teleost classification consisted mainly of strings of orders and suborders with little hierarchical structure. Since 1966 progress has been remarkable. Out of chaos emerged hypotheses of relationships among major teleost groups and considerable phylogenetic infrastructure. Although cladistics played a seminal role in this progress, the new structure is underpinned by morphological data, mostly from the

skeleton. On the cusp of the cladistics revolution, another seminal innovation transformed fish osteology - bone- and cartilage-staining. The skeleton offers a seemingly inexhaustible source of characters that continue to elucidate the complex evolutionary history of the Teleostei. The last several decades have been the heyday for fish morphology, with more scientists studying more taxa than ever before. Nonetheless, their early ontogeny has received short shrift. Most comparative anatomical and phylogenetic investigations fail to include the rich source of information that larvae provide. With the rising dominance of molecular systematics, morphology is often viewed as old-fashioned, much of the important work having been completed. This is absurd, for there are really no engaging questions to ask without a deep understanding of morphology, and without ontogeny that deep understanding is often unreachable. Comparative morphology is founded in exploration and discovery. Our challenge for the future is to instill in the next generation the same respect and passion for morphology-based systematics that has brought us to this point, along with an appreciation that the descriptive work is the most important and lasting thing we do as systematists; without it the rest is meaningless.

0422 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Jarrett Johnson¹, Maureen Ryan³, Ben Johnson⁵, Steven Micheletti⁴, Brad Shaffer²

¹Western Kentucky University, Bowling Green, KY, USA, ²UCLA, Los Angeles, CA, USA, ³University of Washington, Seattle, WA, USA, ⁴Washington State University, Pullman, WA, USA, ⁵Cornell University, Ithaca, NY, USA

The Effect of Mesocosm Hydroperiod on the Fitness of F2 Hybrid Tiger Salamanders

In California, barred tiger salamander (*Ambystoma tigrinum mavortium*) introductions have led to hybridization with California tiger salamanders (*A. californiense*) and the formation of a hybrid swarm that comprises a large proportion of the California tiger salamander's range. Admixed populations have benefitted from the conversion of vernal pools with short hydroperiods to deeper, permanent ponds that allow some hybrid individuals to exploit a paedomorphic life history strategy. Paedomorphosis is a distinctly non-native strategy for tiger salamanders in California. Therefore, hydroperiod manipulation has been implicated as a potential management tool to maximize the fitness of native salamanders relative to hybrids. We examined how variation in hydroperiod affects the fitness of F2 hybrid individuals whose genomes span the range of genomic admixture patterns potentially available in nature. Using cattle tank mesocosms and a variable hydroperiod regime, we reared F2 hybrids to metamorphosis and compared fitness among hydroperiod treatments. Our results provide further evidence for the importance of both genetic and environmental determinants of the dynamics of secondary contact.

0054 Fish Conservation I, Doña Ana/Cimarron, Thursday 11 July 2013

Carol Johnston¹, Alexis Janosik²

¹Auburn University, Auburn, AL, USA, ²University of West Florida, Pensacola, FL, USA

Where have all the Slackwater Darters Gone? Using environmental DNA for detection of rare aquatic species

Environmental DNA (eDNA) in aquatic systems is material left in the water by species that can be detected with genetic markers. These species-specific markers can be used for detection of aquatic organisms, even when traditional sampling fails to detect them. This technique is particularly useful for the detection of rare species, especially when their presence is temporally or spatially variable. A positive detection using the eDNA technique may highlight areas for more concentrated sampling, or for habitat protection. We chose Slackwater Darter as a model for the development of this technique for imperiled species in the Southeastern United States. This species is notoriously difficult to find during the non-breeding season, and can be missed at breeding sites if the timing of sampling is off. Furthermore, this species is in serious distributional decline, and abundance is also declining. Detection is critical for on-going conservation measures. Our work sampling both breeding and non-breeding habitat indicates a far higher detection rate using eDNA than traditional sampling for this species. These results suggest that, for species with low detection, the eDNA technique is a very effective sampling tool.

0201 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Gerald Johnston¹, Eric Suarez², Joseph Mitchell³

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Geographic Variation in Population Structure of the Suwannee Cooter (*Pseudemys concinna suwanniensis*) in a Blackwater River in Northern Florida

We conducted a mark-recapture study of Suwannee Cooters (*Pseudemys concinna suwanniensis*) during 2006-2012 in the Santa Fe River in north-central Florida. This unique system is a blackwater stream with habitats that vary substantially along its reach and among the springs that feed into its lower reaches. Our study emphasizes geographic variation in population structure. We hand-captured 1,103 individuals while snorkeling in two riverine habitats (5 km reach of blackwater stream, 9 km reach of spring-influenced river) and three adjoining spring habitats (Hornsby Spring, Poe

Spring, Gilchrist Blue Springs). Our total sample consisted of 31.1% juveniles (<180 mm plastron length [PL]), 10.2% subadult females (180-299 mm PL), 24.9% adult females (>300 mm PL), and 33.8% adult males (>180 mm PL), suggesting current population stability throughout the system. Relative abundance of size/sex classes varied substantially among sites with only rare exchange of individuals. Juveniles comprised a significantly higher proportion of samples in spring habitats (39%) than in the two riverine habitats (20%). Two of the three springs appear to function as nurseries. Geographic variation in turtle population structure in this river results from variation in habitat structure and quality among river and spring sites. Sampling all habitats in a diverse riverine system over many years is required to understand the complex structure and dynamics of its turtle populations.

0047 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

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¹Coronado National Forest, Tucson, Arizona, USA, ²Eastern Arizona College, Thatcher, Arizona, USA, ³Coronado National Forest, Safford, Arizona, USA

Inter-year Variation in Lizard Assemblage Dynamics at an Ecotone in Southeastern Arizona

Our study site in southeastern Arizona (Marijilda) has the highest diversity of lizards reported for such a small area in the United States of America (ca. 20 species along the 2.6 mile dirt road and adjacent paved road), although it is probably similar to some other areas in southeastern Arizona and adjacent New Mexico. In 2003, the senior author conducted an inventory of lizards in the Marijilda area. Seven years later, Sinervo et al. (2010) demonstrated that lizards as a group were sensitive to climate change, as evidenced by local extinctions at various study sites. They also predicted large-scale declines in diversity at a global scale. As a result, monitoring was reinitiated in 2010 and is ongoing. Here we present early results of inter-year variation in the lizard community to determine if observed trends are consistent with modeled climate change patterns or other factors. Visits from June 2010 through the present were conducted weekly during active periods (March through November) and monthly during winter. In summer 2003 and June 2010 through December 2012, a total of 6,612 lizards, representing 16 species, were detected during 101 visits. The most abundant species were *Urosaurus ornatus* (47% of detections), *Uta stansburiana* (18%), *Sceloporus magister* complex (13%), and *Aspidoscelis tigris* (7%). Lizards were not randomly distributed. Annual reproductive success was largely dependent on precipitation patterns. Intra-year variation was high, but no extirpations or apparent species additions were detected.

0439 Fish Genetics I, Ruidoso/Pecos, Friday 12 July 2013

Mark A. Jordan, Deepal Patel, Kathryn E. Sanders, Robert B. Gillespie

Indiana University - Purdue University, Fort Wayne, IN, USA

Contemporary Land Use and Post-Glacial Range Expansion Contribute to Genetic Variation in Creek Chub (*Semotilus atromaculatus*) Populations in an Agriculturally Dominated Watershed

Conversion of land for agriculture has led to the channelization of headwater streams and reduced water quality. Resident fish populations are expected to be challenged under such conditions and may experience declines that lead to a loss of neutral genetic variation. However, species-specific responses to recent ecological changes in stream condition and/or range expansion following glacial retreat can also influence the pattern of genetic variation found within and among contemporary populations. To evaluate the relative roles of contemporary and ancient scenarios that are hypothesized to affect the genetics of populations in streams we studied the creek chub (*Semotilus atromaculatus*), a common species that is tolerant of stream degradation. We screened eight microsatellite loci on 308 individuals originating from ditches and streams surrounded by agricultural and forested land cover within the St. Joseph River catchment in northeastern Indiana and southern Michigan, USA. We found weak population structure associated with land cover and, in contrast to expectation, higher allelic richness in agricultural streams. Using Bayesian coalescent modeling, the strongest pattern found within the dataset was evidence of a population decline throughout the watershed that most likely preceded stream channelization and land conversion. The results illustrate the complexity of using neutral genetic variation of populations to assay stream quality. Tolerant species may have increased gene flow in channelized streams that leads to an increase in genetic variation. Meanwhile, post-glacial landscape change and subsequent colonization of nascent freshwater streams appears to shape genetic variation regardless of contemporary land use.

0309 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

J. Eric Juterbock

Ohio State University, Lima, OH, USA

Location, Location, Location: Sites of Salamander Activity Are Significantly Related to the Loss of Water From Model Plethodontids

Southern Appalachian plethodontid salamanders regularly climb onto vegetation, although the proportion of those active on vegetation on any particular night varies considerably. Since salamanders cannot control it, cutaneous evaporative water loss

should increase with evaporative potential (VPD) of the environment. Thus, the proportion of active salamanders climbing may relate to VPD levels. Since observations indicate that this is partly true, perhaps climbing does not significantly increase risks due to water loss - i.e., the location of activity does not affect their water balance. I tested this hypothesis using plaster models of plethodontids in several microhabitats at three locations. At two sites, Great Smoky Mountains N.P., TN, and Nantahala N.F., NC, salamanders climb frequently. A Logan Co., OH, site, where climbing is rare, was included for comparative purposes. Latex molds of five preserved plethodontids, covering the size range of *Plethodon glutinosus* group salamanders, were used to cast models. Models were soaked in water, weighed, placed overnight in microhabitats typically used by plethodontids, and reweighed to obtain raw water loss data. Weight-specific rates of loss (g/hr/g) and percent of body mass lost (both based upon molded specimen weights) comprised the data, which were compared using Wilcoxon Rank Sum procedures. For each variable, all 23 tests (4 to 6 replications per model size) supported ($p < 0.009$) the hypothesis that salamanders 1 m up on tree trunks lose more water than those down on the litter. I conclude that salamander activity above ground level produces significantly elevated costs due to increased water loss.

0050 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Ingrid Kaatz¹, Donald Stewart¹, Phillip Lobel²

¹SUNY-ESF, Syracuse, NY, USA, ²Boston University, Boston, MA, USA

Catfish stridulation: testing hypotheses of sound function among species in the genus *Corydoras*

Corydoras catfishes stridulate with their pectoral spines. Sounds are a series of broadband frequency pulses that are longer in duration in courtship than agonism or disturbance. Sound production is rare outside the nonbreeding season linking the significance of these sounds to social and mate interactions. Startle sounds are rare in both reproductive and nonreproductive seasons and similar to courtship sounds. Three hypotheses were tested with new data analysis to determine the nature of these sounds: 1) noise hypothesis: incidental by-product of male fin displays during female courtship or movements; 2) physiological priming hypothesis: female stimulation or mating synchronization during spawning; or 3) communication hypothesis: species recognition, females assessing male quality or social signals. Courtship sound pulse number correlated with duration: A) *C. paleatus* $n = 56$, $r = 0.9148$, $F(1,54) = 277.1$, $p < 0.000$; B) *C. leopardus* $n = 56$, $r = 0.8983$, $F(1,54) = 225.7$, $p < 0.000$; and C) *C. aeneus* $n = 103$, $r = 0.8187$, $F(1,101) = 205.3$, $p < 0.000$. Startle sound pulse number correlated with duration ($n = 31$, $r = 0.8169$, $F(1, 29) = 22.5$, $p < 0.00005$) for a pooled group of species (*C. aeneus*, $n = 14$; *C. leopardus*, $n = 9$; *C. sychri*, $n = 3$; *C. reticulatus*, $n = 4$; *C. paleatus*, $n = 1$). Startle sounds were spectrographically similar across species suggesting that they may function as general alarm signals to conspecifics or congeners; *Corydoras* species may form mixed

species aggregations. These results support the communication hypothesis by the presence of temporally patterned sounds in specific behavioral contexts.

0774 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

David Kacev¹, John Hyde², Andrew Bohonak¹, Rebecca Lewison¹

¹San Diego State University, San Diego, CA, USA, ²Southwest Fisheries Science Center, La Jolla, CA, USA

Using genetics to better understand management of a data-poor, highly migratory predator

Short fin mako sharks (*Isurus oxyrinchus*) are highly migratory predators that are caught in recreational, commercial, and artisanal fisheries. Tagging studies in the Southern California Bight (SCB) suggest that makos can easily cross the US/Mexico border, leaving them susceptible to fisheries in both countries. A better understanding of the population structure of mako sharks in the SCB is necessary to design appropriate binational management for the species. To address this issue we use 13 microsatellite markers to determine if there are barriers to gene flow within the bight. We use population simulations with parameter estimates based on empirical data to determine what levels of migration and population size can lead to our observed values for F_{st} and its analogues. We also use the molecular data to determine whether mako sharks in the region have a strict two or three year breeding cycle. To do this, we estimated the year of birth for each individual using length-based aging and year of capture and split the data set into birth year classes. We then tested for genetic variation between/among birth year classes.

0462 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Samantha Kahl¹, Scott Henke², David Britton³, Gad Perry¹

¹Texas Tech University, Lubbock, TX, USA, ²Texas A&M University - Kingsville, Kingsville, TX, USA, ³United States Fish & Wildlife Service, Arlington, TX, USA

Risk assessment model for brown treesnake introduction into the continental United States

Current and planned military expansion on the island of Guam increases the potential for the spread of brown treesnakes (*Boiga irregularis*) to other areas. Prevention is the preferred method for combating introductions of invasive species. Here we use risk assessment modeling as a tool for preventing the introduction of brown treesnakes into the continental United States. We used Program Maxent to model climatically suitable

areas for brown treesnake introduction into the continental United States. We then used ArcGIS to identify suitable areas that also receive the most shipments from the island of Guam, thus bringing together both risk of dispersal and risk of establishment. We identified Texas, Georgia, Florida, and several East Coast states as high-risk areas with respect to invasion of brown treesnakes. Shipments from Guam to these states should be considered high priority for inspection.

0059 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

Kristine Kaiser, Julia Devito, Caitlin G. Jones, Adam Marentes, Rachel Perez, Lisa Umeh, Regina M. Weickum, Wendy Saltzman

University of California, Riverside, Riverside, CA, USA

Effects of Anthropogenic Noise on Endocrine, Immune, and Reproductive Measures in White's Treefrog

Anthropogenic habitat change is a leading cause of amphibian population declines worldwide. One major impact of habitat loss and fragmentation is construction of roads and increase of traffic in formerly undisturbed areas. Previously, we have shown that anthropogenic noise (e.g., traffic noise) affects call rate in several frog species and has detrimental effects on both individual chorus tenure and on nightly species chorus duration. However, the physiological consequences of noise exposure remain unknown. Noise is a stressor for many taxa, and chronic stress can suppress immune and reproductive function. Therefore, we tested the hypothesis that frogs chronically exposed to traffic noise would have higher plasma concentrations of corticosterone (CORT), the main stress-related hormone in amphibians, and that such elevations would lead to decreases in splenocyte and thymocyte counts and in sperm count and sperm viability. We exposed male White's treefrogs (*Litoria caerulea*) to either traffic noise and chorus noise or only chorus noise (n = 10 per treatment) for 8 nights, after which we collected organs. Plasma was collected 5 days prior to the start of the experiment and at the end of the study for CORT assay. CORT levels increased significantly in frogs exposed to traffic noise but not in controls. We found no differences in thymic or splenic cell counts, but both sperm count and sperm viability were significantly decreased in frogs exposed to traffic noise. This is the first demonstration that anthropogenic noise negatively affects amphibian physiology and may thus be an overlooked mechanism of amphibian declines.

0657 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Kristine Kaiser¹, John P. Pollinger², Erin Toffelmier²

¹University of California, Riverside, Riverside, CA, USA, ²University of California, Los Angeles, Los Angeles, CA, USA

Comparison of PCR-based methods for the detection of the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*)

The presence and abundance of the amphibian pathogen *Batrachochytrium dendrobatidis* (*Bd*) are commonly assayed with polymerase chain reaction (PCR) or quantitative PCR (qPCR). Because PCR is performed on DNA extracts from skin swabs collected in the field, these assays are problematic in two ways. First, while the primers commonly used in PCR detection have been validated for specificity to the pathogenic *Bd* against non-pathogenic chytrids, they have not been validated for non-specific amplification of microbial or other organismal DNA inherent in environmental samples such as skin swabs. Without confirmatory DNA sequencing, false positives are possible. Second, qPCR for each sample are often run in triplicate, but equivocal results in which only one or two replicates show DNA amplification are common, and there is no consensus on how to treat these. We compared two methods of qPCR to assess the efficacy of each: the traditional TaqMan probe-based qPCR and a SYBR Green I-based qPCR with melt curve analysis, both followed by product size confirmation on an agarose gel and DNA sequencing. We assayed 572 skin swabs from at least 25 species of frogs with both methods. The probe and SYBR Green I-based methods performed similarly for strongly positive samples, but the SYBR Green I-based method coupled with DNA sequencing detected *Bd* in more samples overall. Although both methods yield equivocal results and false positives after the qPCR step, our results suggest that qPCR using SYBR green followed by DNA sequencing is a more reliable method for *Bd* detection.

0711 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Stephen Kajiura¹, Min Sig Hwang², Rachel Berquist³, Tricia Meredith⁴, Stephen Blackband², Lawrence Frank³

¹Florida Atlantic University, Boca Raton, FL, USA, ²University of Florida, Gainesville, FL, USA, ³University of California San Diego, La Jolla, CA, USA, ⁴University of Miami, Miami, FL, USA

Novel Olfactory System Neural Organization Revealed by Diffusion Tensor MRM

All life on earth exhibits some degree of chemical sensitivity. Within the vertebrate clade, the organization of the olfactory system is largely conserved, despite their

morphological diversity. Histological evidence suggests that the elasmobranch fishes (sharks, skates, rays) demonstrate a remarkably different olfactory bulb organization than other vertebrates, including the teleost fishes. However, conventional histology is laborious, destroys intact structure, results in disjointed samples which must be reconstituted to elucidate three dimensional organization, and thus is inherently prone to tissue damage and registration errors. Here we show that Diffusion Tensor Microscopy (DTM) can be applied to facilitate Fiber Tract Mapping (FTM) of complex peripheral and central neural pathways. Using this non-invasive 3D digital imaging methodology, we found that elasmobranchs possess a novel, somatotopic organization of fiber tracts within the olfactory bulb. Elasmobranch olfactory receptor neurons maintain their spatial integrity within the bulb by remaining within one to two lamella widths of their point of origin, producing a somatotopic bulbar organization. This contrasts with teleost fishes which possess a chemotopic organization whereby olfactory receptor neurons that share similar chemical sensitivity converge in glomeruli regardless of their point of origin within the olfactory epithelium. Our results illustrate the utility of DTM and FTM to efficiently inform us about intact neuronal structure by revealing a three dimensional bulbar organization that we believe may be fundamentally different from all other vertebrates.

**0409 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

Andrew Kathriner¹, Aaron Bauer¹, Todd Jackman¹, Hinrich Kaiser²

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***Hemidactylus* from Timor provide further evidence of anthropogenic dispersal of *H. brookii* (Squamata: Gekkonidae)**

Among the more than 120 described species of *Hemidactylus* eight have broad distributions that have been achieved, at least in part, through anthropogenic means. Of these, *H. brookii* has one of the widest distributions and perhaps most convoluted taxonomic history. Recent herpetofaunal investigations on Timor revealed *brookii*-like taxa in 4 of 13 districts investigated. The name *H. tenkatei* Lidth de Jeude 1895 has been applied to *brookii* group geckos from the nearby island of Roti, but the validity of this taxon has been called into question. We used both meristic and mensural characters as well as nuclear (RAG1) and mitochondrial (ND2) sequence data to examine relationships of the Timor geckos to other *H. brookii* complex taxa, including topotypical specimens of *H. brookii* from Borneo. Our results reveal that Timorese geckos are referable to *H. brookii sensu stricto*. Assuming that individuals of *H. brookii* occurring on Timor-Leste are conspecific with those on Roti, we regard *H. tenkatei* as a junior synonym of *H. brookii s.l.*, as are all previously investigated *brookii* group animals from Southeast Asia. A newly discovered introduced population of *H. brookii*-like geckos in

New Orleans, Louisiana is referable to *H. parvimaclatus* and represents the first occurrence of this Indian Ocean species in the Americas.

0600 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Ushio Kawai¹, Michio Hori², Juske Horita¹, Gad Perry¹, Akira Mori²

¹Texas Tech University, Lubbock, TX, USA, ²Kyoto University, Sakyo, Kyoto, Japan

Diet of *Hemidactylus frenatus* introduced in Ankarafantsika National Park, Madagascar

Hemidactylus frenatus is a small nocturnal gecko native to Southeast Asia, introduced to tropical and sub-tropical coastal areas worldwide via ships and cargos. They are well adapted to urban areas and often establish population in coastal cities. They are believed to outcompete and displace native gecko species in some localities. Madagascar is known to be one of the biodiversity hotspots for herpetofauna, containing over 400 species of reptiles and many of them are endemic. Populations of *H. frenatus* have been reported in Ankarafantsika National Park, Madagascar. They are confined to areas with human disturbance but their effect on native species has not been investigated. We examined the diet of *H. frenatus* from two localities in the Park using stomach contents and stable isotope analysis. Stomach contents were flushed out from the individuals and identified to the lowest taxon possible. Muscle tissues from tail tips were collected and $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ were analyzed. As expected, dietary analysis showed mainly invertebrates such as Orthoptera. However, stable isotope analysis revealed considerable divergence between localities less than 2 km apart, suggesting that this species opportunistically utilizes multiple carbon sources.

0408 SSAR PHYSIOLOGY & MORPHOLOGY BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Matthew G. Keevil¹, Ronald J. Brooks², Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada, ²University of Guelph, Guelph, Ontario, Canada

Assessing Bias in a Common Method for Estimating Asymptotic Size in Turtles and Evaluation of an Alternative Strategy

Asymptotic size is a parameter of von Bertalanffy, logistic, and several other models of body size growth in non-avian reptiles, amphibians, and other taxa. It is commonly estimated by selecting the mean size of the largest individuals in a population. This

method assumes that most of the variation in adult body size is due to growth post-maturity and age since maturity with the largest individuals being the oldest and most likely to have approached asymptotic size. However, there is evidence that much of the variation in size among adults within populations is due to differences in size at maturity. Therefore some portion of the population may have ceased growth at sizes smaller than those used to estimate asymptotic size. We use long-term individual growth data from populations of Snapping Turtles (*Chelydra serpentina*) and Painted Turtles (*Chrysemys picta*) in Algonquin Park, Ontario, to test whether using only the largest adults will bias estimates of asymptotic size. We will be reporting results of comparisons between the mean size of non-growing adults to the mean size of the largest 10% of individuals. We will also present and assess the suitability of an alternate strategy for estimating asymptotic size in populations where long-term individual growth histories are not available. Unbiased somatic growth models are important for understanding populations because these models inform estimates of vital rates such as age and size at maturity, transition rates between stages of differing reproductive value, and projections of future population growth and viability.

0067 SSAR Effects of Energy Development on Herps Symposium, Galisteo/Aztec, Saturday 13 July 2013

Douglas Keinath¹, Daniel Doak², Matthew Kauffman¹, Holly Copeland³, Amy Pocewicz³, Mark Andersen¹

¹University of Wyoming, Laramie, Wyoming, USA, ²University of Colorado, Boulder, Colorado, USA, ³The Nature Conservancy, Lander, Wyoming, USA

Quantifying exposure of wildlife to energy development in the face of rapidly expanding U.S. production

The global push for increased and diversified energy production is causing rapid, broad-scale habitat change that forces local managers, who are responsible for implementing most wildlife conservation, to react to site-specific impacts at the expense of careful long-term planning. In this setting, quantifying the extent and uncertainty of potential impacts to many species is particularly daunting and thus seldom accomplished. We develop a novel melding of geographically explicit projections of energy development and species' distribution models to better understand threats and thus prioritize species conservation efforts. Our analysis identified conservation concerns in our focal landscape not clearly identified by standard approaches, including identification of a suite of species that are at risk but may not be adequately addressed by current conservation strategies. In Wyoming, sixteen species were more exposed to development than Greater Sage-Grouse, which is known to be impacted by development, including several reptiles and amphibians (e.g., Great Plains Toad, Rocky Mountain Toad, Plains Spadefoot, Plains Gartersnake, Great Basin Spadefoot, and Plains Hog-nosed Snake). This research provides wildlife managers a planning tool needed to

respond to rapidly shifting and increasing development pressures over expansive spatial and temporal scales.

0011 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Ryan Kempster, Nathan Hart, Shaun Collin

University of Western Australia, WA, Australia

Survival of the Stillest: Predator Avoidance in Shark Embryos

Sharks use highly sensitive electroreceptors to detect the electric fields emitted by potential prey. However, it is not known whether prey animals are able to modulate their own bioelectrical signals to reduce predation risk. Here, we show that some shark (*Chiloscyllium punctatum*) embryos can detect predator-mimicking electric fields and respond by ceasing their respiratory gill movements. Despite being confined to the small space within the egg case, where they are vulnerable to predators, embryonic sharks are able to recognise dangerous stimuli and react with an innate avoidance response. Knowledge of such behaviours, may inform the development of effective shark repellents.

0697 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Christopher Kenaley, Brooke Flammang

Harvard University, Cambridge, MA, USA

Morphology as an integrative discipline: a functional focus on endless forms so beautiful

As a distinct discipline, functional morphology – the study of how form relates to a biological role in an organism – matured and continues to develop in parallel with comparative morphology. Because of this and limitations imposed by experimental design and conceptual bases of these disciplines, we as morphologists know little about how the structure of fishes influenced the evolution of the largest group of vertebrates. Despite producing vast amounts of data from morphological systems, comparative studies rarely explore functional roles of the morphologies under consideration, or if they do, they lack a test of performance, a key piece of evidence in understanding how morphology limits diversity. On the other hand, functional morphologists, those who produce and analyze performance data, typically design studies that focus on a small number of species and thus they typically have limited power in explaining the role of morphological systems in shaping the evolutionary trajectory of taxa. As functional

morphology becomes a more integrative discipline, drawing on methods from physical and engineering sciences, new approaches that include biorobotics, flow visualization, and computational modeling, permit relatively quick but detailed analyses of performance over a wide range of species. When integrated with data generated from detailed comparative and phylogenetic studies, these new approaches stand to make major contributions to our understanding of how morphology has constrained evolution in fishes. As examples of this, we present some of our recent work on the evolution of locomotor behavior in sharks and teleosts and feeding systems in deep-sea and percomorph fishes.

0667 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, Doña Ana/Cimarron, Thursday 11 July 2013

Alicia M. Kennedy¹, Patrick J. Lewis², Darryl J. deRuiter³

¹The University of Texas at Austin, Austin, Texas, USA, ²Sam Houston State University, Huntsville, Texas, USA, ³Texas A&M University, College Station, Texas, USA

The oldest fossil of *Cordylus* from continental Africa

Cordylus is represented by a charismatic clade of 21 extant armored lizards in Africa with an elusive fossil history. Although molecular analyses suggest the divergence of *Cordylus* from other Cordyliformes over 35 million years ago on continental Africa, no specimens of *Cordylus* are described from localities older than the Late Pleistocene in the published literature. Matjhabeng, a mid-Pliocene river deposit in South Africa, preserves the earliest record of *Cordylus* known and is described here for the first time. The Matjhabeng specimen is an isolated left maxilla and is identified as *Cordylus* based on several apomorphies. Cordyliform characters present include unequal extensions of the dorsal and ventral processes at posterior end of maxilla, only slight lacrimal and prefrontal emarginations, an apex of the facial process of the maxilla that is not posteriorly directed, a gentle slope down the posterior margin of the facial process, and an anterior overhang of the external naris. This specimen is distinguished from other Cordyliformes to the exclusion of *Cordylus* by an edge of the internal naris that is over half the total length of the maxilla and a diagnostic rectangular-shaped osteodermal impression that is parallel to the maxillary shelf. The description of this specimen makes this the oldest definitive record of *Cordylus* in the fossil record. These data further support the current historical biogeographical hypotheses of *Cordylus* originally based on molecular data, and promise to help elucidate the evolution of this enigmatic African clade.

**0256 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER
HERPETOLOGY AWARD**

Madeleine Kern¹, Jacquelyn Guzy¹, Jeffrey Lovich², J. Whitfield Gibbons³,
Michael Dorcas¹

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Carolina, USA

**Factors Causing Deviation from Optimal Egg Size Theory in the Diamondback
Terrapin (*Malaclemys terrapin*)**

When investing energy in reproduction, organisms face tradeoffs between what number and size of offspring will optimize fitness. Optimal egg size (OES) theory predicts that a relatively constant OES should be selected, while any increase in resources allocated to reproduction should increase clutch size. Variations on this theory predict that egg size should be optimized, but not necessarily constant across a population, as optimality is contingent on maternal phenotypes and recent environmental conditions. We examined the relationships among body size variables (pelvic aperture width, caudal gap height, and plastron length), maternal body condition, clutch size, and egg width of *Malaclemys terrapin* from separate populations at Kiawah Island and Edisto Island, SC. We found that terrapins do not fit traditional OES theory. Both populations exhibited greater variation in egg size among clutches than within (ANCOVA; Kiawah: $F = 26.845$, $df = 25$, $p < 0.001$; Edisto: $F = 12.14609$, $df = 20$, $p < 0.001$), suggesting an absence of optimization. We found that egg size appeared to be constrained in Kiawah terrapins but not in the Edisto population and that maternal body condition explained over half the variation in mean egg width in Kiawah terrapins ($F_{2,16} = 8.489$, $p < 0.001$, $R^2 = 0.514$) but not in terrapins from Edisto Island ($F_{2,19} = 2.694$, $p = 0.093$, $R^2 = 0.221$). This study demonstrates how factors not incorporated into traditional OES theory which result in deviation from the model's definition of optimization can contribute to a more complete understanding of optimizing reproductive output.

0542 AES Behavior, San Miguel, Sunday 14 July 2013

Steven Kessel¹, Nigel Hussey¹, Stephen Petersen², Jeff Higdon³, John Darwent⁴, Hans Lange⁵, Aaron Fisk¹

¹University of Windsor, Windsor, ON, Canada, ²Assiniboine Park Zoo, Winnipeg, MB, Canada, ³Higdon Wildlife Consulting, Winnipeg, MB, Canada, ⁴University of California Davis, Davis, CA, USA, ⁵Greenland National Museum and Archives, Nuuk, Greenland

Shallow water scavenging on marine mammals observed in a deep-water Arctic predator species, the Greenland shark (*Somniosus microcephalus*)

The Greenland shark is considered an important deep-water predator in the Arctic environment. Although the ecology of the species remains relatively unknown, diet data indicates feeding on a diverse prey base, with the presence of marine mammals commonly reported. The lethargic nature of this species evidenced by its extremely slow swimming speeds has raised questions on the mode by which they obtain large mammal prey, whether through predation events or by scavenging. The occurrence of both decaying and fresh seal/decapods remains have been observed in stomachs.

Despite their classification as a deep water shark species, anecdotal Inuit accounts of Greenland sharks entering shallow near-shore waters, in response to marine mammal hunts, are common place throughout the Arctic region. However, documented accounts of this scavenging behavior have previously been lacking. Following a first report by Beck and Mansfield (1969) on Greenland shark occurrence in shallow Arctic waters, we present three new sightings of Greenland sharks feeding on marine mammal carcasses in shallow waters in the Canadian Arctic (n = 2) and Greenland (n = 1). These data provide the first photographically documented behavior of the feeding of Greenland sharks on large mammal carcasses, a behavior only previously inferred from wounds.

In addition, preliminary long-line catch data are presented to link the presence of Greenland sharks with marine mammal movements/migrations. We suggest that Greenland sharks may actively track the movements of marine mammals and discuss the potential importance of this predator-prey interaction in current and historical contexts.

0098 Fish Biology, Doña Ana/Cimarron, Sunday 14 July 2013

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Sound Characteristics and Complex Sonic Apparatus Morphologies in Two Ophidiiformes: *Ophidion rochei* (Ophidiidae) and *Onuxodon fowleri* (Carapidae)

Ophidiiformes show complex and highly diverse sonic apparatus morphologies allowing them a great variety of calls. Some *Ophidion* (Ophidiidae) and all *Onuxodon* (Carapidae) species have in common, at the front of the swimbladder, a mineralized structure called rocker bone. According to morphological observations, it probably results from adaptive convergence. Its evolutionary advantage remains however to be determined. Sonic apparatus morphology and sound characteristics were examined in *Ophidion rochei* from Dûlce-Glàva (Croatia) and in *Onuxodon fowleri* from Makemo (French Polynesia). The rocker bone is only present in males in *O. rochei* but in both sexes in *O. fowleri*. *Onuxodon fowleri* and male *O. rochei* produce calls that often last more than 1 s. Calls are composed of 1 to 41 pulses lasting for 21 ± 10 ms in *O. fowleri* and 1 to 55 pulses lasting for 16 ± 13 ms in *O. rochei*. Mean pulse periods are also relatively long, ca. 95 ms and 125 ms, respectively. Females of *O. rochei* produce short (ca. 20 ms) hum-like sounds that are characterized by shorter pulses (mean duration: 0.7 ± 0.2 ms) and higher pulse rates (mean pulse period: 4 ± 1 ms). Differences in sound characteristics are likely due to the rocker bone that most probably evolved in response to mechanical constraints acting on the swimbladder in *O. fowleri* and male *O. rochei*. Its presence suggests a sustained sound production was crucial in their evolutionary success. However, the sexual dimorphism observed in *O. rochei* but not in *O. fowleri* suggests differences in way of life.

0552 AES Ecology, Mesilla, Thursday 11 July 2013

James Kilfoil¹, Brad Wetherbee², John Carlson³, Dewayne Fox¹

¹Delaware State University, Dover, DE, USA, ²University of Rhode Island, Kingstown, RI, USA, ³NMFS, SEFSC-Panama City Laboratory, Panama City Beach, FL, USA

Assessment of shore based angling on sand tiger behavior: Implications for recovery

In 1997 sand tigers, *Carcharias taurus*, were designated a Species of Concern by NOAA-NMFS due to life history characteristics and population declines. Despite protections, a

recreational fishery targeting sand tigers has recently developed in the mid-Atlantic. Working with volunteer anglers, 25 sand tigers (mean 200cm FL; range 146-248cm FL) were captured via rod-and-reel and fitted with external acoustic VEMCO Ltd tags during July and August of 2012. The majority (52%) of shore-caught sand tigers were hooked posterior to the jaw, a factor often associated with increased mortality. Utilizing passive acoustic receivers we were able to characterize the behavior of shore-caught sand tigers and compare their movements to longline captured individuals tagged in previous years (n=71). We documented one probable post-release mortality among the recreational landed sand tigers. While initial estimates of post-release survival appear high, we have not yet been able to assess possible long term consequences. Given sand tigers' low reproductive output and rebound potential, the magnitude and duration of the shore-based fishery may have deleterious effects on recovery. Furthermore, the majority of detections for both recreational caught sand tigers and those captured on longlines occurred in a centralized open ocean beach environment. This coupled with the relatively small center of activity for sharks in the study suggests that sand tigers occupy specific habitats within near shore coastal waters. If recovery efforts are to be successful managers must focus on ways to curb this emerging fishery, while also considering the potential long-term effects of coastal development on key habitats.

0694 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER ICHTHYOLOGY AWARD

Daemin Kim, Kevin Conway

Texas A&M University, College Station, Texas, USA

Phylogeography of the Longnose Dace, *Rhinichthys cataractae* (Cyprinidae), with an Emphasis on Populations in the Rio Grande Drainage

Rhinichthys cataractae, commonly referred to as the longnose dace, is a primary freshwater fish that inhabits steep-gradient headwater streams across much of North America. Interestingly, populations of *R. cataractae* in the Rio Grande drainage are highly disjunct from each other and from populations in other drainages. Gene tree and species tree reconstruction derived from mitochondrial and nuclear sequence data support the non-exclusivity of *R. cataractae* and suggest a close relationship between populations in the Rio Grande drainage and the Canadian River (Mississippi River drainage). Using a Bayesian approach, a divergence time estimate in the late Pleistocene was inferred between populations of *R. cataractae* in the Canadian River and the Rio Grande drainage, which is consistent with geological hypotheses pertaining to the area. Populations in the upper and lower Rio Grande proper are estimated to have also been separate during the late Pleistocene, suggesting that the saline and frequently dry conditions that currently characterize the stretch of the Rio Grande proper between El Paso and Presidio (Texas) may be acting as a natural barrier, restricting gene flow between populations in the upper Rio Grande (New Mexico) and lower Rio Grande (between Presidio and Lake Amistad, Texas).

0491 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Steven Kimble¹, O. E. Rhodes Jr², Rod Williams¹

¹Purdue University, West Lafayette, IN, USA, ²Savannah River Ecology Laboratory, Aiken, SC, USA

Landscape genetics in the forest-dwelling eastern box turtle *Terrapene c. carolina* across a landscape heavily fragmented by agriculture

Habitat loss and fragmentation are chief drivers of extinction worldwide, but the mechanisms by which they affect species are taxon-specific. Habitat corridors have been proposed as one method for mitigating fragmentation effects. However, such measures are likely better suited to habitat specialists than generalists. Landscape genetics is a powerful means of measuring the effectiveness of corridors, and the eastern box turtle *Terrapene c. carolina* provides an excellent model in which to investigate gene flow in a fragmented landscape. I sampled 396 eastern box turtles at 11 sites from riparian corridors across the Ohio River Valley watershed and conducted landscape genetic and least cost path analyses to identify putative dispersal routes through suitable habitats. The least cost distances were on average 2.23 times longer than geodesic distances, and yet there was no significant genetic isolation by distance (IBD) along the least cost distances. By contrast, there was significant IBD by geodesic distance. These results suggest that corridors with the lowest costs incurred in the least cost path analyses may indeed be more suitable for gene flow.

0493 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Steven Kimble¹, O.E. Rhodes Jr², Rod Williams¹

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Relatedness and other finescale genetic population processes in a declining forest-dwelling turtle *Terrapene c. carolina*

Genetic analyses are important tools in conservation because they can better reveal biological processes where observational data are misleading or in cryptic taxa. Testudines are among the most imperiled vertebrate taxa worldwide yet many of these natural history traits remain unknown. The box turtle *Terrapene c. carolina* is no exception, with gaps in our knowledge addressing traits such as juvenile dispersal and patterns of relatedness across the landscape. All long-term studies have found demographic population declines necessitating an urgent need to understand these

natural history traits. In this study we explore fine-scale population structuring, gene flow, dispersal, and relatedness at four sites across the range of the eastern box turtle. We predicted that populations are highly structured, closely related individuals would be spatially clumped, and individuals exhibiting transient behavior would be genetically distinct from sampled populations. All four sites had very low levels of population structuring; mean pairwise relatedness values were statistically zero, over 90% of dyads were unrelated, 5.3 –9.1% of dyads were half-siblings, and fewer than 1.0% were full siblings or parent-offspring pairs. Despite a mean pairwise geographic distance between full sibling pairs of greater than 12 km, they were significantly clumped on the landscape, whereas half siblings and parent-offspring pairs were distributed randomly across the site. We found that an individual with transient behavior was indeed assigned to another population. These findings suggest that this species may be much more vagile than current management practices recognize and may therefore require much larger blocks of habitat for persistence.

0352 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Abigail D. King¹, Michael J. Sredl¹, Holly Hicks¹, James C. Rorabaugh², Christina M. Akins¹, Katrina Smith¹, Catherine Crawford², Stephane Poulin³, Julio A. Lemos Espinal⁴

¹Arizona Game and Fish Department, Phoenix, AZ, USA, ²U.S. Fish and Wildlife Service, Tucson, AZ, USA, ³Arizona-Sonora Desert Museum, Tucson, AZ, USA, ⁴Facultad de Estudios Superiores Iztacala - UNAM, Tlalnepantla, Estado de Mexico, Mexico

Evolving Expectations: a Decade of Repatriating Tarahumara frogs (*Lithobates tarahumarae*) to Arizona, USA

The distribution of the Tarahumara frog (*Lithobates tarahumarae*) includes three mountain ranges in extreme southern AZ, USA and northern Sierra Madre Occidental and adjacent Sky Islands in Sonora, Chihuahua, and Sinaloa MX. Populations of *L. tarahumarae* in the USA declined during the mid to late-1970's; by 1983, the last wild frog was found dead in Big Casa Blanca Canyon (BCBC), Santa Cruz County, AZ. Although the species was well-represented in the Mexican portion of its range, a plan to repatriate *L. tarahumarae* to its historical AZ range was completed in 2004. This plan, which articulated our initial expectations, included primary conservation activities such as identifying and renovating suitable sites and collecting, rearing and releasing appropriate Mexican stock to those sites. Stock was collected from MX in 2000, reared at several facilities, including the Arizona-Sonora Desert Museum, and released to BCBC in 2004. Repatriated frogs prospered until late-2005 when a catastrophic wildfire exacerbated extreme flooding and sediment deposition in BCBC, severely reducing breeding habitat. A large die-off due to *Batrachochytrium dendrobatidis* (Bd) further impacted this population in 2007. Following these setbacks, conservation strategies have emphasized monitoring habitat recovery in BCBC, reconnaissance and renovation of

suitable sites in other parts of the AZ range, and procurement and release of additional Mexican stock that may be less susceptible to Bd. Limited habitat, disease, long-term drought, dispersal of a single, robust frog, and other logistical limitations have presented new challenges and shaped expectations for this 10-year conservation effort.

0610 SSAR EVOLUTION, SYSTEMATICS, AND GENETICS BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Aja King, Steven Poe

University of New Mexico, Albuquerque, New Mexico, USA

Colonization and Differentiation in the Honduran Bay Islands Populations of *Anolis allisoni*

Anolis allisoni Barbour occurs throughout Islas de Bahia off Honduras, and was originally described from Roatan, Bay Islands. This species also occurs throughout much of Cuba where it was previously considered conspecific with *A. porcatius* but was separated based mainly on ear morphology (elongate in *A. allisoni*, round in *A. porcatius*; Ruibal and Williams, 1961). Populations of *A. allisoni* inhabiting the Bay Islands are geographically isolated from populations inhabiting Cuba by approximately 1,100 km of open ocean. The geographic barriers between Bay Islands populations, and especially between these populations and Cuba, should perpetuate genotypic and phenotypic divergence. We use morphological and molecular analyses of fresh specimens and tissues from the type locality of *A. allisoni* to address the following questions in Bay islands *A. allisoni*: whether the invasion of *A. allisoni* to the Bay Islands was the result of single or multiple dispersal events from Cuba; whether populations of *A. allisoni* from the Bay Islands are morphologically and/or molecularly differentiated from Cuban populations; if so, whether this variation warrants species distinction.

0413 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Jacquelynne King¹, Thomas Helser², David Ebert³, Romney McPhie¹, Christopher Gburski², Craig Kastle²

¹Fisheries and Oceans Canada, Nanaimo, BC, Canada, ²Alaska Fisheries Science Center, Seattle, WA, USA, ³Pacific Shark Research Center, Moss Landing, CA, USA

Preliminary Results on the age validation of big skate (*Beringraja binoculata*) and longnose skate (*Raja rhina*) using bomb-derived radiocarbon

Directed fisheries for big skate (*Beringraja binoculata* [formerly *Raja binoculata*]) and longnose skate (*Raja rhina*) have re-emerged in the Gulf of Alaska. However, due to

their life history traits (i.e. low fecundity, long life span, slow growth, late age at maturity) these species may be at risk of severe population declines and overexploitation. Assessment advice for these species will require accurate age estimates in order to provide robust descriptions of age at maturity and, growth and mortality rates. The current methodology for age estimation for these species relies on thin sectioning of vertebrae for growth band counts. Age and growth curve estimates have been produced for big skate and longnose skate populations in the Gulf of Alaska, British Columbia and California. However these studies have not produced similar results for either species, highlighting the need for age validation. Archived large specimens of big skate and longnose skate collected in 1980 and 1981 had minimum age estimates old enough to suggest that radiocarbon (^{14}C) signals from bomb testing conducted in the late-1960s can be used to establish dates of growth band formation. We present preliminary results of the $\Delta^{14}\text{C}$ in these samples and compare them to reference $\Delta^{14}\text{C}$ marine teleost otolith chronologies that exist for the North Pacific. Validation and improved age determination methods will lead to the development of suitable criteria for growth band counts and inter-agency standardization in age estimates throughout the range of both species.

0674 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Bruce Kingsbury, Christopher Woodley

Indiana - Purdue University, Fort Wayne, IN, USA

Advances in Predicting Spring Emergence of the Eastern Box Turtle (*Terrapene carolina*)

We report on further clarification from our study of thermal factors stimulating Eastern Box Turtles to emerge from over-wintering. Understanding the timing of this initiation of the active season is important not only in terms of natural history, but also from a conservation perspective. We have found that turtles that have not emerged are less likely to be killed or injured by prescribed fire. Resource managers could thus potentially minimize impacts of this and other management tools if they could predict when turtles would be out. We monitored body (carapace) and soil (surface, 15 and 30 cm) temperatures with iButton dataloggers, and also incorporated air temperature from a local weather station. Emergence was observed to be bi-phasic, with an initial "surfacing" phase from deeper underground towards the soil surface stimulated by deeper (15 cm) soil temperatures rising above freezing. Complete "emergence" was initiated when surface ground temperatures rose to 9C and virtually complete by the time soils were 16C. Circannual cues were poor predictors of emergence, as was air temperature. We also explored the application of Growing Degree Days (GDDs) as a proxy for soil temperatures. Such an approach would allow land managers to predict emergence without access to an extensive collection of soil temperatures. We found excellent predictive power for both surfacing and emergence using GDDs. With

adjustment, the approach should have broad utility for a variety of other herpetofauna and help protect them as well.

**0590 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD GENERAL HERPETOLOGY**

Elaine Klein¹, Robert Fisher³, Tod Reeder²

¹University of Washington, Seattle, WA, USA, ²San Diego State University, San Diego, CA, USA, ³U.S. Geological Survey, San Diego, CA, USA

Biogeographic History and Phylogenetic Relationships of Skinks (*Emoia cyanura* Species Group) on South Pacific Islands

The geographic distribution of terrestrial fauna on oceanic islands has long intrigued biologists, and remains a salient topic in the field, especially for the understudied islands of the Pacific region. These landmasses are geologically young as well as geographically isolated from continental sources of biota, yet contain an incredible array of biological diversity, particularly for squamates, which represent the dominant terrestrial organisms in many island systems. A predominant hypothesis for how Pacific island organisms have obtained their extant distribution is that of a stepping stone model, in which flora and fauna originated from Papua New Guinea in the western Pacific and gradually dispersed eastward. Under this mainland-to-island colonization hypothesis, biodiversity results from *in-situ* diversification or multiple colonization events. This study utilizes a multi-locus DNA sequence dataset from lizards representing seven of the nine species within the *Emoia cyanura* species group (Family: Scincidae), to elucidate the group's evolutionary relationships and test the stepping stone hypothesis of dispersal, as well as estimate routes, timing, and possible mechanisms for dispersal. Using innovative coalescent and biogeographic methods in tangent with islands' geologic history, we present results from this study, including evidence for distinctive colonization pathways by closely related species. This work and concomitant findings expand our understanding of the biodiversity and ecology of endemic biota on Pacific islands, which stand to face drastic alterations in the wake of global climate change.

**0405 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Jaimie Klemish¹, Michael Lannoo²

¹Indiana State University, Terre Haute, IN, USA, ²Indiana University School of
Medicine–Terre Haute, Terre Haute, IN, USA

Amphibian Response to Oil Sands Reclamation and Restoration

Oil sands mining companies are required by the Canadian Environmental Protection and Enhancement Act to reclaim land disturbed by their operations. It is essential to measure the ecosystem integrity of these reclaimed landscapes to ensure that reclamation, by definition, has occurred. The complex life cycles of amphibians makes them useful as bioindicators of the successful reclamation of both aquatic and terrestrial ecosystems. Three species of amphibians (Wood Frog, *Lithobates sylvaticus*; Boreal Chorus Frog, *Pseudacris maculata*; Canadian Toad, *Anaxyrus hemiophrys*) are commonly found throughout the Athabasca oil sands region allowing for easy comparison between sites. Several studies have focused on Wood Frogs and amphibian species not native to the Athabasca oil sands region as bioindicators for reclaimed oil sand wetlands, and to study the biological effects of naphthenic acids, a major component of the toxicity of reclaimed oil sand wetlands. However, no studies have shown the effects of oil sands-affected wetlands on all three native amphibian species and interspecies interactions. By reviewing the current literature, we will explain known amphibian responses to wetlands reclaimed by oil sand companies, the gaps in our current knowledge, and how our research aims to address these areas.

0546 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

William Klingbeil, Mark McRae

University of Tampa, Tampa, Florida, USA

Shoaling by Eastern Mosquitofish (*Gambusia holbrooki*) In Response to the Sight of a Potential Predator.

The influence of a predator on the tendency of eastern mosquitofish (*Gambusia holbrooki*) to remain near a shoal of conspecifics was investigated. Female mosquitofish were collected from two sites: a habitat lacking in piscivorous fishes (“naïve” fish), and a habitat where piscivorous fishes were abundant (“experienced”). Our null hypothesis stated that when a potential predator was visible, there would be no difference between naïve and experienced *G. holbrooki* with respect to the amount of time spent either near a predator or near a conspecific shoal. Trials were conducted in a large aquarium consisting of three zones: a shoaling zone (five female *G. holbrooki* in a clear plastic

container), an empty middle zone, and a predator zone. Two assays were conducted (20 ten-minute trials each) for each population, one with a single *Lepomis punctatus* in a clear container in the predator zone, and another that lacked *L. punctatus*. The mean number of seconds spent in each zone by experienced vs. naïve focal fish during the two assays were compared by using unpaired two sample *t*-tests. Naïve and experienced *G. holbrooki* did not differ in the amount of time spent in each zone when *L. punctatus* was visible, suggesting that the visual stimulus of a predator alone may not represent enough of a threat to change behavior.

0300 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

James Knuckey, David Ebert

Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, California, USA

Phylogenetic Relationships of Eastern North Pacific Soft-Nosed Skates (Arhynchobatidae: *Bathyraja*)

The genus *Bathyraja* Ishihara is one of the most speciose genera of skates, with approximately 48 species recognized globally. In the eastern North Pacific Ocean, bathyrajid skates range from the eastern Bering Sea to at least northern Baja California, Mexico. Like other members of the group, they are placed by local fishery agencies into a generic category, e.g. "skates." Unresolved taxonomic issues abound within the genus, including the possible presence of cryptic species, species complexes, and taxonomic problems. Therefore, using the mitochondrial NADH dehydrogenase subunit 2 (NADH2) gene, we examined five of the species that occur within this region to analyze their phylogenetic relationships. These species include: *B. abyssicola*, *B. aleutica*, *B. kincaidii*, *B. microtrachys*, and *B. trachura*. Genetic differences were found among the bathyrajid species studied. Further data analysis, including the incorporation of morphological measurements and skeletal anatomy will provide further insight into the phylogeny of this skate genus. This information is useful for future studies exploring the diversity within *Bathyraja*, as well as providing important species identity information for fisheries management.

0082 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Gunther Koehler

Forschungsinstitut Senckenberg, Frankfurt, Germany, Germany

A Color Catalogue for Field Biologists

The accurate description of the coloration in life of organisms represents an important component of the work of any field biologist. The “Color Catalogue for Field Biologists” is a bilingual (English / Spanish) publication that helps to produce more objective and detailed descriptions that also have a greater chance of being reproducible. It contains 300 swatches arranged in order of similarity of the colors to enhance straightforward comparison of similar color swatches. Also, I have included definitions of descriptive terms and photographic examples of certain patterns frequently found in amphibians and reptiles. Finally, I offer some advice on how to prepare a color description in life with examples of such a description. For each of the 300 color swatches included in this catalogue, I provide an identifying color name and a color number.

0012 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Gunther Koehler, Johannes J. Koehler

Forschungsinstitut Senckenberg, Frankfurt, Germany, Germany

Divergent Evolution of Genital Morphology, Speciation, and Hybridization in Central American Anoles (Squamata, Dactyloidae)

Divergent evolution of hemipenial morphology between closely related forms seems to be a common phenomenon in mainland anoles with at least ten cases well documented today. In most of these cases, anoles that are almost indistinguishable in appearance, scalation and even dewlap color, differ quite drastically in the shape of their copulatory organs. The different hemipenial morphologies are geographically very distinct and stable within the respective population. They therefore do not represent a simple polymorphism, and many of the externally cryptic forms have been raised to species level, assuming they represent distinct, and reproductively largely isolated evolutionary units. I discuss possible evolutionary scenarios for these findings, based on different lines of evidence from our work on several species pairs from Central America. Molecular analysis suggests a very recent separation of these forms and – in some of the species with parapatric distribution – the occurrence of hybridization in the contact zone. Evidence from cross breeding experiments supports these assumptions. The results of an examination of female cloacal morphology indicate coevolution of male and female genital morphologies and thereby contradict functional neutrality of hemipenial morphology.

0073 AES GRUBER AWARD; AES Stingray Symposium, Mesilla, Friday 12 July 2013

Matthew Kolmann¹, Daniel Huber², Mason Dean³, Dean Grubbs⁴

¹University of Toronto, Toronto, Ontario, Canada, ²University of Tampa, Tampa, Florida, USA, ³Max Planck Institute, Berlin, Germany, ⁴Florida State University Coastal and Marine Laboratory, St. Teresa, Florida, USA

Ecomorphology of Durophagy in Myliobatiform Rays - Muscle Anatomy and Feeding Performance

The morphological and performance specializations demanded by a diet including hard, durable-shelled prey typically arise from more generalist ancestral bauplan. As a result, examinations of the routes by which durophagous characters arise - through phylogeny, ontogeny or phenotypic plasticity - can provide insight into how the specialized durophagous niche evolves and is maintained. We present data characterizing broad-scale differences in gross muscular anatomy between durophagous (myliobatid and rhinopterid) stingrays and their non-durophagous relatives, and then focus on the *Rhinoptera bonasus* species complex to examine the ecomorphological consequences of ontogenetic changes in feeding performance by relating modeled and measured bite forces to the fracture forces required to crush prey. We preliminarily extend our assumptions from the cownose ray model to other taxa, durophagous and piscivorous species alike, in order to explore feeding performance across disparate stingray morphologies, and discuss the importance of differences in muscle physiology across species, within species (i.e. phenotypic plasticity) and within individuals (e.g. comparing musculature from different body regions). Finally, we examine trends in feeding performance across durophagous chondrichthyans and discuss potential caveats against generalizing between batoid and shark systems.

0402 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Peter Konstantinidis¹, Lennart Olsson², Brian Metscher³, Eric Hilton³

¹The Virginia Institute of Marine Science, Gloucester Point, VA, USA, ²Friedrich Schiller University, Jena, Germany, ³University of Vienna, Vienna, Austria

The Early Development of the Cranial Musculature of the Longnose Gar

To better understand the evolutionary history and processes of the cranial musculoskeletal system within Actinopterygii we are undertaking studies of the ontogeny of the cranial musculature in exemplar taxa of several actinopterygian clades, including paddlefishes, sturgeons, gars, bowfin, and basal teleosts. In this presentation,

we will report on the development of the jaw musculature of the longnose gar *Lepisosteus osseus*. The gars, Lepisosteiformes, have been considered the sister group of either the Halecostomi (= *Amia* + Teleostei) or grouped together with *Amia* (= Holostei). This order is represented by seven recent species divided in two genera distributed in North and Central America. Juvenile and adult gars are highly derived and anatomical characters can easily be misinterpreted. In contrast, highly complex structures such as the cranial skeleton and musculature are organized more simply early in development, and homologous characters can be traced from their first appearance through to their terminal conditions. As an example, the elongation of the palatoquadrate and the dentary begins late in ontogeny to form the typical snout of the gars. However, the adductor mandibulae, which appears initially as a single portion, does not follow the extension of the palatoquadrate. While state of the art methods, such as clearing and double staining are well known for the analysis of skeletal structures, methods to analyse soft tissues are scarce. To study the development of soft tissue, such as the musculature and nerves, we apply a combination of 3D reconstruction of soft tissue CT scans and whole mount antibody staining.

0696 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Corey Krabbenhoft¹, Ayesha Burdett², Thomas Turner³

¹Texas A&M University, College Station, Texas, USA, ²New Mexico Museum of Natural History and Science, Albuquerque, New Mexico, USA, ³University of New Mexico, Albuquerque, New Mexico, USA

A mesocosm study of trophic interactions in a desert river (Rio Grande, New Mexico)

Arid rivers present difficult environmental conditions for aquatic organisms during dry periods. Fishes may be especially sensitive to stress where high temperatures, low oxygen concentration, and low water availability negatively affect survival and recruitment. Young-of-year (YOY) fishes may respond differently to such conditions compared to adults because of small size and distinct feeding ecology. We conducted a mesocosm experiment to test the hypothesis that YOY fishes fill a distinct trophic role in desert river food webs under drying conditions. Larvae and adults were stocked in mesocosms adjacent to the Rio Grande at Sevilleta National Wildlife Refuge, New Mexico. Fishes and invertebrates were collected biweekly for six weeks and analyzed for community and stable isotope (carbon and nitrogen) composition. We found that arid conditions have detrimental effects on the feeding habits of YOY fishes and constrain the dietary niche in early ontogeny. We confirmed that YOY fishes feed on a different suite of invertebrate taxa than adults. Moreover, a trophic cascade resulted from inclusion of both young-of-year and adult fishes, where predatory invertebrates expanded their isotopic niche in the presence of YOY. This study demonstrates the importance of incorporating young-of-year fishes in aquatic food web studies, and further suggests

that drying conditions can have myriad effects on their performance and roles in aquatic communities.

0695 Fish Genetics I, Ruidoso/Pecos, Friday 12 July 2013

Trevor Krabbenhoft¹, Corey Krabbenhoft¹, Bud Mendsaikhhan⁴, Norman Mercado-Silva³, Olaf Jensen²

¹Texas A&M University, College Station, TX, USA, ²Rutgers University, New Brunswick, NJ, USA, ³University of New Mexico, Albuquerque, NM, USA, ⁴Institute of Geoecology, Ulaanbaatar, Mongolia

Evolution and ecology of Mongolian grayling species (*Thymallus* spp.): an individual-based approach

Grayling (*Thymallus* spp.) in Mongolia have a complex and poorly understood evolutionary history. In particular, it is unclear whether patterns of genetic variation are concordant with morphological variation (e.g., gill raker counts) and taxonomic designations. We present results of phylogeographic analyses of DNA sequence data and compare inferred genetic relationships with complimentary morphological and ecological data sets. We tested the hypothesis that morphotypes represent genetically-distinct lineages, rather than plastic responses to the environment. Importantly, these analyses were conducted at the individual, rather than population level, facilitating direct comparisons of distinct classes of data. As evidenced by this study, discordance between data sets can afford novel and unexpected insight into the biology of fishes.

0303 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Bart Kraus, Rod Williams

Purdue University, West Lafayette, Indiana, USA

Spatial Ecology and Survivorship of Resident and Translocated Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*)

Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) populations have experienced precipitous declines throughout their geographic range. In Indiana, hellbenders have been reduced to a single river within the Blue River watershed. Recent empirical data indicate that both population numbers and densities are critically low. Moreover, telemetry data suggest hellbenders are scattered throughout the river with little spatial overlap among individuals. Our ultimate goal was to increase local population densities and encourage natural reproduction within the Blue River. To this

end, we translocated juvenile and adult eastern hellbenders and assessed home-range and annual survivorship for each age class to determine the feasibility of translocations as a potential method of hellbender conservation. Translocations have resulted in decreased home range size (1219.67 m²), increased home range overlap (1163.97 m²), and spurred local reproduction. Average survivorship for all individuals was high (0.947 ± 0.036 SE), much higher than previous estimates for this population. Our management approach has yielded promising results toward the conservation of hellbenders in Indiana and throughout its geographic range.

0264 AES Behavior, San Miguel, Sunday 14 July 2013

Andrea Kroetz^{1,2}, Sean Powers^{1,2}

¹University of South Alabama, Mobile, AL, USA, ²Dauphin Island Sea Lab, Dauphin Island, AL, USA

Eating Between the Lines: Bonnetheads (*Sphyrna tiburo*) Show a Non-Traditional Functional Feeding Response

Large mobile predators can have strong influences in the structuring of marine food webs. Few quantitative estimates of the effects of predation by large mobile predators exist but are necessary to evaluate their impact on benthic prey species. A predator's functional response provides quantitative information on the potential for predators to regulate local prey populations and community structure. We examined the functional response of the bonnethead (*Sphyrna tiburo*) to one of its few natural prey items brown shrimp (*Farfantepenaeus aztecus*). We simulated natural conditions in outdoor mesocosms and offered live prey at varying densities to quantify the functional response of this small coastal shark. Bonnetheads did not display a distinctive type of functional response; rather, they exhibited a response that fell between a type I and type II functional response. Bonnethead proportional consumption of brown shrimp remained relatively constant over all prey densities. Our results suggest that bonnetheads display what most closely represents a type I functional response. As an alternative to strict typing of predator functional response, we suggest that functional response be viewed as a continuum in order to achieve a more accurate depiction of how predation rates change as a function of prey densities.

**0464 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Kole Kubicek

Texas A&M University, College Station, TX, USA

Developmental Osteology of the Red Drum, *Sciaenops ocellatus* (Teleostei: Sciaenidae).

The family Sciaenidae is a large and diverse group of percomorph fishes with 70 genera and approximately 275 species. Though several species of sciaenid are economically important and are the subject of intense scientific study, very few studies have investigated sciaenid early development and even fewer have investigated aspects of sciaenid skeletal development. In order to further our understanding of the sciaenid skeletal system, we studied the development of the entire skeleton of the commercially important Red Drum (*Sciaenops ocellatus*). Our investigation is based on approximately 200 individuals (2.6-26.3mm NL/SL) representing the first thirty days of development. Specimens were cleared and double stained and scored for the presence or absence of 126 bones. Bones were considered present at the first sign of mineralization. Our preliminary data suggests that the earliest bones to ossify are the cleithrum and maxilla (2.6mm NL), followed shortly by the dentary, premaxilla, parasphenoid, and opercle (3.5mm NL). Development of the axial skeleton is complete by 14.4mm SL and all bones of the cranial skeleton (excluding the basisphenoid and the sclerotics) are present by 12.8mm SL. The basisphenoid develops much later than other cranial bones (24.4mm SL) and the sclerotics are not present in our material. We compare the ossification sequence of the red drum to the ossification sequence of the zebrafish (*Danio rerio*).

0523 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Shawn Kuchta, Ashley Brown

Ohio University, Athens, OH, USA

**Systematics and Biogeography of the Cumberland Plateau Salamander,
*Plethodon kentucki***

The species *Plethodon kentucki* was recently recognized on the basis of allozyme evidence (Highton & McGregor, 1983). The species is cryptic with respect to *P. glutinosus*, also possessing a black ground color with white dorsal spots, and thus was not previously recognized. *Plethodon kentucki* has a moderate range size, being distributed between the New River in West Virginia, west to eastern Kentucky, south to western Virginia. Within this range, Highton & McGregor (1983) documented a substantial amount of geographic variation in allozymes, with many Nei's genetic distances >0.30, and some confusing

patterns of differentiation among populations. Here I report on a phylogeographic analysis of *P. kentucki* using multilocus sequence data (two mitochondrial loci and five nuclear loci). The aim is to evaluate the biogeography and taxonomy of the complex. Preliminary phylogenetic analyses reveal a substantial level of phylogeographic structure, especially for mtDNA. However, not all of these patterns are congruent with results from previous allozyme work. Patterns of concordance and discordance will be analyzed and discussed.

0532 Fish Conservation I, Doña Ana/Cimarron, Thursday 11 July 2013

Bernard Kuhajda, David Neely

Tennessee Aquarium Conservation Institute, Chattanooga, Tennessee, USA

Status of the Imperiled Barrens Topminnow *Fundulus julisia*

The Barrens Topminnow, *Fundulus julisia*, ranks among the most imperiled fishes of the southeastern United States and is currently known to exist only on the Eastern Highland Rim in central Tennessee. Endemic to springs and spring-influenced streams the species experienced a rapid decline during the 1980s. In the 1990s, a partnership was formed to guide the recovery of *F. julisia*. While this partnership has been largely successful in establishing a captive propagation and reintroduction program, annual fluctuations in habitat conditions and the presence of the invasive Western Mosquitofish, *Gambusia affinis*, creates concern about the long-term persistence of *F. julisia*. As *F. julisia* have recently been petitioned for listing under the Endangered Species Act, current knowledge about population size and status and threats to the species and their habitat are critical. All known wild (unstocked) and reintroduced populations and several historical sites for *F. julisia* were surveyed in late February to mid-March 2013. Three of the four wild populations had individuals present, all with high abundance and evidence of recruitment. No *F. julisia* were collected in one wild population, but additional surveys will be performed during the summer under low water conditions. Twelve reintroduced populations had *F. julisia* present, with abundance ranging from 1 to 150, but very few sites had small individuals indicative of recruitment. No *F. julisia* were present at ten reintroduced sites. *Fundulus julisia* were not present in three historical sites sampled, but additional sites need to be surveyed. Surveys will continue through 2015.

**0419 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

Arianna Kuhn, Aaron Bauer, Todd Jackman

Villanova University, Villanova, PA, USA

**Multilocus phylogeny and phylogeography of the Namib day geckos
(Squamata:Gekkonidae: *Rhoptropus*)**

The genus *Rhoptropus* is an ecologically and behaviorally unique group of diurnal gekkonid geckos endemic to arid regions of Namibia and southern Angola. Previous phylogenetic analyses of the genus have been based on morphological, allozymic, and mitochondrial data, but to date no multilocus studies incorporating complete taxon sampling or extensive intraspecific sampling have been conducted. To assess taxonomic relationships for all nine recognized taxa we conducted a molecular phylogenetic analysis using nuclear (RAG-1, KIF24, MXRA5; >3.5 kb) and mitochondrial (ND2 with adjacent tRNAs; 1741 bp) sequence data. Likelihood and Bayesian results confirm previous estimations for patterns of relationships among described Namibian taxa and show high support for several new lineages occupying restricted areas of endemism in Namibia. A previously unsampled Angolan taxon occupies a relatively basal position within a broader clade also including *R. boultoni*, *R. barnardi*, *R. biporosus*, and several putatively new Namibian taxa. In combination with collection-based macroecological approaches, the phylogeny also indicates clear substructuring within the *R. afer* and *R. boultoni* species groups along a latitudinal gradient in the Namib Desert. Within *R. bradfieldi*, inland and coastal areas support highly divergent populations, but within *R. barnardi* an isolated eastern population in the Otavi Mountains is only minimally divergent from Namib and pro-Namib populations. As one of very few vertebrate groups exhibiting extensive *in situ* speciation in the Namib, a robust time-calibrated tree for *Rhoptropus* can provide valuable insight into the age of critical events in the development of the Namib throughout the Neogene.

0241 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Matthew Kwiatkowski¹, Dan Saenz², Scott Nagao³, Jason Fritzler³

¹*Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas, USA,*

²*USDA Forest Service, Southern Research Station, Nacogdoches, Texas, USA,*

³*Department of Microbiology, Weber State University, Ogden, Utah, USA*

Association Between Chytrid Fungus and Symbiotic Skin Bacteria in East Texas Anurans

One of the leading causes of amphibian population declines is the fungal disease chytridiomycosis, which is caused by the species *Batrachochytrium dendrobatidis*, or *Bd*. The fungus infects the skin of amphibians resulting in hyperkeratosis that can lead to osmoregulatory dysfunction, dehydration, electrolyte imbalance and death. Once *Bd* infects a population, it can cause widespread mortality leading to extinction. However, recent studies have found that some amphibians possess symbiotic bacteria on their skin that inhibit infection by *Bd*, thereby protecting the individual. The bacteria species that provide this protection can vary considerably among individuals, populations, and species. In east Texas, some amphibians have tested positive for the presence of *Bd*, yet no widespread mortality has been observed. This may result, in part, from their symbiotic bacteria, but virtually nothing is known about what bacteria species are present in east Texas. We isolated over 70 bacterial isolates from the skin of 51 individuals representing six anuran species. Skin swabs taken from these same individuals revealed the presence of *Bd* in six of them. While the low numbers of *Bd* positive individuals precludes conclusion for now, assays are continuing to determine if a negative association exists between *Bd* and skin bacteria in these anurans.

0735 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD GENERAL HERPETOLOGY

Shea Lambert, John Wiens

University of Arizona, Tucson, AZ, USA

A phylogenetic test of the cold-climate hypothesis for the evolution of viviparity in phrynosomatid lizards

The evolution of viviparity is a key life-history transition in vertebrates, but the selective forces favoring its evolution are not fully understood. With >100 origins of viviparity, squamate reptiles (lizards and snakes) are ideal for addressing this issue. Some evidence from field and laboratory studies supports the “cold-climate” hypothesis, wherein viviparity provides an advantage in cold environments by allowing mothers to maintain higher temperatures for developing embryos. Surprisingly, the cold-climate hypothesis

has not been tested using both climatic data and phylogenetic comparative methods. Here, we investigate the evolution of viviparity in the lizard family Phrynosomatidae (six origins of viviparity) using GIS-based environmental data, an extensive phylogeny (117 species), and recently developed comparative methods. We find significant relationships between viviparity and lower temperatures during the warmest (egg-laying) season, strongly supporting the cold-climate hypothesis. Remarkably, we also find that viviparity tends to evolve more frequently at tropical latitudes, despite its association with cooler climates. Our results help explain this and two related patterns that seemingly contradict the cold-climate hypothesis: the presence of viviparous species restricted to low elevation tropical regions and the paucity of viviparous species at high latitudes.

0671 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Kristen Landolt

Trent University, Peterborough, ON, Canada

Individual-level Trade-offs in Behavioral and Morphological Responses to Predation Risk

Many studies have demonstrated that prey utilize multiple defenses in response to predation risk; however, the functional relationship between defenses is not well understood, particularly within individuals. Studies tend to focus on average responses of prey, potentially over-looking individual-level constraints to phenotypic plasticity. To assess the relationship between multiple induced traits, individually marked wood frog tadpoles (*Lithobates sylvaticus*) were exposed to dragonfly naiad (*Anax* sp.) predator cues over a 3-week period. Individuals were assessed for morphological (tail shape) and behavioral (habitat use, activity) responses. Tadpoles responded by increasing tail fin depth and tail length and by reducing vegetation use and activity. Results indicate a negative correlation between morphology and behavior. The two behavioral traits were not positively correlated; tadpoles either reduced activity or vegetation use, not both. Further, individuals that increased their morphological defense over time subsequently reduced their behavioral response. This suggests a behavioral compensation for morphological vulnerability. Since individuals must balance trade-offs associated with growth and predator avoidance, following individuals is key to understanding the relationship between responses and limits to plasticity.

0605 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Kristen Landolt

Trent University, Peterborough, ON, Canada

Using Visible Implant Elastomer to Mark Early-Stage Tadpoles: an Assessment of Survival, Mark Retention, and Mark Migration

While visible implant elastomer (VIE) has become a commonly used technique for marking amphibians, its use as a viable method of marking early-stage tadpoles has not been evaluated. To address this, mark retention rates and tadpole survival were assessed using American toad (*Anaxyrus americanus*) tadpoles. Stage 25 tadpoles were marked laterally with 0, 1, or 2 1-mm long marks. After 3 weeks, mark retention was 89.2% for tadpoles with 1 mark and 60% for tadpoles with 2 marks. Mark number also affected survival, with a 95% survival rate for tadpoles with 0 and 1 marks and a 75% survival rate for tadpoles with 2 marks. The use of VIE was further explored by assessing tadpole mortality, mark retention, and mark migration in wood frog (*Lithobates sylvaticus*) and leopard frog (*Lithobates pipiens*) tadpoles. Marking methods were similar to above, except that all tadpoles were marked once and a one week buffer period was added after marking to ensure mark quality and to reduce tadpole stress. Mark retention over a 4 week period was 97.2% and mortality associated with marking was 0.67%. Mark migration was high, with 31.4% of marks migrating either ventrally or posteriorly, suggesting that mark location should not be used to identify individuals. Low mortality rates and high mark retention rates indicate that VIE can be a suitable method for marking early-stage tadpoles, particularly when a buffer period is used after marking.

0109 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Kathy Lang, Kimberly Ward, Ava Otway, Nicole Ruiz, Emma Mathews, Rachel Hand

ABQ BioPark, Albuquerque, NM, USA

Conservation of Native Aquatic Species at the BioPark in Albuquerque, NM

The Aquarium at the City of Albuquerque's BioPark includes a separate, off exhibit, Aquatic Conservation Facility (ACF) that is dedicated to the maintenance and propagation of several threatened or endangered native aquatic species. The primary species held at the ACF is the Rio Grande silvery minnow, a federally listed endangered species that was once the most abundant species in the Rio Grande basin, but is now

found in only 7% of its historic range. ACF staff contribute to the survival of the Rio Grande silvery minnow through 1) acting as the primary collectors of naturally spawned minnow eggs (which might otherwise not survive); 2) conducting additional captive spawning using their genetically diverse broodstock population; and 3) participating in the release of juvenile minnows back into the river after the threat of drying has passed. In addition to the silvery minnow, the ACF also currently houses refuge populations of the Socorro isopod, another federally listed endangered species that is considered to be extinct in the wild; the small-bodied Zuni bluehead sucker and the larger-bodied blue sucker, both of which are listed as endangered by the state of New Mexico; and the gray redhorse, a large sucker that is listed as threatened by the state of New Mexico. ACF staff has had very good success in the propagation of the Socorro isopod and the Zuni bluehead sucker, and some limited success in the propagation of the blue sucker.

0589 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Rafael Lara¹, Anibal Díaz de la Vega¹, Víctor Jiménez¹, Héctor Gadsden², Fausto Méndez¹

¹IB-UNAM, México, Mexico, ²Instituto de Ecología, Chihuahua, Mexico

Thermoregulation in Two Sympatric Lizards *Sceloporus poinsettii* and *Sceloporus lineolateralis* (Squamata: Phrynosomatidae) in Durango, Mexico

Environmental temperature is an important factor that regulates activity and physiological processes of ectotherms. Because sympatric species are exposed to similar thermal energy conditions, closely related species could present similar thermal requirements. This similarity may generate interspecific competition for optimal thermal space. The thermal ecology of the sympatric viviparous lizards *Sceloporus lineolateralis* and *S. poinsettii* (*Sceloporus torquatus* species group) were studied in natural populations in Durango, México. We find that active body temperatures and thermal preferences were similar between species. However, *S. poinsettii* exhibited superior thermal efficiency because the preferred thermal range of this species was wider and active body temperature was higher. These results suggest that there is little competition between these sympatric species for thermal resources and that thermal preferences are analogous to those previously reported for the group and the genus.

0618 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Rafael Lara-Resendiz¹, Hector Gadsden², Barry Sinervo⁴, Fausto Mendez-de la Cruz³

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Thermoregulation of Two Sympatric Species of Horned Lizard in the Chihuahuan Desert and Their Local Extinction Risk

Thermoregulation studies on ectothermic organisms are an important tool for research on physiology, ecology, evolution, behavior, and recently for evaluating the effect of global climate change. Here, we examine the body temperature regulation, habitat thermal quality, and hours of thermal restriction of two desert and sympatric horned lizards (*Phrynosoma cornutum* and *P. modestum*) at three contrasting sites within the Mexican Chihuahuan Desert, and we estimate the local extinction risk resulting from climate change along their geographical distribution. We followed the protocol for evaluating thermoregulation proposed by Hertz et al., (1993) and the extinction physiological model of Sinervo et al., (2010). Indices of thermoregulation indicated that both species thermoregulate effectively despite living in habitats of low thermal quality. High environmental temperatures restrict the activity periods of both species. Finally, if maximum local air temperatures continue rising in North America as predicted by global climate models, *P. cornutum* will be locally extinct at 6% of sites by 2050 and 18% by 2080 and for *P. modestum* will be extinct at 32% of sites by 2050 and 60% by 2080.

0228 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Thornton Larson, Eli Greenbaum, Delilah Castro

University of Texas at El Paso, El Paso, TX, USA

Systematics the African Frog Genus *Amietia* (Anura:Pyxicephalidae) in Eastern Democratic Republic of the Congo

The genus *Amietia* currently includes 15 species of frogs that occur in an array of habitats from lowland rainforest to montane grassland in central, eastern and southern Africa. In an ongoing study to evaluate evolutionary relationships and identify cryptic species within the genus, one nuclear (RAG1) and three mitochondrial (16S, 12S, cyt b) genes were sequenced from 44 samples of *Amietia* and one outgroup in the genus *Phrynobatrachus*; 27 additional 16S sequences (East and South Africa) were included from GenBank. Data were analyzed with maximum parsimony and maximum-likelihood

inference criteria with the programs PAUP* 4.0b and RAxML v.7.2.6 after appropriate models of nucleotide substitution were identified in the program jModelTest v.2.1.3. Results support the monophyly of the genus *Amietia*, and 15 well-supported clades were identified from branch lengths and bootstrap support values, of which nine occur within Democratic Republic of Congo (DRC). Described species in some clades will require careful comparison to type material to confirm their identity, but the nine lineages identified from eastern DRC (with only five species currently recognized from DRC) suggest the taxonomic diversity of *Amietia* is underestimated.

0662 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Ian Latella, Steve Poe

University of New Mexico; Museum of Southwestern Biology, Albuquerque, NM, USA

Habitat Use in Naturalized *Anolis* Lizard Communities

Human-mediated introductions of species have resulted in novel combinations of species in communities worldwide. Non-indigenous species may have negative impacts on their new environments, but they also provide unique opportunities to study patterns of community assembly and habitat partitioning. Shared patterns among natural and naturalized communities may suggest universal rules for community assembly and maintenance.

Anolis lizards form natural communities of at least 12 species and naturalized communities of up to six species. *Anolis* has been a model system for study of community patterns and processes in native communities, but little is known about communities of naturalized *Anolis*. We collected habitat use, body size, and abundance data for communities in Florida and Bermuda that include naturalized species of *Anolis*. We compared our data on naturalized communities to existing data on natural communities.

Matthew Lattanzio, Donald Miles

Ohio University, Athens, Ohio, USA

Life on the Phenotypic Edge: Linking Environmental and Phenotypic Variation with Fitness in a Polymorphic Lizard

Anthropogenic disturbance has been implicated as an agent of ecological divergence, yet our understanding of the mechanisms linking these phenomena are limited. The changes in resource availability as a consequence of disturbance, mediated by variation in organismal physiology, in part guide how species respond. Phenotypic integration, as well as the outcome of phenotype-environment interactions, should thus differ in disturbed habitats. We address these considerations using data on tree lizard (*Urosaurus ornatus*) populations from grassland regions varying in prescribed burn history. In the southwestern US, burning induces environmental shifts towards structural homogenization and grass-dominance, resulting in resource-limited environments. Moreover, tree lizards are polymorphic in behavior and throat coloration, and like many other polymorphic species, these differences are likely maintained in part by both divergent natural and sexual selection. Thus is likely that not all morphs may respond equally to broad-scale perturbations like burning. We demonstrate that environmental variation alters microhabitat use and spatial segregation of *U. ornatus* morphs, resulting in increased spatial overlap in burned regions. Phenotypic divergence also increases in burned sites. Using a novel approach, we link phenotypic and habitat variation, illustrating that morphs differing in phenotypic integration also differ in the degree they match their microhabitats. In particular, dominant morphs, especially those lizards with divergent (non-average) morphologies, tended to match best. Finally, we use capture-mark-recapture data to explicitly tie this variation to fitness. Altogether, our results suggest that only dominant morphs, and in particular those living on the phenotypic edge, may fare well in resource-poor environments.

0597 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Matthew Lattanzio, Donald Miles

Ohio University, Athens, Ohio, USA

Social Dominance, Social Networks, and Environmental Change: Contrasting Responses of Male Tree Lizards to Anthropogenic Disturbance

Male-male competition is a key component of sexual selection that drives variation in resource holding potential, social behavior, and ultimately reproductive success among males. This phenomenon is particularly common among males in color polymorphic species where morphs differ in their degree of aggression and territoriality. Interactions between dominant morphs in these species tend to escalate more than interactions between different morphs, resulting in a greater likelihood of injury. Given that variation in morph behavior is associated with variation in their ability to secure environmental resources, disturbed environments should pose a significant challenge to existing morph relationships. Here we investigate the consequences of environmental variation for male tree lizard (*Urosaurus ornatus*) social networks in three sites varying in prescribed burn history (and thus resource availability). Burned (resource-limited) environments should promote greater competition for resources and a greater risk of injury from contest escalation. We consider two hypotheses: either male strategies (behaviors) will remain fixed and social network structure shifts, or, conversely, male behavioral differences may be modulated in order to maintain morph spatial relationships among the study sites. We demonstrate that male *U. ornatus* are larger, have fewer parasites, and escalate to chasing and biting behaviors during male-male encounters more often in burned habitats. Male social networks also vary such that in those same habitats, dominant males are more often found closer to non-dominant males than to each other. Thus, environmental variation modulates both morph behavior and the social structure of *U. ornatus* populations, but in potentially contrasting ways.

0672 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Katie Laumann, Casey Dillman, Eric Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Comparative ontogeny of the jaws and feeding behavior in two sturgeons, *Acipenser transmontanus* and *A. oxyrinchus*

The structure of the jaws in sturgeons (Acipenseridae) is distinct from that of other actinopterygians. The left and right palatoquadrates are rotated such that they meet in the midline, the anterior portion of the suspensorium is decoupled from the neurocranium, and a post-palatoquadrate cartilaginous structure, the so-called palatal complex, is present. Larval sturgeons have terminal jaws that shift during ontogeny to a ventrally directed position. They develop and completely resorb dentition early in ontogeny. Larval sturgeons also exhibit dramatic shifts in feeding behavior. Form and function are often inextricably linked, and both change during development. This study investigates the connections between the timing of changes in jaw morphology and shifts in feeding behavior in two North American sturgeon species, *Acipenser transmontanus* and *A. oxyrinchus*, based on closely spaced growth series of hatchery-reared specimens. Dissection of cleared and stained *A. transmontanus* revealed that dentary and dermopalatine teeth first mineralize at 13.6 mm TL and are lost by 90.9 mm TL. The shift from a forward facing to ventrally oriented set of jaws is complete by 122.4 mm TL. *Acipenser oxyrinchus* exhibits these changes at smaller sizes; teeth first mineralize at 10.11 mm TL and are completely resorbed by 47.0 mm TL. The shift in jaw position is complete by 47.0 mm TL. We draw on published studies of larval feeding behavior in *A. transmontanus* and *A. oxyrinchus* to test for correlation between feeding behavioral changes and developmental osteology in these species.

0602 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD GENERAL HERPETOLOGY

Brian Lavin, Derek Girman

Sonoma State University, Rohnert Park, CA, USA

Glass Lizards, Dirt Dragons, and Slow Worms: Molecular Dating in the Anguinae

The Anguinae are a subfamily of Anguinae lizards composed of legless grass-swimming forms with a distribution that spans Europe, Asia, and North America. This distribution is suspected to be due to dispersal in the Cenozoic. We examined the Anguinae at the species level with multiple nuclear loci (total of 21 loci, ~13,000 bp) including all major lineages and species groups based on morphology and mtDNA. We generated a

phylogeny with Maximum likelihood and Bayesian inference methods. Although all species level relationships examined received high support we were not able to resolve the placement of the three major lineages within the Anguinae (North African, European, and Asian/North American lineages). We then performed a molecular dating analysis in BEAST using the three possible non-polytomy topologies in the Anguinae. Analyses used three ingroup and two outgroup fossil calibrations. Agreement was found in analyses using both ingroup, outgroup, and combined fossil calibrations. Agreement was also found in dates between the three possible tree topologies with minor variations between the three major lineages in the different topologies. The initial divergence between the Anguinae and Gerrhonotinae coincides with the breaking of the Thulean landbridge as has been found in previous studies. Major lineages and sublineages within the Anguinae all appear to have diverged at the end of the Oligocene/beginning of the Miocene as the climate cooled, the forest became more fractured, and grassland habitat spread. Species level divergences in all lineages seem to have occurred during the late Miocene and Pliocene.

0606 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER HERPETOLOGY AWARD

Brian Lavin, Derek Girman

Sonoma State University, Rohnert Park, CA, USA

Molecular Dating and Fossil Taxa: The placement of fossil Anguinae within a Molecular Phylogeny

The Anguinae are a subfamily of Anguinae lizards composed of legless grass-swimming forms with a distribution that spans the continents of the Northern Hemisphere (Europe, Mediterranean North Africa, Asia, and North America). Anguinae lizards are fairly well represented in the fossil record especially in Europe and, to a lesser extent, in North America. We used a molecular dating analysis of the Anguinae based on 21 nuclear loci to examine the taxonomic placement of fossils (from the Eocene to the Pleistocene) within the Anguinae fossil record especially where such fossils have been assigned to modern genera or species.

0024 Herp Systematics, San Miguel, Friday 12 July 2013

Adam Leaché¹, Adrián Nieto Montes de Oca²

¹University of Washington, Seattle, WA, USA, ²Universidad Nacional Autónoma de México, D.F., Mexico

Horned Lizard Phylogeny from Genome-Wide SNP Data.

Thousands of single nucleotide polymorphisms (SNPs) are used to estimate a new phylogeny for horned lizards (*Phrynosoma*). Our sampling includes multiple individuals of all currently recognized species as well as a new species that we discovered on a recent field expedition to Mexico. A species tree is estimated using a coalescent-based approach that bypasses the need for estimating gene trees and can therefore handle datasets with 1000s of markers and multiple individuals per species. The new “Phryno-genomic” tree provides (1) strong support for recent divergences in the *Phrynosoma* phylogeny, (2) a resolved base of the *Phrynosoma* phylogeny, (3) strong support for the placements of *P. cornutum* and *P. asio*, and (4) support for the relationships among all genera within the Phrynosomatidae (*Callisaurus*, *Cophosaurus*, *Holbrookia*, *Petrosaurus*, *Phrynosoma*, *Sceloporus*, *Uma*, *Urosaurus*, and *Uta*). Previous molecular phylogenetic studies of *Phrynosoma* have identified strong discordance between nuclear and mitochondrial DNA gene trees; the SNP data agree with the nuclear results and add further evidence for mitochondrial introgression within *Phrynosoma*. Recent simulation studies have suggested that SNP data should be useful for ancient divergences (up to 100 million years), and we use these new empirical data to explore the relationship between phylogenetic signal and the inevitable accumulation of missing SNP data at deep timescales.

0398 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Arianne Leary¹, Jim Gelsleichter¹, Dean Grubbs²

¹University of North Florida, Jacksonville, FL, USA, ²Florida State University Coastal and Marine Lab, St. Teresa, FL, USA

Polycyclic Aromatic Hydrocarbon Biomarker Exposure in Elasmobranchs after the Deepwater Horizon Oil Spill: Investigations on the Smooth Dogfish, *Mustelus canis*

The Deepwater Horizon Oil Spill (DHOS) released large quantities of liquid petroleum into the Gulf of Mexico. It is vital to determine the effects on Gulf wildlife from oil-related pollutants, particularly the polycyclic aromatic hydrocarbons (PAHs), which are the most toxic components of oil. Prior research suggested the possibility of high PAH exposure in some coastal sharks, particularly the smooth dogfish, *Mustelus canis*.

Therefore, the goal of this follow-up study was to evaluate PAH exposure and effects in this species as a result of the DHOS. This study evaluated PAH biomarkers such as Phase I and II detoxification enzymes and the presence and concentrations PAH metabolites in bile. Individuals of this species were collected from both oiled and un-oiled areas on Florida's coast and compared. In addition, some pregnant *Mustelus canis* mothers and developing embryos were evaluated to examine the potential for maternal-fetal transfer of PAHs. We hypothesized that higher biomarker levels would be observed in northeast Gulf M. canis in comparison with conspecifics from un-oiled locations as well as other elasmobranch species in the northeast Gulf. Additionally we anticipated temporal trends would be observed with biomarker levels declining as time from the spill lapsed.

0071 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Daniel J. Leavitt, Michael Ingraldi

Arizona Game and Fish Department, Phoenix, AZ, USA

Measuring movements of Shovel-nosed Snakes of the genus *Chionactis*, with a particular emphasis on the Tucson Shovel-nosed Snake (*Chionactis occipitalis klauberi*)

Studies of spatial behavior and movement ecology allow us to enhance our understanding of ecology. When organisms move in their environment they do so at the risk of predation or at the benefit of feeding or reproduction. In this sense, movement can be considered a necessary evil. Here we evaluate the literature on movements and methodology for studying movements of *Chionactis*. We focus our research on the Tucson Shovel-nosed Snake (*Chionactis occipitalis klauberi*) a species of conservation concern. We will discuss recent efforts to understand their movement patterns in a field laboratory setting and in the field at the Arizona Army National Guard Florence Military Reservation. All results of this work will be used to assist the management strategy being implemented on the Reservation and to enhance our understanding of movements in the Tucson Shovel-nosed Snake.

0780 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Dean Leavitt

San Diego State University, San Diego, CA, USA

Species boundaries and phylogenetic relationships of the *Xantusia vigilis* species group

The night lizard genus *Xantusia* is a unique component of the Desert Southwest fauna. Morphological similarity and convergence have helped mask considerable diversity among night lizard populations that is now being better understood with genetic tools. Using sequence data from mitochondrial DNA and eleven new nuclear loci, I evaluate whether hypothesized candidate species represent distinct evolutionary lineages. Also, if multiple species are present, is secondary contact characterized by extensive hybridization or relatively complete reproductive isolation? I also investigate the source of previously reported gene tree discordance. These new data confirm the uniqueness of divergent lineages within the *X. vigilis* species group, and I find limited introgression in areas of secondary contact. This study reveals the presence of unique populations within the Anza-Borrego region that may merit conservation attention.

0253 NIA BEST STUDENT PAPER, NIA Oral Papers, Doña Ana/Cimarron, Monday 15 July 2013

Stephanie Lefebvre, Nathan Lujan, Hernan Lopez-Fernandez

University of Toronto, Toronto, Ontario, Canada

Morphology and Diet Correlations in Neotropical Suckermouth Armoured Catfishes of the Tribe Ancistrini (Siluriformes: Loricariidae)

Over 850 species comprise the suckermouth armoured catfish family Loricariidae - the most species-rich family of catfishes in the world, and a radiation that is entirely restricted to the rivers South and Central America. Loricariids are characterized by having bodies covered with dermal plates and teeth, as well as a ventral oral disk formed by decoupled jaws optimized for scraping food items found on various types of substrate. Although it is hypothesized that the specialization of their feeding morphology may have played a role in the diversity of the family, little is known about the ecological and evolutionary processes responsible for this diversification. This study examines relationships between morphological diversity of the loricariid jaw and the isotopic composition of their diets by using six parameters of functional morphology measured from digital images of dissected mandibles. Three of these parameters are consistent with linear measurements commonly studied in the majority of teleost fishes, and pertain to input and output levers of force in the jaws, while the remaining three are

specific to Loricariidae, and indicate maximum force and torque applicable to the mandibles. Correlations between stable isotope signatures indicative of the diversity of foods ingested and attributes of the mandibles were investigated using a Procrustes superimposition analysis on Principal Component axes of morphological and trophic variation. Comparisons were made in an explicitly phylogenetic context by incorporating a newly developed time-calibrated molecular phylogeny of the Loricariid tribe Ancistrini.

0156 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Richard Lehtinen, Jessica Pringle

The College of Wooster, Wooster, Ohio, USA

Impacts of Paternal Care on Offspring Survival: An Experimental Study on a Glass Frog from Tobago, West Indies

The most common form of parental care in frogs is egg attendance. The presumptive function of egg attendance is to decrease mortality during early embryonic stages. However, this is rarely demonstrated experimentally. To address this gap, we conducted male removal experiments in the Tobago glass frog (*Hyalinobatrachium orientale*) to compare embryonic survivorship in clutches that lacked parental care to controls that were not manipulated. This experiment was undertaken twice, once during the rainy season and once in the dry season to examine potential seasonal differences. A total of 37 clutches were included in the study (18 removals and 19 controls). We found that male removal clutches had significantly lower survivorship compared to controls ($p = 0.002$) but survivorship did not differ between seasons ($p = 0.913$). Egg attendance was noted at all hours but was significantly more likely to occur at night compared to during the morning or afternoon ($p < 0.001$). At night, most males (76%) continued to call while attending existing clutches and forty-one percent of these males obtained additional matings. Predation was the primary source of mortality in unattended clutches but in the dry season several clutches dried out, suggesting that hydration may also be an important function of parental care in this species.

**0191 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Erica Lemons, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Montezuma's Revenge: Taking a stab at genetic variation within *Xiphophorus montezumae* (Poeciliidae)

The swordtails, genus *Xiphophorus* (Cyprinodontiformes: Poeciliidae), are recognized for the distinctive caudal fin extension found in the majority of the species of this genus. The northern swordtail clade of the Atlantic slope of the Sierra Madre of Mexico consists of nine currently recognized species, including the Montezuma Swordtail, *Xiphophorus montezumae*, a species that occurs in a small, geographically restricted area of the Rio Panuco basin. A previous study suggested that *X. montezumae* may be more diverse than currently recognized with populations in the Rio Gallinas, and the Arroyo Cienega Grande and Arroyo La Cienega being allozymically and morphologically distinctive

Therefore, we conducted a phylogeographic study to test the distinctiveness and phylogenetic relationships of these and other populations of *X. montezumae* using mitochondrial and nuclear DNA sequences. Results of the phylogenetic and TCS analyses are generally concordant with the previously identified distinctive populations. The taxonomic implications of these results will be discussed.

0727 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Corissa Lennon, Stephen Mullin

Eastern Illinois University, Charleston, IL, USA

Trophic niche breadth in a widely-foraging snake (Colubridae: *Coluber*)

The trophic niche width of a species varies depending on the foraging strategy employed by the individuals within a population. Among reptiles, the niche breadth of many species of snakes is relatively understudied. Within this clade, the genus *Coluber* includes wide-ranging, actively foraging snakes that have been historically labeled as dietary generalists. We report on the diet composition of *Coluber constrictor foxii*, the Blue Racer. The dietary information available for this subspecies is limited and little is known about ontogenetic or seasonal differences in the prey species consumed. In addition to obtaining gut and fecal contents, we employed stable isotope analyses using $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ to describe the dietary preferences of *C. constrictor foxii*. We collected blood and tissue samples of *C. constrictor foxii*, along with whole specimens representing a range of potential prey taxa. We freeze-dried all samples, homogenized them using an amalgamator, and analyzed the samples using mass spectroscopy. We performed

ANOVAs to investigate differences in the isotope signatures of individual snakes between seasons, tissue types, sexes, and size classes. We used a Bayesian mixing model to determine the potential sources of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ in the snake tissues, and assessed differences in diet between individuals representing different genders, seasons, and ontogenetic stages. At the population level, *C. constrictor foxii* appears to follow a dietary pattern typical of an opportunistic predator. Variation exists among age classes, however, with different $\delta^{15}\text{N}$ values for large juveniles indicating that they occupy a dietary niche unique from either hatchlings or adults.

0170 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Carlos Lerma, Clinton Moran, Alice Gibb

Northern Arizona University, Flagstaff, AZ, USA

A tail of two fishes: evolutionary convergence and divergence in caudal peduncle morphology in southwestern native fishes

Waterways in the lower Colorado River basin were habitats defined by periodic flooding events as a result of snow melts and seasonal rains. With the implementation of dams those waterways have been drastically altered to represent an equilibrium habitat that is the same year round. The roundtail chub (*Gila robusta*) and bonytail chub (*Gila elegans*) are species of fish native to the Colorado River Basin. Investigation of the morphology of these species helps us understand the habitats in which they once thrived. We looked at the vertebral column morphology, red muscle location in the peduncle and shape of the fins. Fish were placed in a dermestid beetle colony to have the skeletons cleaned for analysis of the vertebral column. For investigation of red muscle location, seven sections were cut based on a percentage of standard length. Lastly fin aspect ratio was taken from pictures of specimens using imageJ. We compared the roundtail chub and the bonytail chub to the common carp (*Cyprinus carpio*) and mackerels (members of the family Scombridae). We saw similarities in the vertebral structure of the bonytail and the mackerels which suggested evolutionary convergence in response to swimming modes. The mackerels developed a caudal peduncle vertebral morphology that is specialized for constant swimming. The bonytail has developed similar morphology as a response to times of high flow during flooding. It is important to understand how these fishes once interacted with their environment, to truly know what kind impacts dams, diversions and reservoirs have on these native species.

0443 Fish Genetics I, Ruidoso/Pecos, Friday 12 July 2013

Emily Lescak¹, Susan Bassham², Julian Catchen², J. Andres Lopez¹, Mary Sherbick³, Frank von Hippel³, William Cresko²

¹University of Alaska Fairbanks, Fairbanks, AK, USA, ²University of Oregon, Eugene, OR, USA, ³University of Alaska Anchorage, Anchorage, AK, USA

Phenotypic and Genotypic Variation in Young Threespine Stickleback Populations from Prince William Sound and the Gulf of Alaska

We examined phenotypic and genotypic variation in populations of threespine stickleback (*Gasterosteus aculeatus*) that originated after the 1964 Alaska Earthquake. The earthquake uplifted marine terraces on islands in Prince William Sound and the Gulf of Alaska, forming water bodies on newly exposed terraces on Middleton, Montague, and Danger Islands. We have detected phenotypic differentiation between resident freshwater and oceanic stickleback collected in new freshwater ponds and nearby oceanic sites, suggesting recent and rapid morphological evolution. To characterize the genetic variability underlying this morphological change, we examined genome-wide variation through analysis of SNP genotypes. We have characterized patterns of genetic differentiation using a combination of measures of genetic diversity, Structure analyses, analyses of molecular variance, and principal components analyses. Pairwise F_{st} comparisons are consistent with recent colonization of freshwater by oceanic ancestral stock. Consistent with the expectation of a recent origin for these populations, most of the genetic variation is partitioned across individuals. Levels of nucleotide diversity and F_{is} suggest recurrent gene flow between coastal freshwater and oceanic populations. Presence of geographic barriers to movement and extent of genetic divergence among freshwater populations support multiple independent colonization events on Middleton and Montague Islands. Our results are consistent with previous findings of low levels of genetic divergence among oceanic populations sampled hundreds to thousands of kilometers from each other. Due to their recent origin and phenotypic differentiation, these populations present opportunities to study the early stages in the evolution of adaptation and divergence within a natural ecological context.

0458 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Emily Lescak¹, Robert Marcotte¹, Daniel Prince², Jeffrey Colgren², Mark Currey³, Leah Kenney², Mary Sherbick², Frank von Hippel², William Cresko³, J. Andres Lopez¹

¹University of Alaska Fairbanks, Fairbanks, AK, USA, ²University of Alaska Anchorage, Anchorage, AK, USA, ³University of Oregon, Eugene, OR, USA

Mitochondrial Clade Distributions in Threespine Stickleback Populations Across the North Pacific Basin

Extant populations of threespine stickleback (*Gasterosteus aculeatus*) include descendants of two mitochondrial lineages (clades) that diverged approximately one million years ago. We examined the clade distributions in populations spanning the western Pacific, near the geographic origin of the Japanese clade, and the eastern Pacific, where the Euro North American clade predominates. By sampling populations from the Kuril Islands, Aleutian Island Chain, Kenai Peninsula, Prince William Sound, the Gulf of Alaska, and Oregon, we document changes in clade proportions across the Pacific Basin to identify areas of admixture and apparent clade boundaries. Clade identity is determined by restriction fragment length polymorphism analysis of a region of the cytochrome B gene. The western boundary of the Euro North American clade appears to be Simushir Island in the Kuril Island Chain; the frequency of this clade increases from west to east along the Kurils and Aleutians and predominates in Prince William Sound and the Gulf of Alaska. Populations from Oregon are fixed for the Euro North American clade, indicating that British Columbia is the apparent eastern boundary of the Japanese clade. Fine-scale sampling in regions of admixture reveals a great deal of inter-population heterogeneity in clade proportions. Such admixture zones present an opportunity to study patterns of introgression that arise when genomes that have adapted to different environments for extensive periods subsequently come into secondary contact.

0350 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Edwin Leung, Larry Allen

California State University, Northridge, Northridge, California, USA

The influence of El Niño Southern Oscillation on cohort structure in white seabass (*Atractoscion nobilis*) of Southern California

During periods of warmer climate, growth and recruitments rates can increase in fish, suggesting that these factors were influenced by warmer sea surface temperatures. Previous studies have shown that species of fish can either thrive from these climate events or decline primarily from a decrease in food availability brought on by lower

primary productivity during warmer conditions. Otoliths are the calcium carbonate ear stones found in fish. Climate events such as El Niño Southern Oscillation and Pacific Decadal Oscillation can greatly influence the formation of an otolith, where distinct bands in the structure formed during development can represent annual and seasonal variation at a point in time. White seabass (*Atractoscion nobilis*) was a prominent commercial and recreational fishery species in Southern California during the middle of the last century, but had decline substantially by 1982 when the last of the Mexican commercial fisheries closed. This decline was largely attributed to overfishing. Recent studies have shown signs that the native population is in recovery and may benefit from El Niño events through increased growth rates. The purpose of my study was to determine if the distribution of age groups in white seabass differs dramatically between climate events, using otoliths collected from 1997, 1998, 2000, and 2001 as part of the fisheries independent assessment of juvenile white seabass abundance from 1995 to 2008. The results from this study will ultimately determine the impact of environmental conditions on variation in year-class strength of white seabass.

0537 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Brenna Levine¹, Charles Smith², Marlis Douglas¹, Mark Davis³, Steven Beaupre¹, Gordon Schuett⁴, Michael Douglas¹

¹University of Arkansas, Fayetteville, Arkansas, USA, ²Wofford College, Spartanburg, South Carolina, USA, ³University of Illinois, Champaign, Illinois, USA, ⁴Georgia State University, Atlanta, Georgia, USA

Genetic Structure of the Copperhead (Viperidae: *Agkistrodon contortrix*) at its Most Northern Distribution

Molecular studies in North American pitvipers have focused on species of conservation concern, such as Timber Rattlesnakes (*Crotalus horridus*) and Massasauga (*Sistrurus catenatus*). Scant effort, however, has been directed towards studying genetic structure in non-threatened pitvipers, such as the Copperhead (*Agkistrodon contortrix*). This species may serve as a surrogate for threatened and endangered taxa, and examining its genetic structure with DNA-based molecular approaches will broaden our knowledge of population structure in North American pitvipers. We employed 22 polymorphic tetranucleotide microsatellite loci to explore population genetic structure in *A. c. mokasen* at its most northern distribution in Connecticut. Bayesian analysis of 117 adults affiliated with 9 dens identified six admixed genetic clusters. Intra-den relatedness was not significantly different from the overall adult population average, nor was relatedness among males or females within and among hibernacula and across the adult population. However, sib-ship analyses revealed family groups within the study site at a level intermediate to the structure identified through relatedness and Bayesian clustering analyses. These results emphasize the importance of investigating population structure at multiple spatial scales and refine our understanding of dispersal and gene flow in

North American pitvipers that may provide information for population management decisions.

0331 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Patrick Lewis¹, Cristhian Cadena¹, Elisabeth Horstman¹, Grayson Means¹, Alicia Kennedy², Christopher Bell²

¹Sam Houston State University, Huntsville, Texas, USA, ²University of Texas-Austin, Austin, Texas, USA

Cranial Morphology of *Zygaspis quadrifrons* Revealed by High Resolution X-ray Computed Tomography

Amphisbaenians are a poorly understood clade of fossorial lizards. Because of their derived anatomy and relative scarcity, the systematics of the clade and its placement within squamates remain uncertain. Traditional approaches cluster species into four groups according to burrowing behavior and cranial morphology, resulting in the recognition of 'shovel-headed,' 'round-headed,' 'keel-headed,' and 'spade-headed' morphotypes. Recent phylogenetic analyses, however, do not support the monophyly of the taxa that share those morphotypes. Detailed analyses of individuals with those different morphotypes are required to better understand morphological evolution within the clade. Such analyses were previously accomplished using High Resolution X-ray Computed Tomography (HRXCT) for the 'shovel-headed' *Rhineura hatcherii* and 'spade-headed' *Diplometopon zarudnyi*. We use HRXCT imagery to provide additional data about the disparity in cranial morphology among amphisbaenians. Those data allow us to provide the first detailed description of a 'round-headed' amphisbaenian, the African species *Zygaspis quadrifrons*. HRXCT is a nondestructive technology and ideal for this rare and diminutive species. We are able to visualize and describe a detailed reconstruction of the entire skull as well as individual cranial elements. Unlike the 'spade-headed' *Diplometopon zarudnyi*, our preliminary results indicate the absence of a squamosal in *Zygaspis quadrifrons* and the presence of a prefrontal. Overlapping sutures are observed between the nasal process of the premaxilla and the nasals, allowing contact between the nasals medially. Additionally, the frontal process of the maxilla is not bifurcated, as seen in 'spade-headed' morphotypes, and a large lappet extending laterally from the horizontal wing of the vomer appears unique.

**0006 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Russell Ligon, Kevin McGraw

Arizona State University, Tempe, AZ, USA

Chameleon Color Change: Evidence for Communication via Rapid Chromatic Transformation

Animals use many signals for communication, from postures and songs to elaborate dances and electrical impulses. Some signals are relatively static once formed and can reveal information about individuals during the time a trait is developed, while others are dynamic and can provide a real-time update of an individual's quality or intentions. Rapid physiological color change exhibited during social interactions is one example of a dynamic signal; however, the information content of color change signals remains poorly understood from ecological, behavioral, and evolutionary standpoints. Here we use recently developed photographic and analytical tools in conjunction with visual models, to examine the dynamic color changes of male veiled chameleons *Chamaeleo calyptratus* during social interactions. We describe here, for the first time, the attributes of physiological color change that mediate aggressive interactions. Males with brighter bodies were more likely to approach opponents and those that achieved brighter head coloration and changed head color faster (based on chameleon perception) were more likely to win agonistic encounters. Our findings represent the first quantification of rapid physiological color change using organism-specific visual models and provide evidence that the rate of color change, in addition to display coloration, can be a useful component of animal communication. That different color signals are linked to different behaviors also suggests that separate components of color change contain independent information about motivation and fighting ability.

0376 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Lorena C B Lima¹, Paulo Passos², Maria J J Silva²

¹Instituto Butantan, São Paulo, SP, Brazil, ²Museu Nacional, Rio de Janeiro, RJ, Brazil

Phylogenetic Relationships of the *Boa constrictor* Complex (Serpentes, Boidae): Preliminary Results Based on Mitochondrial Genes

Boa constrictor, a species complex distributed from Mexico to Argentina, comprises 12 currently recognized subspecies. Previous studies using cytochrome-b (cytb) recovered two distinct clades to *B. constrictor*: One related to *B. c. imperator* (Central America) and other related to *B. c. constrictor* (South America). This study aims to investigate the phylogenetic relationships within the South American clade, using 1060 bp (380 of cytb

and 680 of ND4) of 68 samples from 40 localities from Brazilian biomes. Sequences from GenBank were also included: five as outgroup (*Candoia*, *Eunectes*, *Epicrates*, *Corallus*, and *Charina*) and four to ingroup (*B. constrictor* spp.). Phylogenies were reconstructed using Maximum Parsimony, Maximum Likelihood and Bayesian inference. Our results recovered *Boa* as monophyletic. Three main groups were recovered in all analyses: one from Central America (*B. c. imperator*, *B. c. longicauda*, *B. c. sabogae*); one from Brazil (*B. c. constrictor* and *B. c. amarali*); and one from Argentina (*B. c. occidentalis*). ML recovered *B. c. occidentalis* as the sister-group of the Central America clade, but MP/BI recovered it as the sister-group of the Brazilian lineage. In the latter, three clades were recovered: the first has individuals from Atlantic Forest and transition areas of Caatinga; the second grouped Amazonian individuals (both correspond to the geographic distribution described for *B. c. constrictor* and *B. c. amarali*, respectively); the third however recovered individuals from all biomes in a polytomy. This preliminary arrangement could be attributed to incomplete lineage sorting and/or relatively small sample size and geographical gaps. Supported by Grants: CAPES, FAPESP, FAPERJ.

0272 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

Jhan-Wei Lin, Pei-Jen Shaner, Si-Min Lin

Department of Life Science, National Taiwan Normal University, TaiPei, Taiwan

Survival cost of reproduction in the green spotted grass lizard *Takydromus viridipunctatus*: interplay among testosterone, immunity and parasitism

The tradeoff between reproduction and survival is a central theme in life-history theory. For male vertebrates, survival cost of reproduction may be mediated through testosterone level: a high level of testosterone reinforces secondary sexual traits and mating performance; at the same time, it induces parasitism through immunosuppression. A long-term capture-mark-recapture (CMR) study of a population of the green spotted grass lizard *Takydromus viridipunctatus* in northern Taiwan provided an extremely large CMR data set with approximately 10,000 unique individuals. Based on this dataset, we found that males with larger area of nuptial color had higher intensity of parasitism and suffered a sharper decline in survival with increasing parasite loads. We then performed a physiological experiment on 60 male lizards with hormone treatment to test the effects of testosterone on: (1) nuptial color, (2) activity, (3) hemipenes and (4) immunity. We found that the male lizards receiving the testosterone treatment had increased areas of nuptial color, higher activity levels and larger hemipenes; at the same time, they showed decreased immune function. Our results suggest that the level of testosterone in male *T. viridipunctatus* mediates the tradeoff between reproduction and survival.

0273 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Yen-Po Lin¹, Hui-Yun Tseng^{2, 3}, Jhan-Wei Lin¹, Si-Min Lin¹

¹Department of Life Science, National Taiwan Normal University, Taipei, Taiwan,

²Department of Life Science, Tunghai University, Taichung, Taiwan, ³Department of Zoology, National Museum of Natural Science, Taichung, Taiwan

Inter- and intra-island differentiation: A case from Japanese Treefrog widely distributed in Ryukyu and Taiwan

East Asian Islands, comprising Ryukyu Archipelago and Taiwan, are characterized for their repetitive connection pattern during geographic history. These islands provide an excellent opportunity to test the influence of historical geological events on current phylogeographic pattern. On other hand, Taiwan, as the biggest island around this region, is characterized by its extremely diverse variation in topography and climate within fine scale. With a throughout distribution in Ryukyu and Taiwan, the Japanese Tree Frog (*Buergeria japonica*, Amphibia: Rhacophoridae) provides a good model to examine inter-and intra- island genetic divergence pattern. In this study, a total of 744 *B. japonica* were sampled from 31 and 10 populations in Taiwan and the Ryukyus, respectively. We sequenced mitochondrial cytochrome b and two nuclear loci (rag-1, rag-2) to reconstruct phylogenetic relationships of *B. japonica* across this region. Phylogenetic analysis indicated six major clades, respectively distributed in Amami group, Okinawa group, Yaeyama group, north-western Taiwan, south-western Taiwan and eastern Taiwan. The results indicated that the ocean has served as a major dispersal barrier and caused substantial genetic differentiation among Ryukyu island groups due to vicariant events. The result of phylogenetic tree and genetic landscape indicated that populations in Taiwan could be divided into three major clades, with the north-western closely related to the Yaeyama population and did not group with other clades within the island. In conclusion, the phylogeographic pattern of *B. japonica* is influenced by historical vicariance events and restricted ability of overseas dispersal among island groups of Ryukyu and Taiwan.

**0279 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013; ASIH STORER
HERPETOLOGY AWARD**

Craig Lind, Steven Beaupre

University of Arkansas, Fayetteville, AR, USA

**The Reproductive Ecology of the Timber Rattlesnake, *Crotalus horridus*, in
Northwest Arkansas**

We describe the reproductive ecology of timber rattlesnakes, *Crotalus horridus*, from an Ozark Mountain population in northwest AR. Our Ozark population displays a similar reproductive pattern and mating system (i.e. a type II vitellogenic pattern, late summer mating season, and mate search polygyny) to other studied populations. However, northwest AR females produce smaller litters less frequently than populations studied elsewhere. Snakes at our site appear to be resource limited, and many individuals in the study were in poor body condition (measured as the residual of a log-mass vs. log-SVL regression). Males and females in poor condition engaged in less reproductive behavior compared to individuals in good condition. Less than annual reproduction in female rattlesnakes has been widely reported for a variety of species, but males are typically assumed to attempt reproduction annually. Preliminary data suggest that male timber rattlesnakes in northwest AR may forgo engaging in reproductive behaviors in years of poor resource acquisition (i.e. when in poor body condition at the onset of the breeding season). Whether low condition males also forgo the physiological processes associated with reproduction (e.g. elevated androgens and spermatogenesis) requires further study and is the subject of ongoing projects in our lab.

**0205 SSAR SEIBERT ECOLOGY I (not competing), Brazos, Thursday 11 July
2013**

Peter V. Lindeman, Stacy L. McFadden, Amy K. Fehrenbach

Edinboro University of Pennsylvania, Edinboro, PA, USA

**Life-History Variation in the Sabine Map Turtle (*Graptemys sabinensis*)
Across Three River Drainages**

The Sabine map turtle (*Graptemys sabinensis*) occurs in the Sabine, Calcasieu, and Mermentau river drainages of Louisiana and Texas. The few studies of its ecology to date have concerned populations of the Sabine and upper Calcasieu drainages, where moderate currents and numerous sandbars occur. Data from these areas suggest that *G. sabinensis* is among the smallest of the 14 species of *Graptemys* and has the smallest clutch sizes, typically just 2-3 eggs. River reaches in the Mermentau and lower Calcasieu drainages have almost no gradient with little perceptible current and no sandbars and

we found them to have much larger *G. sabinensis*. Plastron lengths in the lower Calcasieu and Mermentau were similar (males to 99 mm, females to 189 mm), but specimens from the upper Calcasieu were much smaller (to 77 and 125 mm for males and females, respectively) and museum specimens from the Sabine show a range of body sizes similar to those in the upper Calcasieu (males to 91 mm and females to 176 mm, but most <130 mm). Literature reports of clutch size (2-4 eggs) are from small-bodied populations in the Sabine and upper Calcasieu; we found clutch sizes up to 7 eggs in both the lower Calcasieu and Mermentau, where females were considerably larger. Smaller body size in faster-flowing, sandbar-dominated reaches appears to be a widespread but little-appreciated aspect of *Graptemys* ecology, given results for at least three other species. This consistent pattern may indicate reduced prey base and productivity in faster-flowing southern rivers.

0692 SSAR EVOLUTION, SYSTEMATICS, AND GENETICS BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Deidre Linden, Steven Poe

University of New Mexico, Albuquerque, NM, USA

Estimation of phylogeny of the *Anolis cupreus* (Squamata: Dactyloidae) species group

The *Anolis cupreus* species group of Savage and Guyer (1989) includes *Anolis cupreus* (Hallowell 1860), which encompassed *A. c. hoffmani*, *A. c. spilomelas* (Hallowell 1860), *Anolis c. dariense* (Fitch and Seigel 1984), and *Anolis c. macrophallus* (Werner 1917) at that time; *Anolis dollfusianus* (Bocourt 1873) and *Anolis villai* (Fitch and Henderson 1976). Two of the four subspecies (*A. c. dariense* and *A. c. macrophallus*) have been elevated to species status (Köhler, Günther and Kreutz 1999). We add *A. yoroensis*, which, subsequent to the Savage and Guyer treatment, was diagnosed relative to *A. cupreus* due to its similarity with this species. The members of this species group are distinguished by male dewlap color, the condition of the nasal scale, dorsal coloration, and scale counts (Hallowell 1860; Fitch, Echelle and Echelle 1972; Savage 2002; Kohler 2008). Species of the *A. cupreus* species group are found in Costa Rica, Honduras, Nicaragua, El Salvador, parts of southern Mexico, and southeastern Guatemala (Stuart 1955; Fitch, Echelle and Echelle 1972; Fitch and Seigel 1984; Nicholson, McCranie and Kohler 2000). Previous authors have evaluated the relationships of *A. cupreus* to other anoles in Central America based on morphological data (Fitch, Echelle and Echelle 1972; Poe 2004) and molecular techniques (Nicholson 2002; Nicholson et al. 2005), but no other *cupreus* group species have been included in phylogenetic analyses. We use mitochondrial and nuclear gene sequence data to estimate relationships among the *Anolis cupreus* species group of Central America and test the monophyly of this previously informally recognized group.

0171 Herp Systematics, San Miguel, Friday 12 July 2013

Charles Linkem

University of Washington, Seattle, Washington, USA

Can phylogenomics provide resolution to the skink tree of life?

Molecular phylogenies of scincid lizards have failed to resolve relationships at the base of the tree, or have provided conflicting resolutions among genes sampled. Resolving these relationships is critical to our understanding of early skink morphological evolution and biogeography. This study uses next-generation sequencing of genes flanking ultraconserved elements to determine if resolution at the base of the scincid tree is obtainable.

0135 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

Long-term Study Reveals Decline in a Spotted Turtle (*Clemmys guttata*) Population in a Relatively Pristine Environment

Long-term data are essential for elucidating patterns in population parameters for long-lived species and are invaluable for monitoring species at risk. A Spotted Turtle (*Clemmys guttata*) metapopulation in central Ontario, Canada, has been studied using mark-recapture surveys since 1977 (37 years), including two radio telemetry studies (1993-95 and 2005-06). A total of 222 turtles have been marked. The study site is relatively pristine with no roads or houses, although it is surrounded by cottages, camps and boat traffic, and these human impacts have recently increased. Spring survey data indicate an acute reduction in population size between 1999 and 2000. Despite no appreciable changes in search effort, the numbers of turtles captured during spring surveys and the estimated population size have declined to approximately half of former numbers. There has been no apparent recovery as the number of turtles captured during spring surveys has remained consistent and low for the past 12 years. There are at least three possible hypotheses to explain the decline: H1) a localized poaching event; H2) a localized mass mortality event (e.g., during hibernation); or H3) a sudden habitat change that caused dispersal. In 2000, beaver flooded the main deme and the number of turtles captured in that site has declined from ~10 to zero; however, most of these turtles have not been found in other demes suggesting that emigration was not successful. Observational evidence to support and refute each hypothesis will be presented, and the implications for conservation of this endangered species will be discussed.

**0684 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday
13 July 2013**

J. Andrés López^{1,2}, Matthew Campbell¹

¹*University of Alaska Museum, University of Alaska Fairbanks, Fairbanks, AK, USA,*

²*School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, AK, USA*

EToL: Comparative molecular evolution of protein-coding regions in euteleosts

The number of putatively homologous DNA sequence alignments with representation from diverse fish lineages is rapidly increasing thanks to advances in genome manipulation techniques and the continued interest in producing well-corroborated estimates of phylogeny. The Euteleost Tree of Life collaborative has assembled DNA sequence data from 20 protein-coding regions to test existing hypotheses of relationships among major euteleostean lineages. These datasets present new opportunities to characterize the evolutionary processes that shape diversity at the levels of the coding sequence and its amino acid translation. We contrast patterns of divergence, base composition, base substitution rates, among site divergence rate variability and non-synonymous change in euteleosts across 20 gene fragments. Among the gene regions examined, we identified strong differences in uncorrected divergence (>2-fold) and base composition. These differences are correlated with variation in inferred substitution rates as well as heterogeneity of substitution rates among sites within genes and between genes. Our results highlight the importance of further developing and using methods of phylogenetic inference that can account for a molecular evolution process that has variable characteristics within and between genes.

0174 NIA Oral Papers, Doña Ana/Cimarron, Monday 15 July 2013

Hernan Lopez-Fernandez¹, Karen Alofs², Elford Liverpool⁴, Calvin Bernard³, Donald Taphorn¹

¹Royal Ontario Museum, Toronto, Ontario, Canada, ²University of Toronto, Toronto, Ontario, Canada, ³University of Guyana, Georgetown, Guyana, ⁴Guyana National Museum, Georgetown, Guyana

Endemic fishes of the upper Mazaruni river basin, Guyana: the importance of exploration and discovery in assessing conservation priorities for freshwater fish

Freshwater fish biodiversity is increasingly threatened but poorly understood. Biodiversity conservation efforts often focus on areas of high species richness and endemism. Yet, our understanding of patterns of biodiversity in Neotropical freshwater fish is potentially biased by a lack of exploration in relatively inaccessible locations. Highly isolated and underexplored fish faunas are likely to be underestimated centers of endemism. The upper Mazaruni River drainage is hydrogeographically and climatically separated from the rest of the Essequibo Basin. Three ichthyological expeditions to the upper Mazaruni revealed up to 32 species previously unknown to science and a fish fauna with perhaps the highest rate of endemism of any known in the Neotropics. Unfortunately, this unique fauna is threatened by habitat degradation from gold-mining which is clearly altering the main channel of the upper Mazaruni River. The fishes of the upper Mazaruni represent a highly endemic but vulnerable fauna which demands immediate protection.

0592 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Caleb Loughran, Daniel Beck

Central Washington University, Ellensburg, WA, USA

Ontogenetic Variation in the Thermal Biology of Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*)

The strong size discrepancy between adults and neonates within many species of ectotherms results in drastically different rates of heating and cooling. For squamate reptiles, this may have important consequences for how individuals regulate their body temperature in nature. We hypothesized that since neonate snakes can heat and cool faster than adult snakes they would have more variation in body temperatures and may therefore show different thermal preferences than adult snakes. To test this hypothesis we investigated thermal preferences of neonate and adult Northern Pacific Rattlesnakes in a laboratory thermal gradient at temperatures ranging from 10°C to 35°C. Hide boxes

were placed (at intervals of 5°C) throughout the gradient to offer snakes refugia at a range of temperatures. Snake body temperatures were recorded throughout the day using an infrared thermometer and behaviors associated with recorded body temperatures were also recorded. Neonate snakes had a broader range of body temperatures than did adults and were also active more often than adult snakes, using a wider range of locations throughout the gradient. These differences suggest that the thermal biology of neonate rattlesnakes differs from that of adults, which appears to translate into differences in behavior and microhabitat use. The ecological implications for these differences are important for each age class, as they may result in differences in activity patterns, movements, and habitat use. Field studies to corroborate these findings are currently underway.

0389 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Caleb Loughran, Debbie Lewis, Robert Weaver

Central Washington University, Ellensburg, WA, USA

Chemical Cues Allow for Recognition of Conspecifics by Neonate Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*)

Neonate rattlesnakes are usually born away from the mother's hibernacula. To overwinter they must find their way to suitable thermal refugia, often arriving at the same communal hibernaculum as their mother. It is assumed they find their way to hibernacula by scent-trailing conspecifics. However, neonates may be exposed to confounding odors influencing decision making when navigating to these dens. We used 10 neonate Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*) to test the hypothesis that neonates recognize conspecific scents when compared to scents of heterospecific snake species. A 15 cm cotton swab was used to collect snake odors, and placed 2 cm in front of the neonate's snout. We recorded latency period and the number of tongue flicks by a snake in response to stimulus odors for 60 sec. For conspecific scents, we used three different adult *C. oreganus* from the same hibernaculum as the mother snake. For heterospecific scents, we used three other sympatric species, (*Coluber constrictor*), (*Pituophis catanifer*), and (*Hypsiglena cholorphea*). Preliminary analysis indicates a pattern of conspecific recognition. The average latency time for tongue flicking to rattlesnake scents appeared lower than heterospecific scents. Additionally, the average number of tongue flicks in response to rattlesnake scents appeared to be higher than other scents.

**0124 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Jeffrey Lovich¹, Joshua Ennen²

¹*U.S. Geological Survey, Flagstaff, Arizona, USA,* ²*University of Tennessee, TN-SCORE, USA*

**Renewable energy development and terrestrial and aquatic wildlife
conservation: the new frontier**

Renewable energy development is experiencing a renaissance particularly in the Desert Southwest United States where wind and especially solar energy potential is high. The region is characterized by high biodiversity including threatened and sensitive species like Agassiz's desert tortoise. We surveyed the peer-reviewed scientific literature for information on the known and potential effects of utility-scale renewable energy development (USRED) and operation on non-volant terrestrial and aquatic wildlife. In comparison to the large body of literature on the effects of wind energy facilities on birds and bats, very little is available to evaluate the effects of wind or solar facilities on other wildlife. We found only 1 publication for solar and 16 papers for wind energy, only 5 of which focused on Agassiz's desert tortoise. Effects due to construction and eventual decommissioning of utility-scale renewable energy facilities include direct mortality, environmental impacts of fugitive dust and dust-suppressants, destruction and modification of habitat including impacts of roads, and offsite impacts related to construction material acquisition, processing and transportation. Known and potential effects due to operation and maintenance of facilities include habitat fragmentation and barriers to gene flow, as well as effects due to noise, vibration, electromagnetic field generation, microclimate change, pollutant spills, water consumption, predator attraction, and increased fire risk. Basic information is lacking on facility design effects, the efficacy of site selection criteria, and the cumulative effects of USRED on wildlife populations. Empirical data are currently deficient to determine the specific effects of USRED on most wildlife species.

0329 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Kim Lovich

San Diego Zoo Global, California, USA

An Historical Look at Reptile and Amphibian Confiscations at the San Diego Zoo - Collaborative Efforts Between Agencies and Zoos for Species Conservation.

The Zoological Society of San Diego has a long history of accepting confiscated and abandoned reptiles and amphibians from various governmental enforcement agencies. Working with local, state and federal agencies to accommodate these confiscations is a priority for many zoological institutions including San Diego. Zoos help provide veterinary and husbandry expertise, provide triage emergency health care, long term housing, and temporary care for the animals involved as these cases are carried through the legal process. Although exact locality data is often lacking on these animal specimens, a general understanding of the region and particularly if the animals are wild caught, they can provide valuable genetics to captive breeding program species. At times large groups can become the bases for whole assurance colonies of threatened species and depending on the species and individual specimens, some can become ambassador animals used to educate the public on the importance of wildlife regulations and how smuggling can greatly impact the conservation of imperiled species. In this presentation I examine the historical animal records at the San Diego Zoo and review trends in species accepted over the years as well as numbers of reptiles and amphibians accepted into our collection from confiscations. As the global demand for reptile and amphibian trade increases the San Diego Zoo hopes to continue to provide husbandry and welfare expertise to our various partner agencies as they strive to enforce regulations geared toward conserving ever increasing threatened species.

0338 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Robert E. Lovich¹, Daniel J. Leavitt²

¹*Naval Facilities Engineering Command SW, San Diego, CA, USA*, ²*Arizona Game and Fish Department, Phoenix, AZ, USA*

The Flat-tailed Horned Lizard (*Phrynosoma mcallii*) Monitoring and Management Strategy

The flat-tailed horned lizard (*Phrynosoma mcallii*; FTHL) has the smallest range of all horned lizards in the United States. Restricted to lower Sonoran desert habitats of the states of California, Arizona, and Baja California, in the United States and Mexico

respectively, this species has been the target of research studies and conservation actions for multiple decades. Increasing threats to the long-term survival of this species persist, and challenge the long-term persistence of this species throughout its range. These challenges require rigorous, up-to-date, and accurate status information essential to successful management of FTHL. In order to better understand the abundance and population status for FTHL species across its range, a Rangewide Management Strategy was adopted by major stakeholders for this species in 1997. All of the stakeholders have invested in annual monitoring, which has resulted in a substantial dataset for this species. Herein, we present a cumulative analysis on the demographic and occupancy monitoring methods for the Flat-tailed Horned Lizard through time, with recommendations on future monitoring strategies and management actions.

0278 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, Doña Ana/Cimarron, Thursday 11 July 2013

Benjamin Lowe¹, Kenneth Kozak²

¹*Department of Ecology, Evolution, and Behavior, St. Paul, Minnesota, USA,* ²*Bell Museum of Natural History and Department of Fisheries, Wildlife & Conservation Biology, St. Paul, Minnesota, USA*

Assortative Mating in Hybridizing Southern Appalachian *Plethodon* and Implications for Hybrid Zone Dynamics

Hybrid zones represent model systems for studying the causes and consequences of gene exchange between closely related evolutionary lineages. The salamanders *Plethodon shermani* and *P. teyahalee* replace each other elevationally across several mountain ranges, but hybridize where they come in contact. Genetic, geographic, and life-history data, however, suggest that these two species are not in the process of merging into a single lineage. Potential factors preventing merger include genetic incompatibility, natural selection imposed by divergent ecological conditions, and behavioral isolation. To test the hypothesis that behavioral isolation maintains species limits in these salamanders, we performed courtship trials with individuals collected from opposite ends of four geographically disparate contact zones. We subjected male salamanders to overnight, “no-choice” trials with con- or heterospecific female salamanders, and evaluated whether courtship/mating took place the following morning. From these data, we estimated reproductive isolation (I_{PSI}) and tested for correlations with hybrid zone width (determined using genetic data and cline-fitting software) and genetic divergence across hybrid zones. In total, we conducted 1673 courtship trials. We found considerable variation in the degree of reproductive isolation among contact zones, and the degree of reproductive isolation was related to hybrid zone width. Our findings support the hypothesis that courtship/mating behavior facilitates reproductive isolation in this system and may be responsible for maintaining species limits.

0286 SSAR SEIBERT AWARD CONSERVATION, Galisteo/Aztec, Friday 12 July 2013

Tara Luckau¹, Robert Fisher², Rulon Clark¹

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Comparative Population Genetics of Two Species of Co-Distributed Lizards, *Sceloporus occidentalis* and *Aspidoscelis hyperythra*

The degree to which habitat fragmentation may lead to population fragmentation via reduced gene flow depends on both landscape features and taxa-specific traits. We assessed the population genetic patterns of two co-distributed species of lizards in San Diego County, California. These species differ in various life history traits: the western fence lizard, *Sceloporus occidentalis*, is a territorial sit-and-wait forager while the orange-throated whiptail, *Aspidoscelis hyperythra*, is a non-territorial active forager. Based on a review of the literature, we characterized each species' foraging strategy, territoriality, home range size, vagility and habitat specialization to address the potential impact of species-specific behavioral differences on population genetic structure. We used presence of roads, straight-line distance and habitat suitability to address the potential impact of landscape features on population genetic structure. Through collaborations with both federal and state governmental agencies, tissues were collected at five locations throughout the county. Using primers published in previous studies, we amplified thirteen microsatellite loci for *S. occidentalis* and twelve microsatellite loci for *A. hyperythra*. We then generated various genetic and geographic pairwise distance matrices for input into partial Mantel tests, which assess correlations between two variables while controlling for a third. Results of this study will be discussed. In addition to providing general population genetic information for these two species in San Diego County, the results of this research provide a comparative approach to assess the effects of both anthropogenic impacts and life history traits on these lizards and will inform wildlife management and mitigation decisions for these species.

**0075 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Bill Ludt¹, Prosanta Chakrabarty¹, Luiz Rocha²

¹Louisiana State University, Baton Rouge, LA, USA, ²California Academy of Sciences, San Francisco, CA, USA

Relationships within the surgeonfish genus *Prionurus* with comments on biogeography and evolutionary history

The surgeonfish family Acanthuridae contains six genera with approximately 80 species. One of these genera, *Prionurus*, has a notable distribution and is poorly studied. While the vast majority of surgeonfishes are tropical, most species within *Prionurus* have anti-tropical distributions, or are restricted to cold-water upwelling areas. Within *Prionurus* there are six species distributed in the Indian and Pacific Oceans and one species, *P. biafraensis*, in the Eastern Atlantic. There have been several previous studies examining the relationships among genera within Acanthuridae, however most of these studies have only included one or two species within the genus *Prionurus*. Here we present the evolutionary relationships within this genus using both mitochondrial and nuclear DNA to discuss this lineages biogeographic and phylogenetic history.

0165 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Carl Luer¹, Cathy Walsh¹, Courtney Bennett¹, Jennifer Wyffels², Laura Edsberg²

¹Mote Marine Laboratory, Sarasota, FL 34236, USA, ²Daemen College Center for Wound Healing Research, Amherst, NY 14226, USA

Experimental Wounding and Preliminary Characterization of the Healing Response in the Atlantic Stingray, *Dasyatis Sabina*

Wounds are commonly observed in elasmobranch fishes, yet evidence of infection, necrotic tissue and keloid scarring are notably absent. The protective secretion produced by epidermal mucus cells in Atlantic stingrays (*Dasyatis sabina*) is being investigated to identify mucus-associated antimicrobial compounds and their potential role in the infection-free healing of wounds. Circular wounds 1.0 cm in diameter were inflicted, penetrating the epidermal and dermal layers of the skin, and exposing the underlying epaxial musculature. At regular intervals, digital photographs were taken to document the gross physical changes associated with the progression of wound healing. In all experimental wounding studies to date, infection-free healing in the form of scar tissue across the wound is effectively complete in approximately six weeks. With visual inspection and digital photography, a remarkably consistent observation is the appearance of slightly raised fibrous tissue in the center of wounds after approximately

three weeks of healing which gradually flattens and spreads to the wound margins, forming uniform scar tissue across the wound. Preliminary histological examination of biopsied wounds and surrounding tissue after eight weeks of healing indicates that the wound epidermis remains distinct from the unwounded skin with respect to its pigmentation and allows the wound margin to be identified in the fixed tissue and prepared histological sections. While the wound is not fully restructured with pigmented cells, mucus cells are abundant in the hypertrophied epidermis. Wound studies designed to characterize histological changes and healing biomarkers associated with the formation and dissipation of the centralized fibrous tissue are underway.

0441 AES Ecology, Mesilla, Thursday 11 July 2013

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Estimating the geographic range of a threatened shark in a data-poor region: *Cetorhinus maximus* in the South Atlantic Ocean

The basking shark, *Cetorhinus maximus*, is widely distributed in temperate regions of all oceans except the Indian Ocean. In the southern hemisphere there is a large gap in the information on distribution, especially in the South Atlantic. We compiled all the records of basking sharks in the South Atlantic and used them in a recently developed tool for estimating geographic ranges of species, maximum-entropy distribution modelling (MaxEnt). Basking sharks records used in this study came from different sources: for the southwest Atlantic from scientific literature providing occurrence data, and the database of Onboard Fishery Observers Program of the Instituto Nacional de Investigación y Desarrollo Pesquero (Argentina); for the southeast Atlantic, the data came from the databases of the Fish Collection and the Shark Collection of the Iziko South African Museum, accessed from <http://www.gbif.org/>. Environmental data used as predictors were obtained from the Bio-Oracle database. Occurrence and environmental data were used in MaxEnt models. The model that best fit the data included four variables: chlorophyll minimum concentration, dissolved oxygen concentration, salinity, and sea surface temperature range. Our results indicated that basking sharks inhabit temperate to subtropical continental shelf waters. In the southeast Atlantic, basking sharks inhabited the cool waters from off southern South Africa to northern Namibia, and were absent in the subtropical waters off KwaZulu-Natal (South Africa). In the southwest Atlantic, basking sharks occurred on continental shelves from off Tierra del Fuego

(Argentina) to off Rio de Janeiro (Brazil), being absent from waters north of Rio de Janeiro.

0676 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Daniel Lumbantobing

University of Florida, Gainesville, FL, USA

Variation in the Gill Arch of the Subfamily Danioninae (Teleostei; Cyprinidae)

Danioninae, with approximately 320 species in 51 genera, is one of the most species-rich teleost subfamilies. Despite such diversity and the growing interest in the biology of some of its members, little is known about the morphology of these fishes and its significance for the systematics of the group. The osteological aspects of the gill arch in 32 species of the subfamily Danioninae, representing 21 valid genera, have been studied. As outgroup taxa, five species of four non-danionine subfamilies were also examined. The danionine gill arch shows remarkably high structural diversity, as demonstrated by 16 variable characters, 11 of which are described herein for the first time. Danioninae is uniquely diagnosed by the presence of a cartilaginous fifth epibranchial with a ventral tip articulating only with the posteroventral edge of the fourth epibranchial. In contrast, the cartilaginous fifth epibranchial in all outgroup taxa is ventrally associated not only with the fourth epibranchial, but also with the cartilaginous dorsal tip of the fourth ceratobranchial. Given the presence of a danionine epibranchial articulation in *Sundadanio*, this enigmatic genus is classified in Danioninae, regardless of conflicting and poorly resolved topologies of published molecular trees. The rasborin process *sensu* Liao *et al.* (2010) is confirmed as a synapomorphy that supports the monophyly of the tribe Rasborini. Several novel osteological structures in the gill arch unique to some other danionine taxa were also discovered, particularly in genera that exhibit highly evolved modifications of feeding behavior, such as *Amblypharyngodon*, *Esomus*, *Pectenocypris*, and *Raiamas*.

0105 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

John Lundberg¹, Kyle Luckenbill¹, K. K. Subhash Babu², Heok Hee Ng³

¹Academy of Natural Sciences, Philadelphia, PA, USA, ²University of Jimma, Jimma, Ethiopia, ³Raffles Museum of Biodiversity Research, Singapore, Singapore

A First Phylogenetic Reading of the Skin and Bones of another Enigmatic Catfish: *Kryptoglanis shajii* Vincent & Thomas, 2011 (Siluriformes, *incertae sedis*)

Our post-*All-Catfish-Species-Inventory* world was introduced to another puzzling siluriform with Vincent & Thomas's 2011 description of *Kryptoglanis shajii*. Monotypic *Kryptoglanis* is a small catfish from subterranean waters in southwestern India. Externally *Kryptoglanis* was diagnosed by absences of dorsal fin and pectoral-fin spines; presence of four pairs of barbels, upturned mouth, subcutaneous eyes, and confluence of anal and caudal fins. Little information on internal morphology was reported. The authors were unable to place *Kryptoglanis* in a recognized family; this taxon remains *incertae sedis* among siluriforms. We use preserved specimens, radiographs and a high-resolution CTscan of *Kryptoglanis* to compare its external morphology and skeleton to other catfishes, and to assess its phylogenetic position. Morphology places *Kryptoglanis* within the large multi-family clade of non-cetopsid siluroid catfishes. *Kryptoglanis* is uniquely characterized by three pairs of elongate processes on the compound Weberian centrum extending anteriorly to the occiput and posteriorly to below centrum 5. *Kryptoglanis* exhibits a "nodular," greatly shortened autopalatine that matches a synapomorphy of family Siluridae. *Kryptoglanis* and Siluridae also share ambiguously apomorphic reductions of the dorsal fin, elongated anal fins, and lack of interlocking coracoid symphyses. *Kryptoglanis* does not manifest two diagnostic synapomorphies of Siluridae (lateral ethmoid - sphenotic contact; direct articulations of anal-fin rays with their following proximal radials), and conditions of two other silurid synapomorphies are uncertain (loss of dorsal-fin distal radials, and antero-posterior compression of the ossified transscapular ligament). Membership of *Kryptoglanis* within Siluridae s.s. is contraindicated by its well developed nasal barbels (vs. nasal barbels absent in Siluridae).

**0107 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Dustin Lynch, Daniel Magoulick

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Distribution and Abundance of the Endangered Yellowcheek Darter in the Little Red River Drainage of Arkansas

The yellowcheek darter (*Etheostoma moorei*) is a rare, endemic fish with a geographically restricted range, found only in the Little Red River in the Boston Mountains of Arkansas. The species was listed in 2011 as federally endangered. Yellowcheek darter populations have declined due, in part, to intense seasonal stream drying and inundation of lower reaches by construction of a reservoir. We used a kick seine sampling approach to examine distribution and abundance of yellowcheek darter populations in the Middle Fork and South Fork Little Red River. We used yellowcheek darter presence data to estimate occupancy rates and detection probability and examined relationships between yellowcheek darter density and environmental variables. Occupancy rates were >0.6 but with high 95%CI, and where the darters occurred densities were typical of other Ozark darters but highly variable. Detection probability and density were positively related to current velocity. Yellowcheek darters were present at five Middle Fork and South Fork sites that had yellowcheek darters in 2003-2004. Given that stream drying has become more extreme over the past 30 years and anthropogenic threats have increased, regular monitoring and active management may be required to reduce extinction risk of yellowcheek darter populations.

0231 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Kady Lyons, Christopher Lowe

California State University, Long Beach, CA, USA

Quantification of Maternal Offloading of Organic Contaminants in a Histotrophic Elasmobranch the Round Stingray (*Urobatis halleri*)

Maternal offloading is one route by which animals may bioaccumulate persistent organic pollutants, such as DDT and PCBs. However, this process has not been well documented in elasmobranchs, despite the important roles they play in maintaining communities. The round stingray (*Urobatis halleri*) represents a good model to examine maternal offloading processes due to their high local abundance and use of contaminated nearshore systems. Ovulated and near-term pregnant female stingrays

were sampled from several local estuaries in southern California and organic contaminants were measured in the ova and embryonic tissues and compared to levels measured in corresponding female livers to determine route of and extent of transfer. Total organic contaminant loads measured in ovulated eggs were significantly lower than levels measured in embryos (132.84 ± 58.23 ng/egg versus 438.66 ± 301.64 ng/embryo; $p < 0.001$) indicating females have the ability to transfer contaminants throughout pregnancy. In addition, contaminant loads measured in pups showed a positive relationship with female contaminant concentrations ($p < 0.001$). However, females offloaded relatively low percentages of their total contaminant loads ($1.5 \pm 1.7\%$) compared to other species. Therefore, variation in reproductive modes utilized by elasmobranchs will likely influence the extent to which females may maternally offload contaminants.

0023 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Kohji Mabuchi¹, Thomas Fraser^{2,3}, Hayeun Song¹, Mutsumi Nishida¹

¹*Atmosphere and Ocean Research Institute, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8564, Japan*, ²*Florida Museum of Natural History, University of Florida, Dickinson Hall, Museum Road, Gainesville, Florida, 32611, USA*, ³*Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, Florida 34236, USA*

Molecular phylogeny of the cardinalfishes (Percomorpha: Apogonidae): revisions for genus/subgenus systematics

Cardinalfishes, one of the numerically dominant reef fish families, are mostly nocturnal. The family has 505 nominal species, 348 as valid species, most documented mouthbrooders. There are 69 nominal genera/subgenera with less than half as valid genera/subgenera. *Apogon*, sensu lato, has been the default genus, with 163 to 200 recognized species in 10 subgenera proposed in 1972. A few authors elevated some subgenera to genera following an unpublished doctoral dissertation on the cephalic lateralis system in 2004. A molecular paper in 2006 supported the non-monophyletic nature for the subgenus *Ostorhinchus*, while *Apogon*, sensu lato, had some other lineages poorly represented. Based on morphological characters, about 30 species formerly in *Apogon* have been placed in *Nectamia* and *Apogonichthyoides* in 2008 and 2010. We conducted a molecular phylogenetic analysis using about 130 species representing about 17 genera. Over seventy species of *Apogon*, sensu lato, representing about 13 lineages, were included in this study. The monophyly of *Apogon* was evaluated phylogenetically based on mitochondrial and nuclear DNA sequence data. Preliminary molecular phylogeny inferred by Bayesian method based on ca. 1500bp of mitochondrially encoded 12S and 16S rRNA genes demonstrated that *Apogon* was polyphyletic with over 10 well-supported monophyletic groups being recognized. Some of the monophyletic groups corresponded to existing subgenera (e.g., *Pristiapogon*, *Zoramia*). Some species in *Apogon* and *Ostorhinchus* were divided into multiple independent groups, often forming well-supported monophyletic groups with non-*Apogon*, sensu stricto, species. There is

general concordance with morphological evidence supporting systematic revisions within the family.

0617 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Ian Macdonald¹, Lara Ferry², Adam Summers³, Alice Gibb¹

¹*Northern Arizona University, Flagstaff, AZ, USA*, ²*Arizona State University, Tempe, AZ, USA*, ³*University Of Washington, Friday Harbor, WA, USA*

Burial kinematics of the Pacific sandfish: is the two-phase respiratory pump used for rapid burial?

Many fishes use burial as a mode of crypsis in order to ambush prey or avoid predators. Sandfish descend abdomen first into the substrate while producing cyclical, dorso-ventral movements of the head and tail. Based on preliminary observations, we suspected that movements of the head assist in sandfish burial. We recorded burial events using high-speed videography and quantified kinematic variables from 5 individuals. A typical burial cycle begins when the cranium rotates dorsally and the mouth opens (increased gape). Mouth-gape peaks just before maximum rotation of the cranium and the operculae are adducted as the cranium rotates ventrally; the body of the fish descends into the substrate in pulses that are synchronous with ventral rotation of the cranium. We interpret this pattern as follows: the head is rotated dorsally and the mouth is opened to facilitate the intake of a bolus of water, and then rotated ventrally as the water is forced out of the opercular chamber and into the substrate. By forcing water into the substrate, the sandfish can decrease cohesive forces between the sand grains, which should enable the sand to behave like a fluid. Once the sand is fluidized, the mass of the body can easily descend into the fluidized substrate. The pulsatory nature of descent into the substrate, as well as the cyclic movements of mouth-opening and opercular-adduction suggests that burying behavior may be an exaptation of the two-phase respiratory pump that is common to most teleost fishes.

0100 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Taís Machado¹, Vinícius X. Silva², Maria J. J. Silva¹

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Phylogeography of *Bothrops neuwiedi*: Highly Structured Populations and Recent Demographic Expansion in the Brazilian Pitviper

Bothrops neuwiedi used to be considered as a species complex widely distributed in South America. After a taxonomic review, such species distribution was limited to the East Brazilian Mountains. Previous analyses based on mitochondrial genes showed *B. neuwiedi* as polyphyletic recovered in three clades of the East-West lineage: clade A grouped *B. neuwiedi* and *B. marmoratus*; clade B comprised exclusively of *B. neuwiedi*; and clade C grouped *B. neuwiedi* and *B. pauloensis*. This study aims to investigate the phylogeography of *B. neuwiedi* using 378 bp of the cytochrome b. Sequences from 100 representatives of East-West lineage were used to estimate network haplotypes, molecular diversity estimations, neutrality tests, mismatch distribution, F statistics, and molecular variance (AMOVA). For East-West lineage 29 haplotypes with high nucleotide and haplotype diversities, multimodal mismatch and significant negative values for neutrality tests were observed. Haplotypes were showed in three structured groups within East-West lineage. AMOVA revealed most of the variation among groups. Two phylogroups presented mutation-drift equilibrium, and the third presented strong support for expansion evinced by significant negative F_s value, unimodal mismatch, low raggedness value, high haplotype diversity and low nucleotide diversity. The genetic diversity of *B. neuwiedi* was not randomly distributed, indicating phylogeographic structure and signatures of demographic expansion. Phylogroups have correspondence with previous phylogenetic analyses. Sharing haplotypes occurred due to incomplete lineage sorting. Phylogeographic patterns of genetic variation within East-West lineage support the taxonomic status of *B. marmoratus*, although refute the taxonomic status *B. neuwiedi* and *B. pauloensis*. Grants: CAPES, CNPq and FAPESP.

0565 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Silvia Macia¹, Michael Robinson¹, Nancy Glass²

¹Barry University, Miami, FL, USA, ²University of West Florida, Pensacola, FL, USA

Seagrass Blowouts as Shelters for Seagrass and Reef Associated Fishes

For many benthic fishes, sheltering sites are critically important. Seagrass beds have few permanent shelters relative to other marine benthic habitats. One such potential

structure is a blowout, a region within the seagrass bed with no or thinly dispersed seagrass, and a convex, crescent-shaped vertical wall (i.e., scarp) at a clearly defined eroding edge. We describe the use of blowouts by fishes including those typically associated with coral reefs. We surveyed fishes at seven blowouts in St. Ann's Bay, Jamaica. We swam slowly along the edge of each blowout and recorded every fish within 1 m in either direction from the edge. In some cases, we recorded whether the fish was on the grass above or on the sand/under the scarp behind the leading edge. We observed 23 species from 15 different families for a total of 387 fishes. Several of them (e.g., *Chaetodon* spp., *Myripristis jacobus* and *Pomacanthus paru*) are typically reef species. The most common fishes were surgeonfishes (*Acanthurus* spp.), *Halichoeres* wrasses, squirrelfishes (*Holocentrus* spp.) and juvenile grunts (*Haemulon* spp.). Several individuals of *Sparisoma* spp. were observed. Three *Sparisoma* were observed at night, each sleeping under the overhang of the blowout. Most of the fishes were observed along the vertical edge of the scarp, but wrasses (Labridae) were more often found in the seagrass. This is the first description of the use of seagrass blowouts by many fishes. We argue that these blowouts provide shelter in an environment otherwise lacking shelters of the appropriate size.

0510 HL Detectability Symposium, Brazos, Friday 12 July 2013

Darryl MacKenzie

Proteus Wildlife Reserach Consultants, Dunedin, New Zealand

Occupancy models: not all moonbeams and sunshine

Occupancy models have become increasingly popular over the last decade, with them having been applied to a wide variety of animal taxa. Part of their appeal is that a wide range of field methods could be used to detect the target species as identification of individuals is not required. Thus, sampling protocols can be less stringent than those required to estimate abundance from mark-recapture data, for example. Occupancy models, however, are not without their limitations and have the potential to be misused when not applied in an appropriate manner. In this talk I shall discuss some of the positive, and negative aspects of occupancy models with particular focus on issues that are relevant to studies of reptiles, amphibians and fish.

0704 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Stephen Mackessy¹, Anthony Saviola¹, David Chiszar², Hobart Smith²

¹University of Northern Colorado, Greeley, CO, USA, ²University of Colorado, Boulder, Boulder, CO, USA

Chemosensory Response in Stunted Prairie Rattlesnakes *Crotalus viridis viridis*

Rattlesnakes use chemical stimuli in ambush site selection and for relocation of envenomated prey through strike-induced chemosensory searching. Shifts in responsiveness to prey chemicals have been documented in many snakes, and often correlate with prey commonly taken as snakes increase in age and size as well as geographical locations of the species. For instance, neonate rattlesnakes that prey primarily on ectotherms responded most strongly to chemical cues of commonly taken lizard prey, whereas adult rattlesnakes that prey primarily on small mammals responded significantly to chemical cues of commonly taken rodents. In the current study, 11 Prairie Rattlesnakes *Crotalus viridis viridis* which were classified as large neonates based on measures of snout-vent length (SVL) and body mass, yet chronologically were at or near adulthood, were tested for their responsiveness to chemical extracts of natural and non-natural prey items. Although the snakes had eaten only neonate lab mice (*Mus musculus*), they responded significantly more to chemical cues of natural prey items and particularly to chemical cues of prey normally taken by subadults (*Peromyscus* mice and *Sceloporus* lizard). These results suggest that ontogenetic shifts in responsiveness to natural prey chemical cues are innately programmed and are not based on body size or feeding experience in *C. v. viridis*. This does not imply, however, that growth and experience are without effects, especially with novel prey or rare prey that have experienced recent population expansion.

0037 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

John Maisey, Alan Pradel, Amy Balanoff

American Museum of Natural History, New York, NY, USA

New Fossils provide Fresh Ideas about Chondrichthyan and Gnathostome Phylogeny

Recent phylogenetic analyses have emphasized the significance of fossils in clarifying gnathostome relationships, albeit by revisiting fossils that were already known and which have been repeatedly investigated (e.g., *Ptomacanthus*, *Acanthodes*). Fresh morphological data from additional fossils are clearly desirable in order to test old hypotheses and develop new ones. We have investigated many well-preserved

Paleozoic chondrichthyans by means of computerized tomography (including synchrotron scanning) and computerized segmentation analysis. In addition, we are investigating skeletal morphology in a wide sample of modern elasmobranchs and holocephalans, utilizing CT segmentation data generated for a Chondrichthyan Tree of Life project. Our investigations suggest that modern chondrichthyans offer a misleading guide to understanding primitive gnathostome morphology. Based on new morphological evidence, we identify previously unrecognized apomorphic characters of the chondrichthyan crown group, which can be re-characterized using a combination of classical and new features. Many Paleozoic sharks can be removed from the Elasmobranchii to a position completely outside the chondrichthyan crown; the chondrichthyan total group thus includes an extremely long stem of shark-like taxa. In addition, some features of the osteichthyan cranium and visceral skeleton, previously considered apomorphic, now seem - at best - to represent crown gnathostome characters that were presumably lost along the chondrichthyan stem, prior to the divergence of euselachians and euchondrocephalans (containing crown elasmobranchs and chimaeroids respectively). These data provide an illuminating example of how morphological data obtained from fossils can overturn entrenched views about character polarity in extant taxa, in this case deep within gnathostomes.

0184 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Maria Malabarba¹, Luiz Malabarba², Hernán López-Fernández³

¹Programa de Pós-Graduação em Biologia Animal-UFRGS, Porto Alegre, RS, Brazil,

²Depto. Zoologia-UFRGS, Porto Alegre, RS, Brazil, ³ROM/University of Toronto, Toronto, Ontario, Canada

Fossils, Synapomorphies and the Times of Divergence of Neotropical Cichlids

The Lumbrera Formation is a continental unit exposed in northwestern Argentina. It includes a level, known as Faja Verde, which is interpreted as a freshwater lake deposited during the Lower-Middle Eocene (~48.6 Ma). From this level, a small fauna has been described which represents the oldest Cichlidae record and plays an essential role in the debate of times of divergence of this family. The species †*Gymnogeophagus eocenicus* was included in the living genus *Gymnogeophagus* based on two synapomorphies, lack of supraneurals and a forward spine in the first dorsal pterygiophore, where it was found as closely related to the modern *Gymnogeophagus gymnoyensis* clade. A fossil heroin, †*Plesioheros chauliodus*, was identified by the presence of enlarged canines and lingual subapical tooth cusps. A phylogenetic analysis recovered †*Plesioheros* close to *Australoheros* and deep-bodied South American heroins. Their modern morphologies demonstrate an extensive differentiation from the basal lineages and a conservatism since at least ~48.6 Ma ago. Additionally, their inclusion in modern clades makes them key calibration points for dating molecular phylogenies. †*G. eocenicus* and †*Plesioheros* provide minimum ages of divergence for two clades of Neotropical cichlids, and the strongest internal calibrations available for the family. Use

of them in a recent molecular phylogeny found the origin of cichlids to be middle Jurassic to early Cretaceous, the oldest age found through molecular studies to date. These age estimates, however, highlight the currently controversial knowledge of the age of cichlids, and the importance of these fossils in illuminating future studies of cichlid divergence times.

**0437 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Margaret A. Malone

Loyola University Chicago, Chicago, IL, USA

**Early Invasion of *Neogobius melanostomus* into Lake Michigan Tributary
Streams: Competitive Interactions with Native Percid Species**

Neogobius melanostomus, the round goby, invasion into Great Lake tributary streams has been proposed to have negative impacts on native benthic fishes. In this study we address possible competitive interactions between the round goby and two native percid species: *Etheostoma nigrum* (Johnny darter) and *Percina maculata* (Blackside darter) using field surveys and laboratory experiments. Fishes were sampled from round goby present reaches of two Wisconsin streams to assess diet overlap where the species co-occur and compare diets in the presence and absence of gobies. Stomachs of *N. melanostomus*, *E. nigrum*, and *P. maculata* were dissected and contents identified to the lowest possible taxonomic level. Laboratory behavior of *N. melanostomus* and *E. nigrum* was examined using food patch giving-up densities (GUDs) and video analysis for aggressive behaviors and patch residence time (PRT). *N. melanostomus* diets primarily consisted of non-biting midges (Chironomidae). *E. nigrum* and *P. maculata* diets in goby present reaches consisted of baetid (Baetidae) and heptageniid (Heptageniidae) mayflies, chironomids, and net-spinning caddisflies (Hydropsychidae). *E. nigrum* diets in round goby absent reaches were no different, while *P. maculata* indicated a dietary shift. GUDs of solitary *N. melanostomus* were lower ($\bar{x}=4.6$ prey items/patch) than GUDs of solitary *E. nigrum* ($\bar{x}=24$ prey items/patch). GUDs left by co-occurring *N. melanostomus* and *E. nigrum* were on average 17.5 prey items/patch with higher PRT of *N. melanostomus* and aggressive displays. Resource partitioning *in situ* and laboratory competitive interference indicates that further studies are needed to monitor long term impacts of *N. melanostomus* in tributary streams.

0693 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Margaret A. Malone¹, Janelle Morano², Terry Grande¹

¹Loyola University Chicago, Chicago, IL, USA, ²Cornell University, Ithaca, NY, USA

Comparative Morphology of *Neogobius melanostomus*, the Round Goby, Upper and Lower Pharyngeal Jaw Dentition from a Lake Michigan Tributary Stream and Southern Lake Michigan

Neogobius melanostomus, the round goby, is a highly successful invasive species in the Laurentian Great Lakes. Its success has been attributed, in part, to the co-invasion of dreissenid (Dreissenidae) mussels, a food source for the adult durophagous round goby. Round gobies undergo an ontogenetic shift in pharyngeal jaw apparatus, which corresponds to a dietary shift from soft bodied macroinvertebrates, fish eggs and larvae, to hard bodied mollusks in the Great Lakes. We address changes in the upper pharyngeal jaw (UPJ) and lower pharyngeal jaw (LPJ) dentition in this study. Round gobies were collected from two habitat types and compared: a dreissenid-free Lake Michigan tributary stream, the Pigeon River, Sheboygan, WI and dreissenid-present Southern Lake Michigan. The UPJ and LPJ were dissected from small (< 50 mm TL) and large (> 70mm TL) round gobies, dentition examined, and categorized into percentage cardiform, villiform, and molariform. Small, omnivorous, Lake Michigan goby dentition consisted of cardiform and villiform teeth. While large, molluscivore, Lake Michigan goby dentition consisted of villiform and molariform types. We hypothesize that UPJ and LPJ dentition of adult round gobies collected in dreissenid-free habitats have proportionally less molariform teeth than gobies from dreissenid-present populations. Our results shed light on round goby phenotypic plasticity of UPJ and LPJ dentition, a factor that may contribute to their widespread invasion success.

0152 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Mercedes Maltbie, Brad Coupe

Castleton State College, Castleton, VT, USA

Microhabitat Use in Sidewinder Rattlesnakes (*Crotalus cerastes*) on the Kelso Dunes

We studied microhabitat use of sidewinder rattlesnakes (*Crotalus cerastes*) at the Kelso Dunes near Kelso, CA from 2001 to 2003. Because we could not observe the microhabitat of snakes that were underground, we only included observations of snakes on the surface. So as to maximize our chances of detecting microhabitat selection by the

snakes, we only included snake locations where the snakes were stationary (e.g. coiled) rather than moving. Lastly, because the majority of our snake observations were in sandy habitat, we excluded locations in the adjacent rocky habitat. We collected data on a range of biotic and abiotic microhabitat variables on 50 snakes (30 females and 20 males). A habitat survey collected these same data at 300 randomly selected locations at the field site. We examined habitat selection in sidewinders by comparing their use of habitat features to the frequency of those features in the habitat survey. Sidewinders tend to be in physical contact with vegetation and appear to specifically select locations under burro-weed shrubs (*Ambrosia dumosa*). These shrubs likely provide cover from both predators and the sun and so may also harbor prey. Clear associations between snake locations and substrate features were not detected.

0363 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Aurelia Mapps, Cristhian Cadena, Patrick Lewis

Sam Houston State University, Huntsville, Texas, USA

Analysis of a *Gekko gekko* Skull Using High Resolution X-ray Computed Tomography

The species in the *Gekko* genus inhabit the trees and cliffs of Southeast Asia. The species richness of this genus, which contains over 45 species, has led to many questions on the evolutionary relationships among its members. Previous studies have attempted to determine the intrageneric relationships of the genus by focusing on external morphology and molecular data. The monophyly of the group has not been supported, however, due to the inclusion of misidentified species. As such, the systematics of the genus remains poorly understood. Additional morphological analyses on individual species are needed in order to help determine the evolutionary relationships between these geckos. The use of High Resolution X-ray Computed Tomography (HRXCT) allowed the detailed description of the cranial morphology of *Gekko gekko*. Digital isolation of cranial elements permitted the identification of characters likely useful in the evaluation of phylogenetic relationships within the genus. The squamosal bone is spherical posteriorly, unlike the elongated shape found commonly in scleroglossans. Additionally, fused frontal and fused parietal bones are present in *Gekko gekko*, a common character in some gekkonids. The jugal is also present and rests on the maxillary shelf, while in other gekkotans it is not present. The tympanic crest of the quadrate is linear and concaves less inwardly than commonly observed. The pterygoid possesses an acute notch; differing from the sigmoid shapes that contribute to the distinct Y-shape. Detailed cranial analyses of species across the genus will be used for comparison in order to further understand the systematics of the clade.

**0701 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Elizabeth Marchio

Texas A&M University, College Station, Texas, USA

**The Business end of Belonesox: cranial osteology of the Pike livebearer
Belonesox belizanus (Teleostei: Poeciliidae)**

Belonesox belizanus, a member of the family Poeciliidae, is common in lowland freshwater habitats along the eastern coast of Mexico to Costa Rica. Unlike other poeciliids, *B. belizanus* is a large obligate piscivore. Numerous features of the cranial anatomy of *B. belizanus* are autapomorphic (within Poeciliidae) and likely represent adaptations for a highly predatory lifestyle. Previous osteological investigations have focused predominantly on its elongate jaws and a detailed investigation of the remainder of the cranium has yet to be conducted. In order to further our understanding of the specialized trophic anatomy of this highly unusual livebearer, I provide a detailed overview of the entire cranium (i.e., all chondro-, splanchno-, and dermatocranium elements) based on an investigation of cleared and double stained specimens. Compared to a more generalized poeciliid, *B. belizanus* exhibits an overall elongation of the jaw (premaxilla, dentary and anguloarticular) and hyopalatine arch elements (autopalatine, ectopterygoid, symplectic and hyomandibular), with extensive suturing between the bones of the hyopalatine arch. The dermal skeleton of the branchial arches of *B. belizanus* also deviates from the generalized poeciliid condition. Surprisingly, gill rakers associated with ceratorbranchial and epibranchial elements on arches one to four are greatly reduced as are teeth associated with ceratobranchial five. This reduction of the dermal skeleton associated with ceratobranchial and epibranchial elements contrasts sharply with the well-developed tooth-plates associated with hypobranchials two and three. In conclusion, the overall themes in the cranium of *B. belizanus* are those of "capture" and "retention" versus "forage" and "mastication", as in other poeciliids.

0138 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Clayton Marolt, Christopher Becker, Philip Ryan, Chad Montgomery

Truman State University, Kirksville, MO, USA

Validation of Body Condition Indices in the Lizard *Sceloporus undulatus*

Body condition index (BCI) can be a valuable tool in ecology, conservation, and evolution for predicting energy reserves and relative health among individuals and populations. BCIs have been used as an indicator of fat content and relative fat content in a variety of taxa to examine questions such as population health, resource availability,

and reproductive status, among others. However, BCI has not been validated in lizards. Therefore, we developed BCIs based on mass and SVL in *Sceloporus undulatus* from Missouri and Colorado. We determined fat content of liver, ova, fat bodies and carcass by dissection and total fat analysis. BCI was independent of water content and morphological measurements. No differences in BCIs were found for specimens of different sexes and sites. Although reproductive state of the female influenced BCI, we found that BCI did not correlate with fat content for small lizards. Our results may influence the interpretation of the variation in BCIs within and among populations.

0031 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

AN Marranzino¹, MM Frank², SD Lindemann³, BA Guiffrida⁴, K Sipper⁵, JF Webb⁶, AF Mensinger³

¹Regis University, Denver, CO, USA, ²St. Olaf College, Northfield, MN, USA, ³University of Minnesota Duluth, Duluth, MN, USA, ⁴Wareham Middle School, Wareham, MA, USA, ⁵Northern Michigan University, Marquette, MI, USA, ⁶University of Rhode Island, Kingston, RI, USA

Functional morphology of cephalic protuberances in the oyster toadfish, *Opsanus tau*

The oyster toadfish, *Opsanus tau*, is an important model organism for muscle and sensory physiology. However, the roles of two prominent anatomical features on the head of the fish remain unknown. These include multilobed protuberances, or cirri that project primarily from the lower jaw and simpler, paired projections termed papillae that surround superficial neuromasts. Scanning electron microscopy (SEM) and light microscopy (LM) were used to investigate the morphology and potential functional significance of these structures. It has been proposed that the cirri serve a mechanosensory function, but both SEM and LM failed to reveal neuromasts. However, domed structures with apical microvilli seen with SEM, were determined to be bulbiform organs using LM. These organs were similar to type II taste buds, suggesting a putative gustatory role for the cirri. *O. tau* has a reduced number of anterior canal neuromasts (which detect water acceleration). However, numerous superficial neuromasts (which serve as velocity detectors) are present, and flanked by linguiform protuberances. It has been proposed that these papillae protect the neuromasts from the loose sediment that characterizes the fish's benthic habitat. The papillae may also channel water over the neuromasts, possibly allowing them to function as canal neuromasts. SEM revealed that hair cell orientation in these superficial neuromasts was parallel to the channel formed by the papillae, supporting this hypothesis. Supported by NSF REU 1005378 (AFM), and the Coll. Environment & Life Sciences, URI (JFW).

**0342 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

Bradley Martin¹, Neil Bernstein², Roger Birkhead³, Jim Koukl⁴, Steven
Mussmann¹, John Placyk⁴

¹University of Arkansas, Fayetteville, AR, USA, ²Mount Mercy University, Cedar
Rapids, IA, USA, ³Auburn University, Auburn, AL, USA, ⁴University of Texas at Tyler,
Tyler, TX, USA

**Molecular Phylogenetics of the American Box Turtles (*Terrapene* spp.): A
Classification Re-assessment and a Molecular Clock Depicting Divergence
Time Estimates**

The classification of the American box turtles (*Terrapene* spp.) is in need of a comprehensive re-evaluation, being based primarily on morphological data. Analyses that have used molecular data are often characterized by incomplete taxon sampling, small sample sizes, restricted geographic representation, and limited types of genetic markers. Thus, a more thorough molecular phylogenetic study is warranted to support or reject the current classification scheme. We extensively sampled all currently recognized *Terrapene* species/subspecies from across their ranges (except for *T. nelsoni klauberi*), and sequenced both mitochondrial and nuclear DNA markers in an attempt to resolve the evolutionary history of the group. Furthermore, we conducted a molecular clock analysis on the mitochondrial DNA *cytochrome b* (*Cytb*) gene to calculate divergence time estimates. Our results strongly support the division between the western (*T. ornata*) and eastern (*T. carolina*) groups, but some subspecific classifications within these groups do not conform to the morphological classification scheme. Specifically, we recommend clumping *T. ornata* into a monotypic species and splitting *T. carolina* into two species: *T. carolina* (*T. c. carolina*, *T. c. bauri*, and *T. c. major*) and *T. mexicana* (*T. m. mexicana*, *T. m. triunguis*, and *T. m. yucatanana*). To our knowledge, the *Cytb* chronogram provides the first divergence time estimates for some *Terrapene* taxa, and we suggest historical events that might have contributed to their speciation. Finally, because the *Terrapene* are of conservation concern throughout much of their range, and because conservation efforts are typically species-based, this work may have significant conservation management implications.

0340 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

Karen Martin¹, Michael Murrie¹, Alexander Martin¹, Gregory Martin²

¹Pepperdine University, Malibu, CA, USA, ²Massachusetts Institute of Technology, Boston, MA, USA

Educational documentary, "Surf, Sand, and Silversides: The California Grunion"

"Surf, Sand and Silversides: The California Grunion" is a short documentary about spectacular midnight spawning runs and the challenges a native fish species faces on southern California's most popular urban beaches. Natural phenomenon and cultural icon, California Grunion surf by the thousands onto California's sandy beaches for a midnight rendezvous. Shot in high definition on location at more than a dozen different beaches along the Pacific coast from San Diego to Santa Barbara, this video shares discoveries about the grunion life cycle, its embryonic development buried in beach sand, and its place in the marine web of life. Its unique ecology makes it vulnerable to unintentional human impacts during spawning and nesting. Inspired by this charismatic fish, a group of citizen scientists called Grunion Greeters cooperate with local residents, government agencies, environmentalists, and scientists to find new ways to balance human recreation and wildlife conservation on California's beaches. The video has won many awards including Excellence in Scriptwriting, Sound Editing, Best Eco-Friendly Film, and Best Short Documentary, and was an Official Selection for San Francisco International Ocean Film Festival, Newport Beach Film Festival, Temecula Valley Film Festival, International Wildlife Film Festival, SoCal Film Fest, and Toronto Beaches Film Festival, among others. Support was provided by the National Oceanic and Atmospheric Administration, California Coastal Commission, National Marine Fisheries Service, National Geographic Society, Coastal America Foundation, and Pepperdine University. Total run time is 25 minutes.

0007 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

Samuel Martin

The University of Tulsa, Tulsa, Oklahoma, USA

New Story from an Old Refugium: Phylogeography of *Chrosomus erythrogaster*

The southern redbelly dace, *Chrosomus erythrogaster*, is a minnow found in springs and creek headwaters in the central United States. *Chrosomus erythrogaster* is intolerant of turbidity; large rivers may be effective barriers to its dispersal, and gene flow is limited.

A recent study supported the monophyly of the North American genus *Chrosomus*, but relationships among populations of *C. erythrogaster* have received little attention. I sequenced a section of Cytochrome B (Cytb) from individuals of *C. erythrogaster* collected from over 50 localities in most of its southern range. Uncorrected pairwise distances are as high as 11% between populations, and 8% just within the Ozarks, indicating the possible existence of cryptic species. The Ozark region contains three separate lineages that diverged in the late Pliocene to early Pleistocene, and the western Ozark lineage appears to be more closely related to populations from the Cumberland Plateau than both groups are to those from the eastern Ozarks and northward. Potentially concordant geographical divergence patterns have been documented for other fishes within the Ozarks, although these divergences appear to have occurred at different times.

0053 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Zachary Martin, Larry Page

University of Florida, Florida Museum of Natural History, Gainesville, FL, USA

The Papilla Monologues: Comparative Morphology and Evolution of Genital Papillae in a Genus of Darters (Percidae: *Etheostoma*)

Etheostoma is a hyper-diverse genus that serves as a model system for studying the evolution and diversification in temperate freshwater fishes. The group is well-known for their diversity in reproductive traits, but female genital papillae are rarely the focus of this attention. A comparative morphology study of female genital papillae in *Etheostoma* was conducted and the evolutionary history of these structures was traced using four phylogenetic hypotheses. Additionally, relationships between papilla morphology and spawning strategies were examined. Variation in papilla morphology was described using 14 characters. Developing descriptive terminology and character codes led to the identification of 13 distinct morphologies. Based on maximum likelihood ancestral state reconstructions, the basal morphology of papillae in females of *Etheostoma* was reconstructed as a simple tube with a distally positioned and posteriorly oriented pore. Among the significant phylogenetic results were support for a monophyletic *Catnotus* and a sister-group relationship between *Boleosoma* and *Ioa*. Synapomorphies for *Catnotus* were a rosette papilla and a pleated papillar platform. The *Boleosoma* + *Ioa* clade was supported by a bifurcated papillar platform. Conspicuous villi and a pleated papillar platform separate *Ioa* from *Boleosoma*. When relating papilla morphologies to spawning strategies, the most significant finding was that all species that attach eggs to a rocky substrate possess a basal platform posterior to the papilla; this structure may be required to successfully exploit this substrate for oviposition. Some morphologies are specific to oviposition strategies, and the evolution of papillae may have played a major role in the diversification of *Etheostoma*.

**0625 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Ninon Martinez, Richard Mayden

Saint Louis University, Saint Louis, Missouri, USA

**Morphological Variation of the Blacktail Redhorse, *Moxostoma poecilurum*,
and its closest relative, *Moxostoma sp.*, across the Gulf Coast (Cypriniformes,
Catostomidae)**

The Blacktail Redhorse is a widespread species in the southern Gulf Slope rivers of the USA, occurring throughout Mississippi River tributaries on the former Mississippi Embayment from Southern Kentucky to Southern Arkansas, south to Louisiana, and in Gulf Slope drainages from the Choctawhatchee River in Alabama and Florida to Galveston Bay in Texas. A closely related and purported new species has been reported by several sources as occurring in the Apalachicola River Drainage. This preliminary study examines both meristic and morphometric variation of these species across their respective ranges. Morphometric analyses were conducted using landmark geometric analyses; meristic analyses involved principal component analysis. Coloration and other features were also evaluated. All of these character-based features and a summary of molecular studies on these species are used to assess diversity in this species complex.

0752 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Glenn Marvin, Mattie Lewis

University of North Alabama, Florence, AL, USA

**Influence of Temperature, Photoperiod, and Feeding on Tail Regeneration in a
Semiaquatic *Desmognathan* Salamander**

Salamander tail autotomy can improve survival, but loss of the tail can subsequently be costly to the individual. For example, burst swimming speed is significantly slower after autotomy in desmognathan salamanders, which may increase predation risk in aquatic habitats. However, any long-term cost of tail loss is contingent on the rate of tail regeneration. To examine seasonal variation in the cost of tail autotomy for the semiaquatic salamander *Desmognathus conanti*, we tested the effect of temperature, photoperiod, and feeding on tail regeneration rate. Eight experimental groups (equivalent in body size, N = 15 per group) were tested. After acclimation for four weeks at one of two temperatures (either 10°C or 20°C) and one of two photoperiods (L:D 9.5:14.5 or 14.5:9.5), 60% of the tail length was autotomized for each individual. After

autotomy, experimental groups were maintained under different conditions of temperature (10°C or 20°C), photoperiod (L:D 9.5:14.5 or 14.5:9.5), and feeding (fasting or weekly feeding). The length of the regenerated tail portion for each individual was measured once each week until the group with the fastest tail re-growth had regenerated 50% of the lost tail length. Three-way ANOVA for tail regeneration rate revealed that temperature had a large, significant effect ($F = 378, P < 0.001$), feeding had a small but yet statistically significant effect ($F = 6, P < 0.05$), but photoperiod had no significant effect. We conclude that the cost of tail autotomy differs among seasons (and microhabitats) based on variation in temperature and food availability.

0593 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Christopher Matechik, Carol Johnston

Auburn University, Auburn, Alabama, USA

Developing a Monitoring Protocol for the Pygmy Sculpin (*Cottus paulus*)

Long-term monitoring protocols require adequate levels of precision in order to detect temporal changes in abundance or density. However, the ability to detect changes can be reduced by sampling variation. We are evaluating two sources of sampling variation, habitat type and observer effects, associated with underwater visual observation to aid the development of a long term monitoring protocol for the pygmy sculpin (*Cottus paulus*). The pygmy sculpin is an Alabama endemic, with a range is limited to a single, small spring. The pygmy sculpin population is threatened by rising concentrations of trichloroethylene (TCE), thus there is a need for a monitoring protocol. Our data indicate that pygmy sculpin utilize habitat patches disproportionately, which causes an increase in sampling variation if habitat patch type is not accounted for in the sampling scheme. A comparison between a simple random sampling scheme and a sampling scheme stratified by habitat type showed that the stratified sampling scheme had less variation for an equivalent amount of sampling efforts. Comparisons of observers showed that habitat type also affects inter-observer variation in counts. Additionally, we are evaluating the effects of habitat type on detection of pygmy sculpin.

0058 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

William Matthews, Edie Marsh-Matthews

University of Oklahoma, Norman, OK, USA

Fish in Altered Waters: Species Associations in Oklahoma Streams Before and After the Era of Large Dam-Building

In the 1920s, Carl L. Hubbs and A.I. Ortenburger published seminal papers on fish distribution in Oklahoma and western Arkansas from field collections by Ortenburger and assistants in 1925, 1926, and 1927. These collections comprised the first comprehensive surveys of fish throughout the region, and now give us a detailed view of fish distributions before the construction of large dams and many smaller reservoirs in these river basins. From 1975 to the present, after construction of many dams in Oklahoma and western Arkansas, we made more than 300 collections in this area, using seining methods similar to those of Ortenburger. Using our data, we compared associations of species from the 1920s to their associations since 1975, i.e., before and after alteration of the river basins by dam construction. In spite of many known effects of dams on riverine or stream fishes, our analyses indicate little or no changes in associations of the common species since the time of Ortenburger, suggesting that fish species remain associated within appropriate habitat templates. Such persistence of species associations has important implications for fish communities in general, and for potential co-evolution among species.

0248 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Richard Mayden, Grace Karcher, Kyler Douglas, Qianna Xu, Caroline Dong, Niki Shah

Saint Louis University, St. Louis, MO, USA

Biodiversity of Trout in Mexico (Salmonidae: *Onchorhynchus*): Variation in Some Morphological Traits of Taxonomic Significance*

Until very recently the diversity of trout species of *Onchorhynchus* in Mexico has been largely overlooked, received limited and very hypothetical attention as to origins and extensive hybridization, environmental convergences due to local conditions, and has, for the most part, been considered a series of records of trout resulting from introductions of hatchery trout. While the Mexican Golden Trout, *O. chrysogaster*, has been recognized as a distinct species for a long time, samples of this species were made during the middle 1900's. Since then, the areas Mexico where trout occur in the Sierra Madre Occidental has been avoided for sampling, especially streams off major highways, due to adverse conditions to humans, precluding any efforts of any of

sampling that one might consider thorough enough for taxonomic study. A binational group of scientists have been fortunate enough to safely work streams of this range for two decades, efforts that have yielded information to clarify and falsify misguided rumors as to the diversity of this group. The results of a portion of the morphological variation in some qualitative characters from across the range of Mexican trout are examined in this presentation. Many other morphological and molecular data exist for these species resulting from our investigations that are not presented. Evaluation of an array of characters of these trout, sampled from multiple drainages to south of Durango, clearly point to multiple species existing in these drainages. *Study involves multiple Mexican and US researchers.

0166 HL Detectability Symposium, Brazos, Friday 12 July 2013

Marc J. Mazerolle

Université du Québec en Abitibi-Témiscamingue, Québec, Canada

Estimating Detectability and the Biological Parameters of Interest Using the R Environment

The problem of imperfect detectability in animal studies has been acknowledged for several decades. A number of different analytical approaches, such as capture-mark-recapture, distance sampling, and occupancy analyses, have been developed to deal with the problem and estimate biological parameters of interest. These different analytical approaches can be implemented through various software, each with its own graphical user interface (GUI), data input format, and capabilities. Although GUI and mouse clicks might be convenient to conduct analyses, they are difficult to replicate and archive in the long term. Using programming environments such as the R open source project yields flexibility and a "paper trail" after the analyses are conducted. Such environments also provide statistical and graphical tools for further treatment following the analyses. In this presentation, I will illustrate how to use R to conduct classical analyses that enable the estimation of biological parameters after accounting for imperfect detectability. The examples will feature interacting with certain software such as MARK, as well as using recent R packages designed to implement specific analyses in both a frequentist and a Bayesian framework. The case studies will feature all the steps required to conduct the analyses including data importation, model selection and multimodel inference, and graphing results. Such an integrative approach provides a flexible alternative to using GUI, while keeping everything in the same environment and documenting precisely how an analysis was conducted.

**0634 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Eric Mazzei¹, Hudson Pinheiro², Thiony Simon³, Jean-Christophe Joyeux³,
Rodrigo Moura⁴, Luiz Rocha⁵

¹*Universidade Estadual de Santa Cruz, Ilhéus, Brazil*, ²*University of California Santa Cruz, Santa Cruz, CA, USA*, ³*Universidade Federal do Espírito Santo, Vitória, Brazil*,
⁴*Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil*, ⁵*California Academy of Sciences, San Francisco, CA, USA*

Richness and similarity of reef fish assemblages along the Vitória-Trindade Chain, southwestern Atlantic

The Vitória-Trindade Chain (VTC) is a linear seamount ridge that extends 1,200km from the Brazilian coast, ending in the islands of Trindade and Martin Vaz. Recent expeditions recorded 110 fish previously unknown for the VTC seamounts, which have a total of 159 reef fish species. The richness of each seamount varies between 19 and 71 species and their Bray-Curtis pairwise similarity ranged between 31 and 74%. A cluster analysis comparing reef fish composition of eight seamounts, two coastal areas and two oceanic islands showed two major distinct groups. The first group can be divided in three subgroups: coast (168-209 species), islands (58-109 species) and three seamounts (those biggest and shallowest; 53-71 species) with pairwise similarity between 35-84%. The second group is composed only by seamounts, and can be subdivided in two subgroups related with the summits depth and distance from the coast (19-46 species; 36-61% of similarity). Although situated at one extreme of the VTC, Trindade Island showed closer similarity to the coast than any other seamount. Columbia, the seamount nearest Trindade, showed the most composition difference when compared with the island (24% of similarity), while Davis, 600 km away, showed the most similarity (67%). Our results indicate that most of the shallow water species found at the islands also occur on banks along the center of the chain, and habitat diversity and depth appear to have more influence on diversity than isolation.

**0195 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Shelly C. McCain¹, William I. Lutterschmidt¹, Clifford L. Fontenot, Jr.²

¹Sam Houston State University, Huntsville, Texas, USA, ²Southeastern Louisiana University, Hammond, Louisiana, USA

Behavioral sensitivity to salinity and osmoregulatory capacity of the fully aquatic salamander, *Amphiuma tridactylum*

Amphibians are highly vulnerable to environmental change, especially within aquatic habitats that experience rapid changes in water quality. For obligate aquatic amphibians, such as the salamander *Amphiuma tridactylum*, large fluctuations in the concentration of solutes offer additional challenges of osmotic stress, as they have limited options for avoidance and escape from their obligate habitat. Because a portion of the range for *A. tridactylum* is periodically subject to large deviations in salinity due to salt water intrusion (17 ppt salinity during storm surge) and drought (6.5 ppt salinity during natural drawdowns of water), it is probable that populations of *A. tridactylum* possess a wide ranging tolerance to salinity, particularly those populations within coastal and estuarine regions of their distribution. We found, through investigating the behavioral sensitivity of *A. tridactylum* to salinity, that salamanders do not actively avoid water salinities until salinity reaches 10 ppt. We discuss these behavioral experiments for determining salinity sensitivity and present physiological data on the species-specific osmoregulatory capacity of this fully aquatic salamander.

0497 AES Ecology, Mesilla, Thursday 11 July 2013

Michael McCallister, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Identifying a Scalloped Hammerhead Nursery in the Inshore Waters of NE Florida

Scalloped hammerheads (*Sphyrna lewini*) are a large shark common in the coastal waters of the eastern U.S. It is well documented that juvenile scalloped hammerheads utilize shallow nearshore waters as nursery habitat; however, few studies have identified potential nursery habitat in Florida. With the National Marine Fisheries Service recently listing the scalloped hammerhead as overfished, and Florida Fish and Wildlife's decision to prohibit commercial and recreational harvest of scalloped hammerheads, identifying scalloped hammerhead nursery habitat in Florida waters is critical to helping protect this species. This study identifies a nursery for young-of-the-year scalloped hammerheads in the Tolomato River, FL. Sampling occurred from May - October from

2010-2012, and a total of 123 YOY scalloped hammerheads were caught. Scalloped hammerheads had a mean length of 49.0cm TL (range = 39.5 - 59cm TL), and all had well healed umbilical scars. Mean CPUE was greatest in July (3.5 sharks/50 hooks * hr). There was a significant difference in the observed sex ratio of males to females (1.56:1, $\chi^2 = 5.3$, $p = 0.017$). Only 3 tagged sharks were recaptured, two of which were re-caught less than 1km from where they were tagged. Annual mean CPUE was significantly greater in the Tolomato River (2.4 sharks/50 hooks *hr) compared to surrounding areas in Cumberland (0.08 sharks/50 hooks *hr) and Nassau (0.04 sharks/50 hooks *hrs). These findings suggest this area functions as nursery habitat for this species, and is only the second documented account of a scalloped hammerhead nursery on the east coast of Florida.

0583 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Michael McCallister¹, Katie Jackson², Jim Gelsleichter¹

¹University of North Florida, Jacksonville, FL, USA, ²Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL, USA

Developing a Sighting Database to document the Presence of white sharks (*Carcharodon carcharias*) off the Southeastern United States

The white shark (*Carcharodon carcharias*) is one of the most recognizable sharks in the public eye. Recent research has shown that white sharks in the NW Atlantic migrate to the waters off the southeastern US during winter months. Although there are multiple reports of white shark sightings off the SE US each year, there exists no formal record to document these reports. The goal of the Southeast United States White Shark Encounter Database is to document movements, determine seasonality, and identify potential hotspots of white shark activity off of the SE US (North Carolina - Florida). Aerial surveys conducted by the Florida Fish and Wildlife Conservation Commission contributed 54 sightings from December - March between southeast Georgia and northeast Florida (the spatial and temporal extent of the surveys). An online survey was created for the public to report white shark sightings, and information on how to report encounters was distributed to fishing and diving communities. Since the database was created in January of 2013, 14 reports have been submitted using the online survey. These sightings ranged from Wilmington, NC to Port St. Lucie, FL. By soliciting public sighting information, this database provides a unique way to gain a better understanding of the biology of the white shark in the NW Atlantic.

0079 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Amy R. McCune¹, Amanda N. Cass¹, Sarah J. Longo², Mark L. Riccio¹

¹Cornell University, Ithaca NY, USA, ²University of California, Davis CA, USA

Homology and transformation of lungs and gas bladders: evidence from morphology at multiple levels

Since the middle of the 19th century, most comparative vertebrate morphologists have regarded lungs and gas bladders as homologous. Lungs are a synapomorphy of Osteichthyes and gas bladders are a synapomorphy of Actinopteri. However, if gas bladders are indeed modified lungs, then they are also transformational homologs. Despite pervasive textbook accounts that gas bladders are modified lungs, two questions have persisted. One is whether the pulmonary arteries that supply the respiratory gas bladder of *Amia* are convergent or homologous with those in sarcopterygians and polypteriform fishes. The other is, whether a lung that evaginates ventrally from the gut can be the same organ as a gas bladder that evaginates dorsally. These two unresolved issues have led some to question whether lungs and gas bladders are actually homologous; instead, they might be independent derivations of the posterior pharynx. Using modern morphological techniques, micro-CT technology and spatial distribution of gene expression, we present new evidence that lungs and gas bladders are the “same” organ. Furthermore, we identify a key dorsal-ventral inversion of gene expression between Sarcopterygii and Actinopteri that coincides with the dorsalization of the gas bladder in zebrafish, thereby suggesting a mechanism by which lungs could have been modified into a dorsal gas bladder.

0686 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Jan McDowell, Heidi Brightman, Robert Fisher

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Species Boundaries and Cryptic Species in Atlantic Rhinopterids: Will the Real *R. bonasus* Please Stand Up?

The family Rhinopteridae contains a single genus, *Rhinoptera*, which includes 8 recognized species. The lack of obvious morphological characters to discriminate these species complicates accurate identifications. The cownose ray, *Rhinoptera bonasus*, ranges from southern New England to southern Brazil within the western Atlantic Ocean and throughout the Gulf of Mexico and off Cuba. Claims of increases in the population growth rate of the cownose ray coupled with concerns over damage to shellfish culture, grow-out, and restoration operations have led to pressure for a targeted fishery in regions such as Chesapeake Bay, Virginia, despite the fact that no investigation of

genetic stock structure has been conducted. We present preliminary data based on analysis of mitochondrial and nuclear DNA markers indicating that there are at least two cryptic species of *Rhinoptera* in the eastern Gulf of Mexico, the cownose ray and a second species which bears a close genetic affinity to the Ticon cownose ray, *R. brasiliensis*, which is considered to be endemic to Brazil. The genetic data also suggests that there has been historical introgression between these two species. We have not seen evidence of multiple species off the Atlantic coast based on limited sampling effort. Furthermore, analysis of a limited number of cownose ray samples captured off the coast of Campeche, Mexico suggest that the Caribbean Sea may harbor a separate genetic stock. This study highlights the need for a comprehensive assessment of both species boundaries and stock structure in Atlantic Rhinopterids.

0096 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Kira McEntire¹, Blake Sissel², Nathan Bendik²

¹Southwestern University, Georgetown, Texas, USA, ²City of Austin, Austin, Texas, USA

Movement Patterns of the Jollyville Plateau Salamander (*Eurycea tonkawae*) Near Lanier Spring in Bull Creek, Travis Co., Texas

The Jollyville Plateau salamander (*Eurycea tonkawae*), a perennibranchiate plethodontid, is a species of conservation concern due to its limited distribution to northern Travis and southern Williamson Counties, Texas, and its vulnerability to habitat destruction caused by extensive urbanization. It has been suggested that *E. tonkawae* and other spring-dwelling central Texas *Eurycea* salamanders do not move very far from spring outlets. However, very little information is known about the dispersal and movement patterns of the species within a spring-fed stream. We established nine 5 m sections, spaced 15 m apart, in Bull Creek, Travis Co., (bisecting a major spring inflow). The sections were sampled every two weeks for three months. We used photographic capture-mark-recapture techniques to monitor movement of salamanders between sections. Only a few of the recaptured salamanders moved to a different section and most of those moved to an adjacent section (average distance of 20 m), though we observed some movement up to three sections away (60 m). Individuals previously marked with VIEs at the spring outflow were found up to, at least, 81 m from the spring where they were originally marked. Although this study was only conducted at one location, the findings expand knowledge about the potential distribution and migration abilities of *E. tonkawae*, and challenge a commonly held assumption that surface dwelling populations are restricted to spring outflows within streams.

0732 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

T. Lorraine McInnes¹, Nelson Rios², Henry Bart², Michael Doosey²

¹University of New Mexico, Albuquerque, NM, USA, ²Tulane University, New Orleans, LA, USA

Georeferencing Museum Fish Collections: FishNet2 and GEOLocate--A 7-Month Progress Report

The FishNet2 network is a collaborative effort among fish collections around the world to share and distribute data on specimen holdings. Approximately two of the four million records within FishNet2 lack geospatial coordinates. August of 2013 will mark completion of the first third of a collaborative project to georeference over 2 million fish records in FishNet2. Continued efforts to georeference museum data is important for many aspects of biological study especially questions regarding species decline, distribution, and the effects of climate change. This 36-month project is shared among 12 institutions, which have been designated to georeference their home state or region of the United States, as well as an additional portion of the world based on their geographic expertise. In January 2013, work was initiated with a training workshop to familiarize the georeferencing technicians with the GEOLocate Web Application. By early April, our efforts spanned 4 continents with a primary focus in the United States (21 states), georeferencing 133,224 specimen records which includes 31,333 unique localities. Project coordinators at Tulane University manage georeferencing progress and provide additional data as designated areas are completed. Through this collaborative effort, suggested improvements to GEOLocate have been implemented to increase efficiency to the georeferencing process. The final goal of the project is to redistribute the georeferenced data back to the 53 institutions currently contributing to FishNet2.

0594 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

T. Lorraine McInnes, Howard Snell

University of New Mexico, Albuquerque, NM, USA

Thermal Ecology of Western Diamond-backed Rattlesnakes (*Crotalus atrox*): Hibernation, Den Variation and Winter Mortality

In temperate latitudes, hibernation within appropriate retreats can provide protection from extreme cold temperatures and predation. Western Diamond-backed Rattlesnakes (*Crotalus atrox*) are known to use a variety of different types of hibernacula. Specific characteristics of various hibernacula may offer better protection than others, for example, natural versus man-made structures. To locate hibernacula while recording

temporal and spatial variation in habitat and body temperatures we initially implanted radio-transmitters and temperature data-loggers into 16 *C. atrox* at Bosque del Apache National Wildlife Refuge, Socorro County, New Mexico. Predation, radio failure, and vehicular mortality reduced the effective sample size to 9 logged and telemetered individuals. Body temperature was recorded every two hours from spring 2010 to spring 2012. Sample size varied over time due to winter and spring mortality but the minimum duration was 8 months. We found *C. atrox* using natural hibernacula (retreats in cliff faces and burrows) and man-made structures (metal and concrete culverts). Winter mortality occurred at natural and man-made dens during the study. We documented 100% mortality at a den within a metal culvert in February 2011, during a period of abnormally cold temperatures and insufficient protection from predators, when a Spotted Skunk (*Spilogale gracilis*) killed and partially consumed 24 *C. atrox*.

0775 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Camille McKellar, Jennifer Ciaccio

Dixie State University, St. George, UT, USA

Environmental Effects on Scale Morphology in *Carassius auratus*

Organisms exposed to periods of environmental stress will often conserve or reassign energy that would normally be dedicated to growth. Many species of fish possess a unique trait that can document these periods. Otoliths, cycloid scales, and certain skeletal structures of fish grow concentrically; changes in growth rate cause variations in the circular patterns of the structure. Examination of these variations can tell quite a bit about where a fish has been and when. In this experiment we tested the effects of exposing goldfish (*Carassius auratus*) to hypoxic and hyperosmotic environments. We hypothesized that these environments would present stressors significant enough to affect growth rates. To test this, scale samples from the control and treatment groups were examined under a scanning electron microscope. Widths of the outermost circuli were measured and compared between groups. Results showed that samples from the hypoxic group had significantly smaller widths compared to the control ($T= 2.43$, $p= 0.029$) and no significant difference between the control and hyperosmotic groups. A continuation of this research is currently underway. The present study aims to reach a better understanding of how changes in outer circuli width reflect short-term growth through variable weekly feeding amounts.

0451 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Donald McKnight, Tyler Dean, Day Ligon

Missouri State University, Springfield, MO, USA

An Effective Method For Increasing the Catch Rate of Pitfall Traps

Pitfall traps are widely used by researchers to survey a variety of terrestrial taxa. To test a method for improving the results of pitfall traps, we built a Y-shaped drift fence with six pitfall traps on each arm. We improved the pitfall traps by staking four pieces of aluminum flashing around each of the traps in order to increase their effective area. For experimental purposes we used the aluminum flashing wings every other day. Traps without flashing caught a total of 395 reptiles and amphibians representing 15 species, and traps with the flashing caught a total of 624 reptiles and amphibians representing 20 species.

0378 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Donald McKnight¹, Anne Jones², Day Ligon¹

¹*Missouri State University, Springfield, MO, USA*, ²*Virginia Polytechnic Institute and State University, Blacksburg, VA, USA*

The Omnivorous Diet of the Western Chicken Turtle (*Deirochelys reticularia miaria*)

Eastern chicken turtles (*Deirochelys reticularia reticularia*) are known to be strict carnivores, but no previous studies have examined the diet of the western subspecies (*D. r. miaria*). To investigate this important aspect of this subspecies's ecology, we collected 25 fecal samples from 14 *D. r. miaria* in southeastern Oklahoma. Crawfish (*Procambarus* sp.) were found in 96% of samples and appear to be the dominant food source for *D. r. miaria* at this site. Most of the consumed crawfish were 26–32 mm in carapace length, and there was a correlation between turtle size and crawfish size. Insects representing four orders (predominantly Hemiptera and Coleoptera) were found in 48% of samples, and plant matter was found in 96% of samples. Vegetative matter was found in 92% of samples, roots were found in 56% of samples, and seeds were found in 48% of samples. While most of the plant matter was unidentifiable, the common rush (mostly seeds; *Juncus effusus*), broadleaf cattail (*Typha latifolia*), and giant cutgrass (seeds; *Zizaniopsis miliacea*) were identified in 28, 28, and 24% of samples respectively. While it is clear that invertebrates comprise the majority of the diet of *D. r. miaria*, it is equally clear that, unlike its eastern counterpart, *D. r. miaria* is omnivorous.

0101 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Caleb McMahan, Prosanta Chakrabarty

LSU Museum of Natural Science, Baton Rouge, LA, USA

Phylogeny of the Herichthyine Cichlids (Teleostei: Cichlidae)

The herichthyines (Teleostei: Cichlidae) are a diverse clade of some 37 species of primarily northern Middle American cichlids. There exists great variation in the morphology, ecology, and behavior of this group of cichlids, and recent work has proposed differing hypotheses regarding the evolutionary relationships among these fishes, as well as the inclusion of some species within this group. The purpose of this study is to take an integrative approach using both multilocus sequence data, as well as morphological data, to elucidate the phylogenetic history of this group of cichlids. Results will allow us to diagnose the herichthyine cichlid clade and its inclusive species, as well as assess taxonomic validity of genera within. This large-scale phylogenetic hypothesis also sheds light on the evolution of certain characters among these fishes, as well as questions regarding species-level relationships.

0185 General Herpetology, San Miguel, Monday 15 July 2013

Caleb McMahan¹, Layla Freeborn², Brian Crother³

¹*Louisiana State University, Baton Rouge, LA, USA*, ²*Tulane University, New Orleans, LA, USA*, ³*Southeastern Louisiana University, Hammond, LA, USA*

Revisiting Incongruences in Squamate Phylogenetics

Incongruence between molecular and morphology based phylogenetic hypotheses have been reported across a wide range of taxa. Molecular and morphological hypotheses of squamate phylogeny have been consistently incongruent and have been notoriously difficult to reconcile. With the ever-rising popular view of the superiority of molecular data over morphological data, the studies have been biased towards seeking explanations for homoplasy in the morphological data. We propose considering approaches that don't make a priori assumptions about the superiority of one type of data over another. We present a case study using the proto-oncogene *c-mos* to examine apomorphy distributions across hypotheses. This approach reveals novel insights into the data incongruences currently plaguing squamate phylogeny.

0414 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Jessica L. McQuigg, Richard M. Lehtinen

The College of Wooster, Wooster, OH, USA

A Reassessment of the Conservation Status of a Critically Endangered Neotropical Frog, *Mannophryne olmonae*, Using Occupancy Modeling Techniques

Amphibian species worldwide are threatened with decline and extinction, making species monitoring an important scientific endeavor. The Bloody Bay Poison Frog, *Mannophryne olmonae* (Aromobatidae), a Tobago island endemic, was identified as critically endangered by the IUCN in 2004. However, recent evidence suggests that a less severe conservation status may be appropriate for *M. olmonae*. This study employs acoustic calling surveys, land-use information, and occupancy modeling techniques with two years of survey data (2011 and 2012) from 34 sites to rigorously assess the conservation status for this species. The robust estimate of occupancy was 75.9% (SE=0.0779) and no covariates were found to affect occupancy. This study suggests that *M. olmonae* occupies a larger geographic range than was previously thought, and is not experiencing population declines. These findings, in conjunction with other data, suggest that this species does not require the conservation status of critically endangered and should be re-classified with a less severe conservation status.

0129 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Cintia Medina¹, Avila Luciano¹, Jack Sites², Mariana Morando¹

¹CENPAT-CONICET, Pto Madryn, Chubut, Patagonia, Argentina, ²Brigham Young University, Biology Department, Provo, Utah, USA

Phylogeographic Study of *Liolaemus buergeri* (Iguania: Liolaemini) Based on Two Mitochondrial and Two Nuclear Gene Sequences

Liolaemus is the most southerly distributed lizard genus in South America, with more than 230 described species. Within *Liolaemus*, several clades and species complexes have been proposed, including the *kriegi* complex proposed in 1986 by Cei. This complex includes species distributed in Argentinean and Chilean Patagonia. Described species of the complex are: *L. kriegi*, *L. ceii* and *L. buergeri* and candidate species are: *L. sp. A*, *L. sp. B*, *L. sp. C* and *L. sp. D*. The aim of this study is to present an extended and intensive phylogeographic study of *Liolaemus buergeri* and closely related candidate species. The sampling sites encompass an area from south of Mendoza province to central Neuquén province, covering the entire distribution range of this species with intensive population

sampling. We used 154 individuals from 43 localities, for which we sequenced two fragments of mitochondrial genes (cytb, ~800 bp and 12s, ~850 bp), and for a subset of samples, two nuclear markers (KIF24, ~490 bp and BA3, ~265 bp). We generated gene trees and single marker as well as multilocus networks. Based on the cytochrome-b fragment we performed standard genetic diversity and demographic analysis for many well-supported clades recovered in the gene trees. We performed statistical comparative analysis based on traditional morphological characters for each of the main clades. We discuss these results within geographical, demographic and evolutionary contexts. The evidence indicates that candidate species are populations of very recent origin with different degrees of differentiation, some of which could be considered full species.

0651 Herp Systematics, San Miguel, Friday 12 July 2013

Maria Fernanda Medina¹, Eli Greenbaum¹, Aaron Bauer², William Branch³

¹The University of Texas at El Paso, El Paso, TX, USA, ²Villanova University, Villanova, PA, USA, ³Bayworld, South Africa, South Africa

Systematics of African Skinks in the *Panaspis wahlbergi* Complex

Snake-eyed skinks are relatively small lizards of the genus *Panaspis* that are mostly endemic to the savannah areas of sub-Saharan Africa. During an expedition in January 2010, specimens of this genus were collected from a moss forest in Katanga Province, Democratic Republic of the Congo (DRC). Out of the three species known to reside in Katanga, *P. seydeli*, *P. smithii* and *P. wahlbergi*, the newly collected specimens had a congruent morphology with *P. wahlbergi*. Our well-supported genetic and morphometric datasets suggested that the Katanga population is distinct from all other known *Panaspis* species, and *P. wahlbergi* is a complex of several cryptic species. To test the extent of the diversification in the *P. wahlbergi* complex, we used PCR to amplify the mitochondrial genes 16S and cyt *b* (550 bp and 614 bp respectively) and the nuclear gene PDC (422 bp) from additional samples from different localities in Sub-Saharan Africa. We aligned these data for analyses with maximum likelihood (RAxML program) and maximum parsimony (PAUP* 4.0b) optimality criteria. Our analyses demonstrated widespread cryptic speciation within the complex, illustrating that there is far more diversity in *Panaspis* than previously recognized.

0313 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Bruno Melo¹, Brian Sidlauskas², Kendra Hoekzema², Richard Vari³, Claudio Oliveira¹

¹Universidade Estadual Paulista, Botucatu, SP, Brazil, ²Oregon State University, Corvallis, OR, USA, ³National Museum of Natural History, Washington, DC, USA

The first molecular phylogeny of Chilodontidae (Teleostei: Characiformes) reveals cryptic biodiversity

Chilodontidae is a small family of eight described characiform species popularly known as headstanders. These small to moderately sized fishes are well known to aquarists, who prize their striking spotted pigmentation and unusual behaviors, and to systematists, who have revised both chilodontid genera in recent memory and studied their phylogenetic relationships using a comprehensive morphological dataset. However, no molecular phylogeny for the family has ever been proposed. Here, we reconstruct phylogenetic relationships for all eight known chilodontid species using three mitochondrial and two nuclear loci. Results largely agree with the previous morphological hypothesis, and confirm the monophyly of the family as well as its included genera, *Caenotropus* and *Chilodus*. The molecular topology differs slightly from the morphological hypothesis by placing *Caenotropus maculosus* rather than *C. mestomorgmatos* as the sister to the remaining three congeners, and by reconstructing the Curimatidae as the closest outgroup family, rather than the Anostomidae. However, the topologies supported by the morphological data were only slightly less likely and could not be rejected via a Shimodaira-Hasegawa test. Within *Chilodus*, two described species with distinctive pigmentation (*C. fritillus* and *C. zunevei*) appear embedded within a biogeographically structured *C. punctatus*, suggesting the presence of cryptic taxa with polymorphic pigmentation within the present concept of *C. punctatus*. Future work should combine morphological and molecular data to revisit the systematics of *Chilodus* and determine species limits within the *C. punctatus*-group *sensu lato*.

0062 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Veronica Mendoza-Portillo, Hector Espinosa

Instituto de Biología, UNAM, Mexico DF, Mexico

Potential Distribution of the Catostomidae in the Sierra Madre Occidental, Mexico

Sierra Madre Occidental (SMOc) extends from the Mexico-USA border, through the Mexican Volcanic Belt, measuring more than 1 200 km of distance and a maximum altitude of 3348 m. Its fish diversity includes a total of 108 species (15 families and 41

genres): 25 endemic of Mexico, 9 endemic of the SMOc and 17 exotic species. From the total count, 25.9% were found to be threatened, 10.2% endangered, 6.5% protected and 0.9% probably extinct, according to the Mexican Oficial Norm (NOM-2010). Although the suckers family (Catostomidae) represents the 12.4% of the whole fish diversity of the SMOc and 22.2% of its endemic species, six of the 11 species found are under some category of threat, mostly because of the anthropogenic habitat alteration, stream desiccation and pollution. Therefore we modeled the known and potential distribution of the family (present and future), in order to elucidate the alterations in its distribution because of the climate change, and to identify the places where the species should be specially protected. We used MaxEnt to map the distribution of the 11 species of Catostomidae in the SMOc, resulting in a general maintenance of its range, thus the family is not radically affected by general climatic changes within its habitat, even though it resulted severely affected by the mean diurnal range of the data set.

0787 Fish Conservation, San Miguel, Sunday 14 July 2013

Norman Mercado-Silva, Scott Bonar, Matt Rahr, Toby Torey, Averill Cate Jr.

University of Arizona, Tucson, Arizona, USA

Comparing Standard North American Freshwater Fish Data Using a Simple Online Tool: fisheriesstandardsampling.org

Recently, the American Fisheries Society developed standard methods to sample freshwater fish populations, publishing them in 2009 in the book *Standard Methods for Sampling North American Freshwater Fishes*. This project involved 284 scientists from 107 different organizations across Canada, Mexico and the United States. Data collected using standard methods gives biologists the ability to compare data across regions or time. Here we discuss recent progress on an on-line web-accessible database program to compare fish growth, condition, length-frequency, and catch per unit effort data collected using AFS standard methods. Development of this database is a collaborative effort among AFS, the US Geological Survey, the National Park Service, the U.S. Forest Service, the University of Arizona, and the University of Guadalajara, Mexico. The database (1) provides on-line summaries of 4,092 data sets of condition, length-frequency, CPUE and growth indices of common freshwater fishes, collected using standard gears from 42 states and provinces across North America, (2) allows entry of new data collected using standardized methods, so averages of commonly-used fishery indices can be updated, and (3) allows queries, graphical, and tabular output of the data summaries so they can be easily accessed and integrated into projects across North America. Users will be able to compare condition, growth and abundance of fish collected in a particular waterbody with regional and rangewide averages and percentiles, thus increasing resource information in a variety of areas. The database is programmed in a PHP-based Drupal framework.

0193 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Norman Mercado-Silva¹, Kyle Piller², John Lyons³, Rodrigo Moncayo-Estrada⁴, Pablo Gesundheit - Montero⁵

¹DERN-IMECBIO, Universidad de Guadalajara, Autlan de Navarro, Jalisco, Mexico, ²Southeastern Louisiana University, Hammond, Louisiana, USA, ³University of Wisconsin - Madison, Madison, Wisconsin, USA, ⁴Instituto Politecnico Nacional, Jiquilpan, Michoacan, Mexico, ⁵Instituto Nacional de Ecologia y Cambio Climatico, Mexico City, Mexico

Trophic Role of Lake Chapala (Michoacán and Jalisco, Mexico) Species of *Chirostoma* (Pisces, Atherinopsidae) Analyzed Using N and C Isotopic Signatures

Lake Chapala, the largest freshwater lake in México, harbors 26 native species of fishes including eight species of *Chirostoma*. Silversides in this lake have been an important cultural and economic component of the region since pre- Colombian times. Many species, especially *pescados blancos* in Lake Chapala have been heavily over-fished and have witnessed severe population declines. Several *Chirostoma* in lake Chapala have distinctive morphologies and large range of body sizes. Morphological and size diversity have been related to different trophic specializations. The large species of *Chirostoma*, including *C. lucius*, tend to be piscivorous, whereas the smaller species, such as *C. jordani*, are typically plankton feeders. We present N and C stable isotope evidence of the trophic role that six species of *Chirostoma* and other species of native and non-native fish have in the Lake Chapala foodweb. Our preliminary analyses show important differences in stable isotope signatures between samples collected in 12 different sites across the lake. Further, we find some differences in stable isotope signatures related to fish size and among different species of *Chirostoma*. Future linkage of stable isotope data with morphological analyses of Lake Chapala species of *Chirostoma* could result in a better understanding of the phylogenetic and trophic relationships that occur among members of this commercially and scientifically important genus.

0500 HL Detectability Symposium, Brazos, Friday 12 July 2013

David Miller¹, Cheryl Brehme³, Evan Grant², James Hines², James Nichols², Robert Fisher³

¹*Penn State University, University Park, PA, USA*, ²*USGS - Patuxent Wildlife Research Center, Laurel, MD, USA*, ³*USGS - Western Ecological Science Center, San Diego, CA, USA*

Using occupancy models to determine the influence of water dynamics on amphibian communities

Annual water dynamics and permanence of breeding habitat have important influences on the structure of amphibian communities. We use two examples to demonstrate how occupancy models can be used to examine the influence of water dynamics on amphibian community composition. The first example involves occurrence dynamics in vernal pool habitats in 14 protected areas from throughout the northeast United States. We focus on wood frogs and spotted salamanders and show how pond characteristics interact with annual variability in precipitation and latitude to affect the occurrence of breeding activity by each of the species. For this example we use a hierarchical approach to modeling, which allows to efficiently examine patterns across multiple study areas. In the second example, we examine how annual changes in water availability in stream habitats affect interactions between populations of endangered arroyo toads and a suite of introduced predators that threaten the species. In this example we simultaneously model the occurrence of water, toads, and predators using a multi-state approach. We show that drying of stream habitat in drought years has a differential effect on toads versus predators that can lead to the creation of a period of predator free space after water returns in subsequent years. In both examples, occupancy models provide a flexible framework for observing community dynamics and help to elucidate the mechanisms that structure species occurrence in each system.

**0356 NIA BEST STUDENT POSTER, Poster Session II, NW Exhibit Hall,
Saturday 13 July 2013**

Elizabeth Miller¹, Philip Hastings², Hsiu-Chin Lin³

¹University of California, San Diego, La Jolla, CA, USA, ²Scripps Institution of Oceanography, La Jolla, CA, USA, ³Biodiversity Research Center, Academia Sinica, Taipei, Taiwan

A Molecular Phylogeny of the Neotropical Tripterygiidae (Teleostei: Blennioidei)

The blennies (Blennioidei) are an excellent group to study evolutionary processes. They possess several life history traits that promote population isolation and formation of genetic structure, such as demersal egg laying, semi-sessile adult lifestyle, nearshore development, and short larval duration. The triplefin blennies (Tripterygiidae) are a group of small cryptobenthic shorefishes that are found worldwide. Despite the potential for the group to reveal interesting patterns of speciation, the phylogenetic relationships within the triplefins has not been fully resolved. We present a molecular phylogeny of the triplefin blennies of the Neotropics. Sequence data was acquired from from 16S and 18S ribosomal RNA, CO1 and cytochrome b mitochondrial DNA, and the following nuclear markers: Rhodopsin, TMO-4c4, RAG1, and Histone H3. Taxa coverage includes 12 species of triplefins from 4 genera, as well as 6 outgroups to determine the placement of the Tripterygiidae within the broader context of the Perciformes. Sampling includes two newly described triplefin species. Preliminary analyses support the monophyly of the Tripterygiidae.

0576 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Melissa A. Miller¹, John M. Kinsella², Ray W. Snow³, Christina M. Romagosa⁴, Robert N. Reed⁵, Michelle McEachern⁵, Craig Guyer¹

¹Department of Biological Sciences, Auburn University, Auburn, AL, USA, ²HelmWest Laboratory, Missoula, MT, USA, ³Everglades National Park, National Park Service, Homestead, FL, USA, ⁴Center for Forest Sustainability, Auburn University, Auburn, AL, USA, ⁵Fort Collins Science Center, US Geological Survey, Fort Collins, CO, USA

An Examination of Lung Endoparasites of Invasive Burmese Pythons (*Python molurus bivittatus*) in South Florida

Non-indigenous species (NIS) can be a source for the introduction of exotic parasites. Identification of such parasites is critical to understanding overall impact of NIS on native faunas. We examined wild-caught Burmese pythons (*Python molurus bivittatus*; n =296) from south Florida for the presence of lung endoparasites during 2009 to 2012.

Two species of pentastomid parasites, *Raillietiella orientalis* and *Porocephalus crotali*, were identified based upon morphological traits; however the identity of *R. orientalis* is currently tentative. *R. orientalis* is native to Asia while *P. crotali* is distributed throughout the Americas. Twice as many *R. orientalis* were found compared with *P. crotali*. All gravid females observed were *R. orientalis*, which may signify *P. crotali* cannot develop to maturity in pythons. Prevalence of infection in pythons was low (16%) and mean parasite load was 1.5 pentastomes per python. There was no difference in infection rate between male (54%) and female (46%) pythons.

0280 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

William Miller, Joel Snodgrass, Gail Gasparich

Towson University, Towson, Maryland, USA

The Effects of Urbanization on Gene Flow and Genetic Population Structure in a Headwater Salamander, *Desmognathus fuscus*, Over Multiple Spatial Scales

Many organisms are arranged in spatially explicit populations linked by the transfer of individuals among habitat patches. Dispersal represents both spatial and temporal connectivity and can be indirectly inferred via spatial genetic population structuring.

Organisms that prefer headwater streams can be conceptualized as occupying patches potentially connected by within stream and overland dispersal, and may be particularly subject to isolation caused by anthropogenic disturbance associated with urbanization.

We used six microsatellite markers to compare patterns of genetic population structuring in a headwater salamander, *Desmognathus fuscus*, between urban and rural watersheds. We selected study streams to be proximate based on within stream distances and overland distances. Our preliminary findings showed significant genetic structuring at within stream distances of as little as ~10.7 km ($F_{st} = 0.026$) and overland distances of as little as approximately 1.0 km ($F_{st} = 0.069$). However, there were no relationships between within stream or overland distance and genetic population structuring as measured by F_{st} , suggesting that anthropogenic barriers to dispersal are influential in both urban and rural watersheds and affect both within stream and overland routes of dispersal. Addition of more watersheds and analyses of landscape resistance models will help clarify these patterns and identify specific barriers to *D. fuscus* dispersal.

0150 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Ignacio Minoli, Mariana Morando, Luciano Avila

CENPAT-CONICET, Puerto Madryn, Chubut, Argentina

Integrative Taxonomy: Adding Methodological Approaches to Species Delimitation in the *Liolaemus fitzingerii* Complex

We performed a comparative study of the species currently included in the *Liolaemus fitzingerii* complex (sensu Avila et al., 2006): *L. fitzingerii*, *L. xanthoviridis* and *L. chehuachekenk* including the recently described *L. camarones* and *L. shehuen* (Abdala et al., 2012). The objective of this study is to incorporate methodological approaches previously not used for this complex, i.e. statistical morphometric analyses and niche modeling, to evaluate their contribution to species delimitation for phylogenetically closely related species. To avoid possible morphological, ecological and geographical bias we analyzed only individuals restricted to their five type localities. We used ten continuous morphometric variables (adults differentiated by sex) and performed classical statistical analyses and lineal discriminant analysis. We also implemented niche modeling analyses using 19 environmental variables plus altitude with a resolution of 30 arc-seconds (~ 1 km). Statistical analyses were performed with R 2.15.2, niche modeling with Maxent 3.3.3k, and maps and Quantum GIS 1.8. Although most of the species showed differentiation with these analyses, *L. fitzingerii* occupies the same morphospace as *L. camarones*; linear discriminant analyses had a high error in separating *L. chehuachekenk* from *L. shehuen*, which also have overlapping environmental niches (it was not possible to model *L. camarones*). The results are compared and discussed in relation to their taxonomic and methodological implications.

0140 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Seiji Miyazono¹, Christopher Taylor²

¹Texas Tech University, Lubbock, TX, USA, ²Abernathy Fish Technology Center, Longview, WA, USA

Effects of Natural Stream Fragmentation on Desert Fish Metacommunities

Stream fragmentation via desiccation is a major threat for desert fish assemblages. We hypothesized that fragmentation of the stream continuum would affect the relative importance of local and regional processes on desert fish assemblages. To test this hypothesis, we examined species-area relationships, nested subset patterns along local factors and spatial position, and distance-decay relationships of fish assemblages in 42 pools in three stream segments with different fragmentation levels in the Trans-Pecos

Region in Texas. Our results indicated that the stream pools were significantly nested when ordered by pool volume (more species in large pools) in all stream segments, suggesting that the fish assemblages could be extinction-driven. However, the species-volume curves considerably varied among the stream segments, indicating that pools in the least fragmented stream segment accommodated more fish taxa than pools in the most fragmented stream segment. We found a significant distance-decay relationship for fish assemblages in only most fragmented stream segment, suggesting that as fragmentation increases, dispersal limitations might become more important. These results suggested that fragmentation in stream continuum might intensify the local species extinction by decreasing rescue effects for the fish assemblages in the desert stream systems.

0158 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Patrick D. Moldowan¹, Ronald J. Brooks², Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada, ²University of Guelph, Guelph, Ontario, Canada

Sexual dimorphism and alternative mating strategies in the Midland Painted Turtle (*Chrysemys picta marginata*)

Well-recognized sexual dimorphisms (SD) of the Midland Painted Turtle (*Chrysemys picta marginata*) include a larger female body size and longer male forelimb claws. Another potential SD of Painted Turtles is the size of the philtrum, anatomically defined as the upper jaw cleft bordered on each side by a tooth-like cusp. Observations from a long-term study of Painted Turtles in Algonquin Provincial Park (Ontario, Canada) suggest that males have pronounced philtra of variable lengths, whereas the philtra of females are often less prominent. In addition, female Painted Turtles in Algonquin Park have been regularly recorded with injuries on the neck indicative of bite wounds, possibly inflicted by males during mating. Traditionally, it is thought that female Painted Turtles choose mates based on courtship display and/or traits that demonstrate male quality; however, recent work has indicated that predictors of male quality (e.g., forelimb claw length) do not reliably account for male reproductive success, suggesting that an alternative mating strategy may be involved in reproduction. We propose that male Painted Turtles exhibit a coercive mating strategy, using their philtra to secure females, as evidenced by bite wounds observed on females. We hypothesize that the philtra of male Painted Turtles confer a reproductive advantage by increasing the frequency of successful copulation. Using field observations, behavioural trials, and paternity data from the Algonquin Park population, our study will explore the relationship between male phenotype and behaviour with respect to siring success in a well-studied population of Painted Turtles.

0622 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Patrick D. Moldowan¹, Glenn J. Tattersall², Jennifer Hoare³

¹Laurentian University, Sudbury, Ontario, Canada, ²Brock University, St. Catharines, Ontario, Canada, ³Algonquin Provincial Park, Ontario, Canada

Seeing spots: population and reproductive monitoring of Spotted Salamanders (*Ambystoma maculatum*) in Central Ontario

Since 2008, a breeding population of Spotted Salamanders (*Ambystoma maculatum*) has been intensively monitored at Bat Lake, Algonquin Provincial Park (Ontario, Canada), approaching the species northern range limit. This research has focused on establishing data records of individual morphometrics, breeding phenology (e.g., arrival, egg laying, and departure dates), population parameters (e.g., breeding population size, sex ratio), local geographic dynamics, and environmental conditions. Annual mark-recapture is facilitated through the use of a minimally invasive photographic identification software (Interactive Individual Identification System, I³S 2.0), which catalogues each animal based on the unique spotting pattern. The earliest lay date has advanced by approximately two days every year for the past five years. Combined with data from the early 1990s, it is evident that the earliest lay date of salamanders has been steadily advancing to earlier in the season. Climate change seems a likely explanation for the underlying changes in the breeding phenology of Bat Lake salamanders; however, little research exists on whether these changes in climate may be involved in influencing population size, operational sex ratios, and arrival and departure dates of salamanders at breeding sites. We ask, are salamanders altering the time spent in courtship and is an altered arrival time the explanation for changes in lay dates? This presentation will highlight findings of the Algonquin Park salamander monitoring project to date and discuss the use of photographic identification software in mark-recapture study.

0204 NIA Oral Papers, Doña Ana/Cimarron, Monday 15 July 2013

Rodrigo Moncayo-Estrada¹, Pablo Del Monte-Luna², Juan Pablo Ramirez-Herrejon³, Carlos Escalera-Gallardo¹

¹CIIDIR-Instituto Politecnico Nacional, Unidad Michoacan, Jiquilpan, Michoacan, Mexico, ²CICIMAR-Instituto Politecnico Nacional, La Paz, Baja California Sur, Mexico, ³CIBNOR-CONACYT, La Paz, Baja California Sur, Mexico

Analysis of Food Webs in Mexican Aquatic Ecosystems

Food webs represent a complex interweaving of several food interactions. They describe the energy and nutrients movement among the ecosystem components (principally the

prey-predator interaction). The present contribution describes several proposals that lead to the understanding and structuring of food webs, and their management in dynamic models in small water bodies in Mexico using mainly fish. It is divided into sections where the analysis begins with the basics about feeding trophic guild and the importance of food items through the Index of Relative Importance and the complementary stable isotope analysis of nitrogen ($\delta^{15}\text{N}$) and carbon ($\delta^{13}\text{C}$). Next it follows a description of the trophic niche in terms of position, breadth and overlap for determining how species use resources in ecosystems, analyzing food strategies. We emphasized the importance of species interactions considering the coexistence of some species flocks and the presence of introduced species including proposals for implementation of multivariate statistical analysis. Finally, we explore the moving from static models to dynamic food webs with the use of programming tools (ECOPATH with ECOSIM and Stella) to obtain a consistent representation of system processes and understand their function. In each of the sections we reviewed of the main methodological approaches used, utilizing examples of their application in different water bodies of Mexico and the results are discussed in light of conservation initiatives, control and effects of resource use.

0658 Reptile Ecology, Mesilla, Monday 15 July 2013

Chad Montgomery¹, Scott Boback², Robert Reed³, Steve Green⁴, Tony Frazier⁵

¹Truman State University, Kirksville, MO, USA, ²Dickinson University, Carlisle, PA, USA, ³USGS, Ft. Collins, CO, USA, ⁴Operation Wallacea, Lincolnshire, England, UK, ⁵California Polytechnic State University, San Luis Obispo, CA, USA

Body Size, Growth, and Sexual Size Dimorphism in *Boa constrictor imperator* from Cayos Cochinos, Honduras

Body size is one of the most important characters of an organism because of its relationship to a suite of life history variables. Often insular populations show differential growth and overall body size relative to mainland populations. This difference can be related to differences in prey base and prey availability. We examined growth rate, body size, and sexual size dimorphism in an insular population of dwarf *Boa constrictor imperator* in the Cayos Cochinos Archipelago, Honduras. The population shows female larger sexual size dimorphism. There was an ontogenetic decline in growth rate in both sexes. Females had a significantly greater growth rate than males at larger body sizes. Both initial body size and sampling interval had a significant effect on growth rate estimation, which implies that sampling interval be considered carefully when estimating growth rates.

0627 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Millke Jasmine Arminini Morales¹, Claudio Oliveira¹, Fernando Fernandes Mendonça¹, Rui Coelho², Miguel Neves Santos³, Fausto Foresti¹

¹Instituto de Biociências, UNESP, Botucatu, São Paulo, Brazil, ²Centro de Ciências do Mar (CCMAR), Universidade do Algarve, Faro, Algarve, Portugal, ³Instituto Português do Mar e da Atmosfera (IPMA, I.P.), Olhão, Algarve, Portugal

Population genetic structure of the bigeye thresher shark, *Alopias superciliosus*, using mitochondrial DNA control region, in a comparison between the Atlantic and Indian Oceans

The bigeye thresher shark, *Alopias superciliosus*, is a highly migratory species that occurs in oceanic and coastal areas of all Oceans, particularly in tropical regions. It is currently assessed as globally “Vulnerable” by the IUCN (International Union for the Conservation of Nature) because of its population declines in the past years. Considering the scarcity of information regarding the biology and population genetics of this species, the current study sought to characterize the genetic population structure of *A. superciliosus*, comparing samples from the Atlantic and Indian Oceans. Sequences of mitochondrial DNA from the control region (D-loop) were used, with 913 bp (base pairs) analyzed from 122 specimens from the Atlantic and 11 specimens from the Indian Ocean. Considering all the samples, both from the Atlantic and Indian Oceans, only eight haplotypes were found, with one of the haplotypes shared by 93.2% of the analyzed sharks. These results suggest a very low genetic variability ($\pi = 0.00121 \pm 0.00042$ and $h=0.131 \pm 0.040$), no population structure (no significant Φ_{ST} value), and an intense gene flow across the studied areas, even between the two Oceans. Therefore, for fisheries management and species conservation purposes, a single *A. superciliosus* stock should be considered in the entire sampled area, with this low genetic variability suggesting a natural fragility of the species. Furthermore, it seems the bigeye thresher sharks have the ability of migrating between those two regions of the Atlantic and the Indian Oceans.

**0502 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Clinton Moran, Alice Gibb

Northern Arizona University, Flagstaff, AZ, USA

My, what big eyes you have! Do non-native species in the Colorado River basin have a greater reliance on vision, relative to native fishes?

Waterways in the southwest were historically defined by periodic flooding events produced by snow-melt and seasonal monsoons; native fishes of the southwest evolved to succeed in this high seasonal variation in biotic and abiotic features. However, the installation of dams on southwestern rivers has created a reduction in seasonal variation and an overall drop in water temperature and turbidity. We hypothesize that these abiotic changes are exploited by introduced fishes that have a greater reliance on visual sensory input, which facilitates their ability to target and catch native fishes and other prey items. We sampled native and non-native fishes from several waterways in the lower Colorado River basin and photographed them from the lateral view with their jaws manually extended. From these photos, we measured eye diameter, standard length, head length, and maximum gape. As predicted, non-native fishes have a larger eye diameter (at a given standard length) than native fishes, and this pattern was consistent across different trophic guilds and within a family. Maximum gape was also larger in the non-native fishes, which should enable non-natives to consume relatively larger prey at a given body size. It is likely that native fish did not evolve strong visual capabilities because they were unable to see their prey from a distance in the naturally turbid environment. However, non-native fishes are better suited to the current conditions of the Southwestern rivers because, under the drastically different conditions seen now, highly visual predators will out-compete and directly prey upon native fishes.

0763 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Krista Mougey, Gad Perry

Texas Tech University, Lubbock, TX, USA

Ecology and Life History Characteristics of the Repatriated Stout Iguana Population of Guana Island, BVI

The stout iguana (*Cyclura pinguis*) is a critically endangered West Indian rock iguana endemic to the British Virgin Islands. The distribution of *C. pinguis* was limited to the single island of Anegada until conservation concerns in the 1980s prompted the founding of an artificially reestablished population on Guana, a minimally developed island within the historic range of the species. Despite dramatic differences in the

geology and vegetation between the islands, and a founding population of only 8 individuals, the Guana population has grown markedly. We have been conducting a mark-recapture study, tracking population trends, and recording the morphometric, physiological, and life history characteristics of this population for ten years. We have captured, measured, and PIT tagged over 400 individuals. Our studies have shown evidence of ecological, morphometric, and physiological differences from the Anegada population. Both within- and between- year growth rates are significantly higher in the Guana population than in the head-started Anegada population. Hatchlings found on Guana gain an average of 115 mm snout-vent-length within the first year of development, but growth rates decrease with increased body size. The sex ratio of captured adults is near 1:1. Adults are known to be territorial, but hatchlings and sub-adults also exhibit some site fidelity. The height of the daily activity period is between 9:30 and 14:30, although larger individuals tend to be active longer. The success of the Guana population offers insights into the importance of island management and provides a geographically distinct conservation hedge for this critically endangered species.

0645 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Genevieve Mount, Evan McCartney-Melstad, Phillip Spinks, Bradley Shaffer

University of California, Los Angeles, Los Angeles, California, USA

Genomic Resource Development in California Ranids

The majority of true frog (family Ranidae) species native to California are in decline, and currently there are limited genetic resources available for conservation or reintroduction studies. The goal of our study is to develop genetic resources usable across a variety of spatial scales, and for multiple species. We used target enrichment and next generation sequencing to develop nuclear markers for five species of Ranids in California including *R. boylei*, *R. aurora*, *R. draytonii*, *R. muscosa* and *R. cascade*. Our markers were developed from a 454 run enriched for microsatellites. From this resource, we eliminated repetitive regions and identified approximately 3,000 unique sequences ranging from 300-600 base pairs each. Next, we created DNA libraries enriched for these targeted regions and sequenced the targeted regions using the Illumina Miseq platform. Our preliminary data show at least 300 regions that amplified across all species. From our preliminary results we were able to 1) create a single nucleotide polymorphism (SNP) panel for use in better characterizing the extent of the hybrid zone between *R. aurora* and *R. draytonii*, 2) develop SNP resources for phylogeography in *R. boylei*, and 3) generate a phylogeny for these five ranid species. Due to the successful enrichment across these five species, it is likely these resources will be useable across other ranids for future conservation biology and phylogenetic studies.

0282 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Peter Moyle, John Durand

Center for Watershed Sciences, University of California, Davis, CA, USA

Ecology of non-coevolved fish assemblages in the San Francisco Estuary, California

The San Francisco Estuary, California, supports rich assemblages of organisms that are mixtures of native and alien species, forming novel ecosystems. The estuary is constantly changing due to natural variation in tides, water flows, salinity and temperature, in addition to anthropogenic changes brought by water diversion, urbanization and agriculture. The 50+ fishes known from Suisun Marsh, a large tidal marsh centered in the estuary, are about an equal mix of native and alien species, including some recently invading species. The assemblage appears to behave much as a co-evolved assemblage might under these conditions, with both ecological segregation and similar responses to environmental change in evidence. Native species currently demonstrate a long-term decline with somewhat synchronous, muted population fluctuations. Alien species show more asynchronous and extreme population fluctuations. Food webs involve integration of native and alien species of fish and invertebrates. Estuarine organisms appear to be adapted to respond well to incremental changes in environmental conditions, species assembly (via alien introductions) and anthropogenic alterations, until a threshold of stress is passed, causing a regime shift that can result in widespread population collapse among species. While evolutionary adaptations may also be taking place, the rate of non-directional environmental change, combined with new species invasions, swamps directional selective pressures.

0553 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Brenee Muncy¹, Steven Price², Michael Dorcas³

¹*University of Kentucky, Lexington, KY, USA*, ²*University of Kentucky, Lexington, KY, USA*, ³*Davidson College, Davidson, NC, USA*

Capture Probability and Survivorship of *Eurycea cirrigera* in Drought and Non-drought Conditions

Droughts represent a major disturbance in lotic systems, and likely negatively influences stream-inhabiting amphibian populations. However, due to the inability to predict droughts, investigations examining the response of stream amphibians to drought are uncommon. We conducted a capture-mark-recapture (CMR) study of a *Eurycea cirrigera* population at one stream from 2005-2010; during this 5 year period several drought events occurred. This stochasticity provided an opportunity to examine the effects of

drought on *Eurycea cirrigera* survivorship and capture probability. We found that capture probability was influenced by season and drought conditions. During most seasons, individuals were captured in the stream at higher probabilities during drought. We also found that salamander survival was also influenced by drought; monthly survivorship decreased from 0.96 ± 0.04 during non-drought conditions to 0.78 ± 0.04 during drought conditions. Our results suggest that drought leads to decreased monthly survivorship, yet capture probability increased during droughts possibly due to salamanders seeking refuge in the stream as opposed to in the terrestrial environment.

0573 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Christopher Murray¹, Mahmood Sasa², Craig Guyer¹

¹Auburn University, Auburn, AL, USA, ²University of Costa Rica, San Jose, Costa Rica

The Interface of Natural Population Dynamics, Land Use and Enigmatic Disturbance: Understanding Human Conflict with a Sentinel Species

Studies in the Tempisque River Basin in Guanacaste, Costa Rica document a highly skewed (3:1) male-biased sex ratio (Bolaños pers. comm). This is the highest recorded male-skewed populational sex ratio for any crocodylid (Thorbjarnarson 1997) and is thought to be responsible for increased human-crocodile conflict. Additionally, the Tempisque drainage houses a unique and vast wetland habitat. This “humedal” in Palo Verde National Park is a seasonal floodplain that offers unique habitat for reproduction, feeding, and development. We hypothesize that anthropogenic factors such as regional warming, agricultural clearing of riparian habitat, and synthetic androgen use pose potential explanations for this biased sex ratio. Preliminary data suggest abiotic and behavioral influences on nest thermal regimes and thus, clutch sex ratios. Further, we report nest thermal regimes and hatchling sex ratios that contribute to our hypothesis testing.

0046 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Ian Murray, Andrea Fuller, Hilary Lease, Duncan Mitchell, Robyn Hetem

University of the Witwatersrand, Johannesburg, South Africa

Physiological Ecology of the Husab Sand Lizard, *Pedioplanis husabensis*, a Namib Desert Endemic

Namibia hosts a diverse lizard fauna with an incredibly high level of endemism, particularly in the Namib Desert. One such endemic is the Husab Sand Lizard, *Pedioplanis husabensis*, a lacertid lizard with a distribution centered around the Husab

Mountains in the Namib Desert. Since its formal description by Berger-Dell'Mour & Mayer in 1989 few data have been published on the ecology of this species, and no data are available on its physiology. A heightened awareness of the vulnerability that many populations of lizards have to global climate change focuses efforts to better understand lizard physiology and ecology in order to predict how climate change may impact the distribution of lizard species. We used the doubly-labelled water method to estimate lizard field metabolic rates and focal animal observations to examine the activity patterns and foraging behavior of a population of Husab Sand Lizards during December - January along the ephemeral Swakop River in the Namib Desert. Husab Sand Lizards were active foragers with an abbreviated, unimodal pattern of daily activity. We found that field metabolic rates were substantially lower than would be expected for a similarly sized iguanid lizard, a trend similar to published field metabolic rates for a Namib gekkonid and gerrhosaurid.

0612 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Melia Nafus¹, Brian Todd¹, Tracey Tuberville², Kurt Buhlmann²

¹University of California, Davis, Davis, CA, USA, ²University of Georgia, Savannah River Ecology Laboratory, Aiken, SC, USA

Differential Habitat Use by Desert Tortoises (*Gopherus agassizii*) in Relation to Forage Availability

Greater net energy intake should result in faster growth rates and greater reproductive output. However, resource acquisition incurs cost and habitat use by individuals may vary as a result. Our goal was to examine trade-offs between resource acquisition and risk avoidance in Agassiz's desert tortoise (*Gopherus agassizii*). Our objectives were to determine: 1) whether resident female tortoises in two habitat types (creosote scrub and *Yucca* woodland) exhibited morphological differences that indicated long-term differences in forage availability; and 2) whether females in the two habitats varied in microhabitat selection. The *Yucca* woodland habitat contained greater perennial and annual species diversity, and more annual vegetation. Both shell volume and mass of *Yucca* woodland females were significantly larger than those in creosote scrub, but we found no difference in their body condition. We measured vegetation around used and available habitat. Creosote scrub females preferred burrows near microhabitats with increased annual abundance, greater species richness, and low grass-to-forb compositions. In contrast, *Yucca* woodland females did not select microhabitat based on forage but instead used burrows with increased perennial shrub number and volume. Tortoises in areas with abundant forage may reduce selection for forage in favor of areas that provide greater cover. In contrast, low forage availability may result in selection of areas with greater annual plant biomass despite potential added risk of exposure to predators and harsh weather. This study indicates that trade-offs between mortality risk and resource acquisition may affect microhabitat choice, and that the response varies in relation to forage availability.

0726 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Renato C. Nali¹, Cynthia P. A. Prado²

¹Universidade Estadual Paulista, Rio Claro, SP, Brazil, ²Universidade Estadual Paulista, Jaboticabal, SP, Brazil

Internal Oral Morphology of *Bokermannohyla ibitiguara* Tadpoles (Hylidae, Cophomantini) from the Brazilian Cerrado

The presence of a larval stage in anurans is widespread, but studies on tadpole morphology are scarce. Tadpoles' traits may be useful in solving taxonomic and phylogenetic problems, thus herein we used scanning electron microscopy to describe the internal oral morphology of *Bokermannohyla ibitiguara* tadpoles, a stream-dweller species endemic to the Brazilian Cerrado. The species belongs to the *B. pseudopseudis* group, included in the Cophomantini tribe. Buccal floor had a pair of lingual papillae and two pairs of infralabial papillae, with first pair showing digitiform secondary projections, a trait already reported for *Aplastodiscus* and *Bokermannohyla*, including species in the *B. pseudopseudis* group. The papillae of the buccal floor arena were disposed in three separate rows, differently from *B. alvarengai*. Buccal roof presented vacuities anterior to the internal nares, which has been suggested as a synapomorphy for the Cophomantini. The three pairs of postnarial papillae form an inverted V-shape, which seems to be typical in this genus, although a similar pattern has been found in *Aplastodiscus*. The papillae of the prenarial arena showed variation among individuals analyzed, and the lateral ridge papillae had short projections, which was never reported before. *Bokermannohyla ibitiguara* showed unique characteristics regarding oral morphology of tadpoles, but also shared traits with other studied species in the Cophomantini tribe, genus and taxonomic group. The study of other related species is needed, including Cophomantini genera never studied before (*Myersiophyla* and *Hyloscirtus*), which will allow further comparisons.

0145 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Ann-Elizabeth Nash

University of Colorado, Boulder, CO, USA

Vigilance Behavior of *Ctenosaura similis*, the Spiny-Tailed Iguana: Group Size, Rank, and Spatial Effects

Lizards may live in groups but are they truly social? A social group is a collection of individuals that live in close proximity, engage in behavioral interaction, and is discrete from other groups. Non-cooperatively breeding taxa that form aggregations may also have beneficial social behaviors.

Monitoring potential predators, observing conspecifics for threats and dominance rank, learning, and detecting mating opportunities are vigilance behaviors. Group size effect on vigilance behavior is well studied but little is known about its effects on reptiles including the Spiny Tailed Iguana, *Ctenosaura similis*, a lizard that forms aggregations. At Palo Verde National Park, Costa Rica, *Ctenosaura similis* were captured, morphometric data collected, and each lizard individually identified. Discrete groups were observed and dominance hierarchies established. Hypotheses were tested to determine the effects of social structure on vigilance behavior including group size, hierarchy rank, sex, spatial position, and behavioral syndrome. Preliminary data suggest an animal's behavioral type is the best predictor of vigilance behavior and is not fixed spatiotemporally.

0575 SSAR SEIBERT AWARD CONSERVATION, Galisteo/Aztec, Friday 12 July 2013

Kevin Neal¹, Todd Jackman¹, Ross Sadlier², Aaron Bauer¹

¹*Villanova University, Villanova, Pennsylvania, USA*, ²*Australian Museum, Sydney, New South Wales, Australia*

Comparing Population Genetic Structure in Two Sympatric New Caledonian Lizards: Implications for Conservation in a Mining-impacted Region

Habitat loss and fragmentation due to expanded mining activity in the Grande Sud region of New Caledonia have raised concerns over the viability of the island's diverse endemic lizard fauna. These geckos and skinks are generally considered susceptible to habitat loss and fragmentation due to geographic restriction, limited dispersal ability, and habitat specificity. However, differing life histories and dispersal capabilities might be expected to affect the responses of geckos and skinks to the effects of mining. To

determine susceptibility of geckos and skinks to the threat of expanded mining, I conducted population genetic analyses of two well-sampled species with overlapping ranges: the diplodactylid *Bavayia geitaina* and the scincid *Sigaloseps deplanchei*. Using one mitochondrial and three nuclear genes, I examined population structure and genetic diversity among populations of each species. *Bavayia geitaina*, inhabiting low- to mid-elevation humid forests, shows strong mesoscale genetic structure but little fine-scale structure, and displays little genetic diversity both within and among populations, suggesting limited resilience to the effects of mining. *Sigaloseps deplanchei*, restricted to high elevation humid forests on disjunct peaks or to humid microhabitats in drier forests, exhibits substantial fine-scale genetic structure, with relatively deep divergence among populations and relatively high genetic diversity within populations suggestive of a complex history of isolation and connection. The patterns identified in these two well-sampled species will help in diagnosing conservation needs in other New Caledonian geckos and skinks whose rarity prevents adequate sampling for fine-scale genetic analysis, but whose ecologies are well understood.

0427 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

Thomas Near

Yale University, New Haven, CT, USA

Phylogeny and tempo of diversification in the superradiation of acanthomorph fishes

Acanthomorphs comprise nearly one third of all living vertebrate species, but their phylogenetic relationships and evolutionary history are poorly understood. Molecular phylogenetic studies published over the past 10 to 15 years have resolved several unexpected and interesting clades within acanthomorphs. These recently discovered lineages include a clade containing Gadiformes, *Stylephorus*, and Zeiformes, a clade containing Lophiiformes and Tetraodontiformes, and the recently described Ovalentaria. In this talk I present a set of phylogenetic analyses of acanthomorphs using a nuclear gene supermatrix that includes 10 genes sampled from more than 600 species. This new molecular phylogeny challenges existing taxonomic classifications, supports the unexpected resolutions discovered in earlier molecular phylogenetic analyses, and resolves several additional novel clades. A relaxed molecular clock time tree was inferred using 36 well-justified age constraint priors from the teleost fossil record. The temporal analysis indicates acanthomorphs originated in the Early Cretaceous, with no changes in lineage diversification across the Cretaceous-Paleogene (K-Pg) mass extinction event 66 million years ago. A decrease in lineage diversification 50 mya is associated with a saturation of morphospace occupation, indicating that the early Paleogene was the zenith of acanthomorph evolutionary innovation. The hyperdiversity of living acanthomorphs is highlighted by several rapidly radiating lineages

including tunas, gobies, blennies, snailfishes, and cichlids that collectively invaded diverse aquatic habitats.

0660 AES Conservation, San Miguel, Sunday 14 July 2013

Christopher Neff¹, Robert Hueter²

¹University of Sydney, Sydney, Australia, ²Center for Shark Research, Mote Marine Laboratory, Sarasota, FL, USA

The role of science in improving shark bite terminology

The terminology surrounding shark “attack” is outdated and misleading to the public, perpetuating a perception of universal, intent-laden fatal outcomes. In this paper we examine the role of science in shark “attack” terminology. For more than 300 years scientists have sought to explain why sharks bite humans, including the work of Linnaeus (1758), Coppleson (1933), Gilbert (1963), Schultz (1963), Davies (1964), Baldrich (1974), Tricas and McCosker (1984), Gruber (1988) and Hazin and Burgess (2008). This paper builds off the typology of human-shark interactions proposed by Neff and Hueter (2013) and argues that communities such as the American Elasmobranch Society should consider adopting a formal position on the proper usage of “shark attack” terminology because: a) current terms fail to represent scientific knowledge; b) media discourse is misleading in its overuse of the term “shark attack”; and c) government policy overreactions to shark "attacks" threaten shark conservation of vulnerable species. This analysis provides a starting point for a robust scientific review of human-shark interactions. Given the attention of governments and the media to human-shark interactions, it is in the interest of the scientific community to call for the use of better, data-based terminology describing this phenomenon.

0034 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Jennifer Newby, Andrew Shedlock

College of Charleston, Charleston, SC, USA

An Assessment of Population Genetic and Social Structure in the Spotted Eagle Ray (*Aetobatus narinari*) off Sarasota, FL and the southeastern United States

The spotted eagle ray, *Aetobatus narinari*, is a semi-pelagic myliobatoid recognized as near-threatened by the World Conservation Union. A decreasing population trend, K-selected life history and primarily inshore, coastal habitat renders this species susceptible to over-exploitation by targeted fisheries, drift netting, and capture as

bycatch. Recent molecular investigations and the subsequent taxonomic recognition of *A. narinari* as a species complex have revealed a complete absence of data concerning population structure and genetic health for this species in the Central Atlantic region. This study is the first to examine fine-scale structure on a regional basis in the Gulf of Mexico and coastal Atlantic waters off the U.S. Individuals sampled non-invasively from 4 sites; Sarasota (n=143), the Everglades (n=36), Ft. Pierce (n=8) and the southeast Atlantic (n=24), were genotyped across 8 microsatellite loci. Standard tests for Hardy-Weinberg Equilibrium, null alleles, linkage disequilibrium, allelic richness (mean= 15.38) and gene diversity (0.7014) were performed. Analyses of statistically significant patterns of geographic structure using the applications STRUCTURE and AMOVA available in the Arlequin v. 3.5 software package yielded non-significant findings and support a single population model opposed to several admixed populations. Similarly, tests for isolation by distance returned non-significant results (Mantel test, $p=0.605$). Effective population size was estimated between 2,200 and 3,300 (LDNe and ONeSAMP applications, respectively). These assessments of population structure and measurements of genetic health for the Central Atlantic provide a critical first step toward furthering our understanding of *A. narinari* vitality and better informing conservation and management decisions.

0095 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Abbigail Nicholson, Dustin Siegel

Southeast Missouri State University, Cape Girardeau, MO, USA

Seasonal Variation and Modifications of the Genital Kidney Nephrons in *Notophthalmus viridescens*

Male salamanders possess dualistic kidneys, containing regions that differ primarily by function. Within the genital portion of the kidney, nephrons communicate with testicular ducts through vasa efferentia (via renal corpuscles) to allow sperm passage to the Wolffian ducts. Caudally, the pelvic kidney nephrons are responsible for filtration and urine formation. Stereotypical nephron regions found in the pelvic kidney exist in the genital kidney. Previous studies have assessed variation along the length of the genital kidney nephrons at the light microscopy level, but historical information on this phenomenon is lacking in terms of how genital kidney nephrons are modified from pelvic kidney nephrons for sperm transport, and how such modifications vary within the annual sperm production and transportation cycle. With ultrastructural analysis we support our hypothesis that the genital kidney nephrons are modified in structure from those found in the pelvic kidney. Folding along basal plasma membranes in the genital kidney proximal and distal tubules is absent, and within the proximal tubules exist epithelial cells with elongated cilia, suggestive of genital kidneys having reduced ability of reabsorption and gained ability to mix seminal fluids through ciliary action.

Ultrastructural analysis of proximal and distal tubules of the genital kidneys revealed

no seasonal variation in cellular activity and no production of seminal fluids throughout the sperm transport cycle. Thus, we failed to support our hypothesis that the cellular activity within the epithelia lining the genital kidney nephrons is correlated to specific events in the reproductive cycle.

0288 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Kirsten Nicholson¹, John Phillips², Sarah Burton¹

¹Central Michigan University, Mt. Pleasant, MI, USA, ²University of Tulsa, Tulsa, OK, USA

Biogeography of *Norops capito*: Second Example of a Contradictory Pattern

Previous literature has posited that the genus *Norops* originated in the Caribbean after the separation of North and South America, left members in Cuba and Jamaica, and disbursed overwater to Mexico, subsequently giving rise to a monophyletic clade that distributed themselves southwards until they invaded South America, presumably after the closure of the Panamanian Portal. However, a recent paper proposed a contradictory hypothesis suggesting that entire genus *Norops* originated prior to the separation of North and South America. It was suggested that perhaps *Norops* was widespread prior to the separation of North and South America, and that perhaps some mainland *Norops* lineages were separated on the mainland when the proto-Greater Antilles moved eastward. We present evidence from *Norops capito*, an arboreal species, and the second anole species to show a distinct south to north biogeographic pattern in contrast to previous hypotheses positing a north to south distribution. Our analysis of DNA sequence data from samples throughout the range of *N. capito* show this south to north distribution, in agreement with previously presented data for the *N. limifrons* group, but in contrast to data we presented previously for the *N. humilis* group, which shows a north to south distribution. A picture is emerging suggesting support for widespread *Norops* distribution prior to the separation of North and South America.

0740 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

James Nifong, Brian Silliman

University of Florida, Gainesville, FL, USA

Impacts of a large-bodied, apex predator (*Alligator mississippiensis* Daudin 1801) on salt marsh food webs

Large-bodied apex predators (e.g., sharks, wolves, crocodylians) are believed to regulate food web structure and ecosystem processes, but there remains relatively little

experimental evidence. Here we use field surveys and a mesocosm experiment to evaluate cascading effects of an apex predator (American alligator) on a salt marsh food web. Consistent with previous studies (n =10), field surveys revealed blue crabs (*Callinectes sapidus* Rathbun 1896), an important marsh mesopredator, were a frequent component of estuarine-occurring alligators' diet (mean \pm SD, 47 ± 20 %, n = 1384). In mesocosms, we examined potential consequences of this interaction in a simplified salt marsh community. We experimentally isolated alligator effects on the abundance (consumptive effect) and behavior (non-consumptive effect) of blue crabs and on blue crabs' consumption of plant-grazing snails and ribbed mussels. Alligators reduced blue crab abundance by ~ 40 % over 3 days and induced behavioral changes, resulting in decreased foraging activity and increased refuge use by blue crabs. The combined effects of reduced crab abundance and altered behavior translated into increased survival of both a keystone grazer (snails) and a mutualist (mussels) within the salt marsh food web. Our findings experimentally demonstrate a large-bodied, apex predator has the potential to 1) generate a trophic cascade, 2) elicit behavioral changes (i.e., non-consumptive effects) in mesopredator prey, and 3) indirectly affect the potential for both grazing and mutualism to occur in this food chain. Our results generate testable hypotheses regarding the broad-scales effects of alligator presence and top-down forcing in salt marsh ecosystems.

0741 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

James Nifong¹, Brian Silliman¹, Russell Lowers², Lou Guillette³, Kyler Abernathy⁴, Greg Marshall⁴

¹University of Florida, Gainesville, FL, USA, ²InoMedic Health Applications, Cape Canaveral, FL, USA, ³Medical University of Charleston South Carolina, Charleston, SC, USA, ⁴National Geographic Remote Imaging, Washington, DC, USA

Animal-borne imaging reveals theory-challenging insights into foraging success and strategies of a large-bodied apex predator, the American Alligator (*Alligator mississippiensis*)

Determining foraging habits of large-bodied, apex and top predators is often a difficult task. Due to inherent difficulties in studying these species, little is known regarding the frequency of prey-attacks, capture success, and diel activity patterns. We used animal-borne imaging systems (Cittercam) to quantify prey-attack frequency and prey-capture success of American alligators in two estuaries in coastal Florida, USA. We estimated the frequency of prey attacks and success rate of attacks using observations from video data (~ 70 hrs) retrieved from 15 deployments on individual adult alligators. Using general linear models (GLMs) we examined the variance in these behaviors explained by abiotic factors. We also provide a detailed assessment of alligator diel activity patterns and compare our results to published studies on other crocodylian and other apex predator

species.

We found the frequency of prey attacks (mean = 0.49 prey attacks / hour/ alligator) as well as probability of prey-capture success (mean = 0.52 / attack) were significantly affected by time of day. Alligators attempted to capture prey most frequently during night. Probability of prey-capture success per attack was highest during morning and lowest during day, night, and sunset, respectively. Position in the water column also significantly affected prey-capture success; alligators experienced two-fold greater success when attacks occurred below the water's surface.

Our estimates are the first for adult American alligators and one of the few examples for any crocodylians in nature. Our results highlight the importance of determining species-specific estimates of the frequency of prey-capture attempts and capture success rates.

0534 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Kenneth Nobleza¹, Cristhian Cadena¹, Christopher Bell², Patrick Lewis¹

¹Sam Houston State University, Huntsville, Texas, USA, ²University of Texas-Austin, Austin, Texas, USA

Cranial Endocast of the Amphisbaenian *Zygaspis quadrifrons*

Amphisbaenians are a diverse clade of squamate reptiles. Although the external anatomy and skeleton of amphisbaenians are relatively well described, virtually nothing is known about the anatomy of the brain and its associated nerves and blood vessels. That paucity of knowledge likely is driven by both the difficulty of dissecting such small and fragile specimens, and the reluctance of curators to permit destructive analysis of rare taxa. High Resolution X-ray Computed Tomography (HRXCT) provides a non-destructive method for reconstructing the endocranial space and the pathways of many associated blood vessels and cranial nerves. The goal of this project, therefore, was to use HRXCT imagery to create a three-dimensional cranial endocast of the skull of the African species *Zygaspis quadrifrons*. Several anatomical features clearly are discernible in the digital dataset. For example, the cast of the olfactory bulb is heavily marked by the frontoparietal suture. Posterior to the frontoparietal suture, the cast of the paired optic nerves extend anteriorly. The position of the posterior aspect of the pituitary gland is marked by a V-shaped formation positioned at the midpoint of the cranial endocast in ventral view. A bifurcated cast of the vidian nerve splits into its anterior and posterior branches anterior to the cast of the pons. The cast of the vagus and hypoglossal nerves extend posteriorly at the terminal end of the pons. These new data provide the first high-resolution description of the cranial endocast of this enigmatic taxon.

0679 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Jamie Nogle, Craig Wolf

GEI Consultants, Denver, CO, USA

The Impacts of a Reservoir Aeration System on the Food Web at Cherry Creek Reservoir, Aurora, Colorado

In 2008, an aeration system was installed in Cherry Creek reservoir to manage nuisance filamentous cyanobacteria. This system included 102 aerators that cover approximately 350 of the total 850 acre reservoir. The primary goal of this aeration system is destratification of the reservoir to reduce preferred filamentous cyanobacteria habitat and minimize their abundance. Since the installation of the aeration system there has been a change in algal dominance with diatoms, cryptomonads, and green algae being the more dominant groups. Cyanobacteria composition has decreased from 44.5 percent in 2006 to 3.9 percent in 2012. While apparently effective at controlling nuisance cyanobacteria, the destratification system has resulted in greater biomass production by these other algal groups. The destratification system and increased algal biomass production has also resulted in changes to the fishery. Prior to the installation of the aeration system, there was a balanced walleye population with multiple age classes. In 2011, there was a reduced number in large walleye and increased numbers of gizzard shad with multiple age classes. Data indicates that this response is likely due to the changes in the algal community composition that are affecting the higher trophic levels. The goals of the study are to: 1) continue to examine the algal community's response to the destratification of the reservoir (i.e., mixing), 2) better understand the mechanisms and effects of the system on zooplankton and fish, 3) evaluate the role of sediments and their influence on nutrient conditions that affect the algal community.

0666 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Eric Nordberg, Vince Cobb

Middle Tennessee State University, Murfreesboro, Tennessee, USA

Thermal Ecology and Behavioral Activity of Hibernating Timber Rattlesnakes (*Crotalus horridus*)

Hibernation is an important process in temperate region reptiles for escaping periods of harsh winter environmental temperatures. Although hibernation is generally associated with periods of inactivity, we present data that more resembles a period of reduced activity. Due to numerous winter anecdotal observations, such as mid-winter basking, we monitored the hourly body temperatures and small-scale movements of timber rattlesnakes (*Crotalus horridus*) throughout the 4-5 month hibernation period in Middle

Tennessee with the purpose of identifying potential shuttling behavior in and out of hibernation. Environmental temperatures (air, soil, and den cavities) and snake operative temperatures (using models) were also recorded. Multiple snakes were visibly observed basking during warm days throughout winter and made small (< 10 m) movements to different micro-hibernation sites. Additionally, the rapid sampling of snake body temperatures allow us to accurately predict when snakes were basking without visual observations by comparing snake body temperatures to operative snake models. As mild winters become more common, the likelihood of snakes emerging from dens during mid-winter warming periods may increase. Such energetic costs associated with increasing body temperature during hibernation are predicted to have a negative influence on body condition and potentially influence survival.

0539 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Eric Nordberg, Vince Cobb, Henrique Momm

Middle Tennessee State University, Murfreesboro, Tennessee, USA

Large Ranging Snakes in a Small Nature Preserve: The Seasonal Movement Patterns of Timber Rattlesnakes (*Crotalus horridus*) in Middle Tennessee

Habitat loss and degradation has been a major cause of the decline of timber rattlesnakes across much of its range. In many cases, populations have become separated and scattered throughout suitable habitat. Tennessee is no exception; many areas have become fragmented by urbanization resulting in isolated rattlesnake populations. Here we present data on the seasonal movement patterns and habitat use for 8 timber rattlesnakes in Middle Tennessee throughout their 2012 active season. The study site is unique in that suitable hibernacula exist within a small nature preserve just 8 km from a major developing city. Snakes were surgically implanted with radio transmitters and located via telemetry every 2-3 days and their movement patterns were quantitatively characterized using Geographic Information Systems (GIS) methodology. Snakes emerged from hibernation in March/April and exhibited extensive movement through forested areas early in the season. By late spring and throughout summer, movement bouts shortened and snakes commonly chose open canopy habitats (old growth fields, cedar glades, or mixed forest openings), often in close proximity to habitat edges, houses, and roads. Net movement varied considerably among individuals (total distance traveled 1.91 - 7.95 km). All snakes spent multiple days at each location (1 - 45 d) and averaged 33 movements or changes in location throughout their active season. During September and early October, snakes made lengthy movements back to a forested ridge for hibernation.

0238 AES Conservation, San Miguel, Sunday 14 July 2013

Andrew Nosal¹, Elizabeth Keenan², Ayelet Gneezy²

¹*Scripps Institution of Oceanography, University of California - San Diego, La Jolla, CA, USA*, ²*Rady School of Management, University of California - San Diego, La Jolla, CA, USA*

Happy and Playful Sharks? The Effect of Background Music in Nature Documentaries on Viewers' Perception of and Willingness to Protect Sharks

To examine the effect of background music on viewers' perception of and willingness to protect sharks, undergraduate students were randomly assigned to view a two-minute documentary montage of swimming sharks set to "happy" music ($n=37$), "scary" music ($n=39$), or silence ($n=36$). Participants then rated how well (1 = not at all, 7 = very well) each of six adjectives (*scary*, *dangerous*, *playful*, *happy*, *beautiful*, *intelligent*) described the sharks. Control participants (silent condition) rated sharks neutrally (mean rating not significantly different from 4.0) for *scary* (3.8) and *dangerous* (3.8). However, participants in the scary condition rated sharks significantly more *scary* and *dangerous* (5.2 and 5.1, respectively), while participants in the happy condition rated sharks significantly less so (2.9 and 3.1, respectively). Similarly, control participants rated sharks neutrally for *playful* (3.5) and *happy* (3.8). However, participants in the happy condition rated sharks significantly more *playful* and *happy* (4.4 and 4.9, respectively), while participants in the scary condition rated sharks significantly less so (2.4 and 2.6, respectively). Music treatment did not affect ratings for *beautiful* and *intelligent*. Finally, participants were given the option to donate part of their US\$2.00 earnings to a shark conservation charity. Mean donation was highest in the happy condition (US\$1.30), compared to scary (US\$0.93) and silent conditions (US\$0.92). Additional studies are underway to examine the effects of other music treatments on perception of and willingness to protect sharks, including support for banning shark fins in restaurants and listing the white shark (*Carcharodon carcharias*) as an endangered species in California.

0320 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Tanya K. O'Brien, Richard B. King

Northern Illinois University, DeKalb, IL, USA

Impacts of Microclimate on Neonatal Growth Trajectories in Grassland Snakes

Growth during the first year of life can influence population dynamics and may provide a useful metric for the management of species of conservation concern. To understand causes of variation in growth, we compared neonatal growth trajectories across years and among sites for three grassland snakes. Dekay's Brownsnakes (*Storeria dekayi*), Redbellied Snakes (*S. occipitamaculata*) and Common Gartersnakes (*Thamnophis sirtalis*) showed parallel patterns of variation in growth trajectories among years such that neonates were 16-44% longer by 1-Oct (the approximate end of the active season) in 2010 and 2012 than in 2009 and 2011. Similarly, in 2011, Dekay's Brownsnakes and Common Gartersnakes showed parallel patterns of variation among sites such that by 1-Oct neonates were 11-24% longer at Nachusa Grasslands (a mesic prairie) than at Potawatomi Woods (a wet sedge meadow). This variation in growth trajectories may be attributable to differences in micro-climatic conditions through an effect on (i) date of birth, (ii) size at birth, or (iii) growth rate. Consistent with this, growth trajectories were elevated at Nachusa Grasslands, the warmer and drier of the two sites. Growth trajectories were also elevated in years with higher May-June temperatures, but were not associated with August-September temperatures, suggesting that conditions during gestation (perhaps through an effect on date of birth) are especially important. To test for an effect of thermal regime on date of birth and offspring size, gravid snakes from both sites are being housed in outdoor enclosures under thermal conditions mimicking those observed at our two field sites.

0226 HL Detectability Symposium, Brazos, Friday 12 July 2013

Katherine M. O'Donnell, Frank R. Thompson III, Raymond D. Semlitsch

University of Missouri, Columbia, Missouri, USA

Evaluating the Effects of Forest Management on Terrestrial Salamander Detectability and Abundance

Terrestrial salamanders are thought to be integral for nutrient cycling and forest productivity, but may be harmed by disturbances that alter their microhabitat due to their moisture dependence and limited vagility. Salamanders are notoriously difficult to

detect, and changes to the landscape may unpredictably alter their detectability. We are investigating how forest management practices affect terrestrial salamander populations. Our field observations (salamander counts) result from two processes: an ecological process that produces the observed patterns, and a detection process that filters our view of the ecological process. Both processes are influenced by other mechanisms, including site characteristics. We account for potential changes in detectability by using hierarchical modeling to estimate salamander abundance before and after disturbances using the R package **unmarked**. This approach requires spatially and temporally replicated counts, and allows us to simultaneously estimate abundance and detectability without marking individuals.

In spring and fall 2010 - 2012, we conducted repeated samples of 20 5-hectare experimental plots that were subject to one of three forest management treatments in late 2012. We will continue sampling for 2 years post-treatment. We performed area-constrained searches of natural cover and leaf litter, and found most salamanders (73%) within/under leaf litter; the rest were under rocks (14%) or woody cover (13%). Rainfall and woody cover object abundance had the strongest effects on detection; slope, aspect, and site were the best predictors of true abundance. Detection probability averaged <10% and varied among sites and years, which sharply illustrates the importance of accounting for imperfect detection.

0304 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Katherine M. O'Donnell, Frank R. Thompson III, Raymond D. Semlitsch

University of Missouri, Columbia, Missouri, USA

Initial Terrestrial Salamander Responses to Prescribed Fire and Timber Harvest in Southeast Missouri

After decades of fire suppression, prescribed fire is increasingly being applied in forest ecosystems to reintroduce fire as an ecosystem process. Timber harvest is also an anthropogenic disturbance that markedly affects forest ecosystems. Wildlife responses to timber harvest have been relatively well studied, but the effects of prescribed fire on wildlife generally - and amphibians specifically - are inadequately understood. Amphibians are integral components of ecosystems, and have unique characteristics that cause their responses to fire to differ from other vertebrate taxa. Terrestrial salamanders represent a large proportion of forest ecosystem biomass, but they may be disproportionately affected by disturbances due to limited movement capacity and high moisture dependence.

We are investigating the effects of prescribed fire and timber harvest on terrestrial salamanders in southeast Missouri. In spring and fall 2010-2012, we sampled experimental plots at the Sinkin Experimental Forest (Mark Twain NF) that were shelterwood-harvested or prescription burned in late 2012. We performed area-constrained searches for Southern redback salamanders (*Plethodon serratus*), and used

program **unmarked** in R to analyze changes in salamander abundance while accounting for imperfect detection.

Before treatments, the strongest predictors of detection probability were rainfall and woody cover abundance; slope and aspect best predicted salamander abundance. Post-treatment results will be available in May 2012. We expect to see changes in salamander microhabitat use, which will be measurable because our searches include both leaf litter and natural cover objects. Investigating amphibian responses to fire is essential so that managers can balance habitat management needs with biodiversity conservation.

0385 Fish Conservation, San Miguel, Sunday 14 July 2013

Matthew O'Neill, William Stewart

Arizona Game and Fish Dept., Flagstaff, AZ, USA

Training Hatchery-raised Bonytail to Recognize Predators

Predation by non-native fish may be the main source of mortality for stocked bonytail (*Gila elegans*) in the lower Colorado River. Hatchery-raised fish are naive to this risk and may not survive their first encounter with a predator. We are developing a protocol to train large groups of hatchery-raised fish to recognize predators in an effort to improve post-stocking survival. We use the cypriniform alarm pheromone, present in the skin of many cypriniform species, to train groups of predator-naive fish to recognize largemouth bass as dangerous. The alarm pheromone is collected by sacrificing a hatchery fish and blending the body in water to form a solution containing the alarm substance. Groups of hatchery fish are trained to recognize a predator by placing a hindered bass (no predation during training) into their tank and simultaneously adding the alarm pheromone. Hatchery fish are moved into a fresh tank, and we commence a survival trial within 24 hours. Each survival trial combines 20 prey fish (either all trained or all untrained) and 4 predators in a concrete pond for 24 hours, and we compare percent survival of trained and untrained groups. We find a significant effect of training: an average of 90% of trained fish survive compared to 41% of untrained fish. If predator avoidance training continues to show promise, further experiments will include refining training techniques, introducing habitat, larger field tests, and scaling training to a hatchery production pond size.

0738 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Caleb Ofori-Boateng¹, Adam Leache²

¹Forestry Research Institute of Ghana, Kumasi, Ghana, ²University of Washington, Seattle, WA, USA

Innovative Conservation Awareness Program Increases Stakeholder Participation and Protection for a Critically Endangered Frog in West Africa.

Rediscovered in 2007 after nearly four decades, the critically endangered Togo slippery frog (*Conraua derooi*) faced an imminent extinction threat due to habitat loss and high hunting pressures. To conserve this species, we initiated a novel conservation program in Ghana. A key aspect of this program is a novel outreach program dubbed 'conservation evangelism'. The 'conservation evangelism' capitalizes on the highly devout nature of the local people to integrate conservation practices into religious belief systems. The approach has proven to be most effective with respect to both impact and cost. Through this program, local communities have adopted this frog, reduced its exploitation, and taken great pride in its conservation. In order to ensure continuous local support, we combine our community outreach with field surveys and report back to the communities about the progress they have made in protecting their frogs! The intervention has seen a dramatic frog population increase (from 45 to ~ 335). Our success remains a classic example of how conservation biologist can work with indigenous communities to increase protection of species.

0438 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Taku Okamoto, Tsutomu Hikida

Dept. Zool., Grad. Sch. Sci., Kyoto Univ., Kyoto, Japan

A phylogeographic study of three parapatric species of *Plestiodon* (Scincidae, Reptilia) on the mainland of Japan

On the mainland of Japan and peripheral islands, three species of *Plestiodon* occur with parapatric distributions: *P. latiscutatus* Hallowell, 1861 on the Izu Peninsula and Izu Islands, *P. japonicus* (Peters, 1864) on western Japan, and *P. finitimus* Okamoto et Hikida, 2012 on eastern Japan. The genetic variation of these species and population genetic structure along the contact zones were examined based on several molecular markers. *Plestiodon latiscutatus* exhibited small genetic variation, although this species include many island populations isolated each other. This implies a recent isolation between the present island populations. *Plestiodon japonicus* had large genetic variation without distinct geographic divergence, which suggested that this species may have been

maintained as a large metapopulation. *Plestiodon finitimus* consisted of two genetic lineages of the central and northeastern Japan with a wide hybrid zone, as clarified by a preceding study. In the northeastern lineage, quite small genetic diversity was detected in northern area populations, although the southern populations had moderate amount of diversity. This implied that geographic range of this species was limited to the southern area in the last glacial period, and rapid northward range expansion may have occurred after the glaciation. Along the boundaries of geographic ranges of these species, narrow hybrid zones were detected.

0599 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Charles W. Olaya-Nieto, Angel L. Martínez-González, William A. Pérez-Doria

Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas, Universidad de Córdoba, Lorica, Córdoba, Colombia

Trophic ecology of Pacora (*Plagioscion magdalenae*) in the Ciénaga de Ayapel, San Jorge river system

To study the feeding ecology of Pacora in the Ciénaga de Ayapel, Colombia, we analyzed 371 stomachs of individuals collected with sizes between 20.5 and 67.0 cm total length (TL) and total weight (WT) between 92.0 and 3764.0 g. The stomach content was analyzed using the Proportion of empty stomachs, Grade of digestion, Frequency of occurrence, numerical Frequency, Gravimetry and relative importance Index. The Proportion of empty stomachs was high and most of the foods were half digested, identifying five food groups: Fishes, Shrimp, Insects, vegetable Rests and Others. Fishes were conformed by species like *Andinoacara pulcher*, *Sternopygus macrurus*, *Astyanax* sp., *Cyphocharax magdalenae* y *Plagioscion magdalenae*, and were the most common group (96.5%), the most abundant group (95.4%) and the greatest group composition in weight (99.8%) and the main food in the Pacora's diet. The relative importance Index indicates that Fishes is a food group of high relative importance in the species's diet, while other food groups are classified as occasional food groups with low relative importance. The results indicate that Pacora is a carnivorous fish with a piscivorous trend that shows cannibal behavior in the wild, whose food preferences are kept as they grow.

0636 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Ronald Oldfield¹, Kapil Mandrekar², Dean Hendrickson³, Prosanta Chakrabarty⁴, Hans Hofmann³

¹Sam Houston State University, Huntsville, TX, USA, ²State University of New York, Syracuse, NY, USA, ³The University of Texas at Austin, Austin, TX, USA, ⁴Louisiana State University, Baton Rouge, LA, USA

Evolutionary changes in parental care in North American cichlid fishes

Parental care is any form of parental behavior that increases the fitness of offspring. Behavioral plasticity in paternal care has been tested empirically many times within individual species. However, these studies do not consider the feedback effects that occur between parental care, sexual selection, and operational sex ratio that occur over evolutionary time. On the other hand, phylogenetic studies have compared categories of behavior among species but have not considered subtle differences in direct measures of behavior. The current study used cichlid fishes to test a recent model that predicts reduced paternal care at female-biased sex ratios. We hypothesized that in an evolutionary transition from a monogamous to polygynous mating system associated with reduced interspecific competition, non-random variance in mating success among males would cause an increase in sexually selected traits, and would feedback to create an operational sex ratio functionally skewed toward females, and reduced paternal care. Monogamy was found to be ancestral in *Herichthys* cichlids, and the evolution of polygyny was phylogenetically associated with sexual selection. Consistent with the model, males of the polygynous Cuatro Ciénegas cichlid, *H. minckleyi*, were present at their nests less often and performed lower rates of aggressive defense of their offspring compared to the monogamous Rio Grande cichlid, *H. cyanoguttatus*. To our knowledge, this is the first study to demonstrate quantitative changes in observed measures of parental care behavior over evolutionary time.

0057 POSTER SESSION I, NW Exhibit Hall, Friday 12 July 2013

Mark Oliva¹, Tom Chen¹, Kristine Kaiser²

¹California State University, Northridge, Northridge, CA, USA, ²University of California, Riverside, Riverside, CA, USA

Anthropogenic Noise Affects Calling Behavior in a Bromeliad-Dwelling Treefrog

Noise generated from human activity is detrimental to many organisms that rely on acoustic communication to mediate social interactions, but the effects of anthropogenic noise on anuran communication are not well understood. The bromeliad-dwelling

treefrog, *Osteocephalus fuscifacies*, is categorized by the IUCN as Data Deficient but is threatened by habitat destruction due to agriculture and logging, both of which will introduce substantial amounts of anthropogenic noise into the landscape. We therefore tested whether the calling behavior of *O. fuscifacies* was affected by anthropogenic noise. This study was conducted at the Tiputini Biodiversity Station in Ecuador. We broadcast pre-recorded anthropogenic noise (automobile engine) or control (white noise) at 75 db SPL from 1 m to focal frogs for 2 min each in random order and recorded advertisement calls for 2 min before, during, and after the noise was presented. A repeated-measures ANOVA showed that there was a significant effect of noise on call rate: playback of anthropogenic noise elicited the highest call rate response, which was significantly higher than all other treatments except pre-playback. Although that comparison did not reach significance, there was a trend toward a difference. The results of this study suggest that calling behavior in *O. fuscifacies*, like many other species of frogs that rely on vocalizations to attract mates, may be detrimentally affected by anthropogenic noise. Due to the energetic and physiological costs of increased calling spurred by man-made noise, knowledge of the calling response to noise may be important in the conservation plight of anurans.

0717 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Jason Ortega

University of Arkansas, Fayetteville, AR, USA

Prey Preference Determination in the Western Cottonmouth (*Agkistrodon piscivorus leucostoma*)

The determination of preferred prey is vital to understanding the nutritional ecology of any species. Some species have been found to have a surprisingly wide diet breadth, yet many of those food items may not represent the animal's core diet. To determine the prey preference of the western cottonmouth (*Agkistrodon piscivorus leucostoma*), snakes were placed in an "X" maze and were offered various items to choose from. The maze consisted of four terminal boxes where each one was linked to a center box by PVC tubing. Each terminal box had a small fan that would blow air towards the center box. The center box had sliding doors that allowed snakes to acclimate to the arena before the doors were remotely opened. Maze runs consisted of placing four items in each of the terminal boxes, placing a snake in the center box with the doors lowered and with the fans running. Cottonmouths were acclimated to the maze for one hour before the doors were lifted; each snake was given five hours to make prey choices. All runs were recorded using a video camera; the resulting footage was watched and scored for arm choice order and item consumption order. Snakes (n=20) were offered all permutations of the following items: mouse, frog, crayfish, fish, and a control item (a scented sponge). A total of 160 trials were conducted in a repeated measures design, wherein each snake was run six times through the maze. Preliminary data suggests that fish are the preferred prey item.

0736 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Robert Ortega, Justin Saiz, Steven Sallinas, Micah Daboub, Jesus Rivas

New Mexico Highlands University, Las Vegas, NM, USA

The Impact of Invasive Bullfrogs on the Demographics of Northern Leopard Frogs in Northern New Mexico

Invasive species are able to alter the dynamics of the trophic levels of an ecosystem, having no natural controls they can displace native species in the food web, to prey on species with no adaptive defenses. The Rio Mora National Wildlife Refuge has both invasive Bullfrogs and native Northern Leopard Frogs. The extent to which the bullfrogs have impacted the native Northern Leopard Frogs has not been previously studied. The purpose of this study is to investigate the effects of the presence of the invasive Bullfrog on the demographics of the native Northern Leopard Frog in northern New Mexico. A section of the Mora River in the refuge was divided into two 2000-meter long section a control site containing Bullfrogs and an experimental site where Bullfrogs were eradicated. Relative abundance surveys were utilized to sample demographic parameters. Fifty one Leopard frogs were captured, pit tagged, and processed for demographic data. Control and experimental regions did not differ in the relative abundance of the leopard frogs. We did not find a significant difference in the mass of frogs from the two regions. However, preliminary data does show lower average mass and greater abundance in the experimental region suggesting an increase in recruitment of metamorphosis frog into the population. A change in demography within a year of bullfrog removal shows how fast a species can react to environmental changes.

0629 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday 13 July 2013

Guillermo Orti, Ricardo Betancur-R, Kyung Ko

The George Washington University, Washington, DC, USA

EToL: molecular markers for fish phylogenetics--past, present, and future.

The era of molecular systematics of fishes began in earnest after development of PCR and publication of "universal primers" for mitochondrial DNA (mtDNA) in 1989. The most popular mtDNA genes included those encoding ribosomal RNA subunits (12S and 16S) and cytochrome b. Masaki Miya and collaborators developed efficient protocols to sequence and compare whole mitochondrial genomes and published a series of "mitogenomics" papers starting in 2001. Only gradually were nuclear gene fragments

added to the molecular toolbox, starting in the early 1990s with ribosomal genes and internal transcribed spacer regions (ITS) and a few other protein-coding fragments from genes such as tyrosine kinase, rhodopsin, and recombination activating genes (RAG). New nuclear markers continued to be developed, but a leap forward occurred in 2007 with systematic scans of genomic databases to identify sets of single-copy protein-coding genes (the “EToL markers”). Current studies typically include between a handful to up to 20 nuclear gene fragments to infer phylogenetic relationships, but we are in the midst of an exponential increase with the advent of massively parallel “next-generation” sequencing platforms. New technologies enable compilation of data sets with hundreds of genes in a cost-effective manner, with studies targeting ultraconserved elements (UCEs) or protein coding genes (exomes). Although complete genome sequences for thousands of fishes may become available in the near future (Genome 10K Project), we present a powerful strategy to use next-gen methods immediately that will efficiently integrate old and new markers to enable the construction of taxonomically comprehensive data sets.

0136 Fish Conservation I, Doña Ana/Cimarron, Thursday 11 July 2013

Megan Osborne, Tracy Diver, Thomas Turner

University of New Mexico, Albuquerque, New Mexico, USA

Introduced Populations as Genetic Reservoirs for Imperiled Species: A Case Study of the Arkansas River Shiner (*Notropis girardi*)

The Arkansas River Shiner is a threatened species that has been extirpated throughout much of its native range and remaining populations are imperiled. Prior to 1978, this species was accidentally introduced to the Pecos River (Rio Grande drainage) via bait bucket, and has since persisted for over 30 years. Genetic data show that the Pecos River population maintains comparable levels of diversity at mitochondrial DNA and microsatellite loci relative to native range populations. Hence, we examined several factors that could be responsible for high introduced genetic diversity including (a) multiple introductions from genetically distinct sources (b) introduction of individuals from a genetically diverse source followed by rapid population expansion, (c) presence of life-history traits that foster propagule diversity and wide spatio-temporal demographic and genetic mixing; and (d) introduction to a suitable habitat in the non-native range. Our findings indicate Arkansas River Shiner was likely introduced from the Canadian River and subsequently experienced rapid population expansion that mitigated loss of diversity during the founding event. Threats to native Arkansas River Shiner have increased due to ongoing drought and water resource development, thus a finding of high diversity in the Pecos River suggests conservation significance of this non-native population. Further, it identifies the Pecos River as both a refuge for native endemic fishes and of genetic diversity of introduced, yet threatened, species.

0163 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Audrey Owens, Cristina Jones

Arizona Game and Fish Department, Phoenix, AZ, USA

Habitat use and activity of juvenile Sonoran desert tortoises in Central Arizona

Most of what is known about desert tortoises is based on research conducted on adult Mojave desert tortoises (*Gopherus agassizii*), a species listed as Threatened under the Endangered Species Act (ESA); significantly less is known about Sonoran desert tortoises (recently recognized as a new species, *Gopherus morafkai*), despite their status as species of greatest conservation need by the Arizona Game and Fish Department, and Candidate status under the ESA. In particular very little is known about juvenile Sonoran desert tortoises, which are notoriously difficult to find due to the complex nature of tortoise habitat in the Sonoran Desert. We used radio-telemetry to study juvenile Sonoran desert tortoise habitat use and activity. Our study site is in the Mazatzal Mountains, Maricopa County and is characterized as Arizona Upland paloverde-mixed cacti series with an elevation between 550-850m. It has a high density of desert tortoises, with over 180 tortoises marked since 1991 in an approximately 66 ha area. We equipped 13 juvenile desert tortoises (ranging in size from 124-175mm MCL) with radio-transmitters in 2010-12 and tracked them at least once a week during the active season and periodically during winter dormancy. We present our findings on juvenile tortoise home ranges, activity, and habitat use. Given the recognized differences in morphology, ecology and genetic structure between the two desert tortoise species, these natural history data on juvenile desert tortoises will be valuable in guiding management of this species in the Sonoran Desert of Arizona.

**0430 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Hannah Owens

University of Kansas, Lawrence, KS, USA

A Phylogentic Approach to Niche Evolution in Gadine Fishes

Fishes of the subfamily Gadinae are distributed throughout the Arctic, northern Pacific and Atlantic Oceans, and Mediterranean Sea. Gadine fishes occupy niches ranging from the temperate benthos of the continental shelf to the edges of Arctic sea ice. The rapidly-growing body of ecological niche evolution literature suggests that while niche is conserved among closely-related lineages at relatively short timescales, the pattern breaks down through deeper time. Given the diversity of habitats gadine fishes occupy

and the wealth of available information about the group, they present an ideal system for the first study of the evolution of ecological niche in fishes. Occurrence data from the Global Biodiversity Information Facility database and several museums, in combination with environmental data from NOAA's World Ocean Atlas 2009 were used to generate ecological niche models using Maxent. For each species, the resulting distributions were used to calculate predicted niche occupancy (PNO) profiles, a measure of where a species can be found in multimodal ecological parameter space. A phylogenetic tree was developed for Gadinae using mitochondrial and nuclear DNA sequences. PNOs were then plotted as characters onto the tree to demonstrate how niche occupancy among gadine lineages has evolved. My results indicate that while ecological niche preferences for cool, low salinity waters are largely conserved among Gadinae, some species have diversified into other regions of ecological niche space. Niche reconstructions suggest an origin for the clade that was warmer and more saline than waters currently occupied by most species.

0187 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Lawrence M. Page

Florida Museum of Natural History, Gainesville, Florida, USA

iDigBio, the National Coordinating Unit for the NSF-funded Advancing Digitization of Biodiversity Collections Project

Advancing Digitization of Biodiversity Collections is a project funded by the U.S. National Science Foundation to facilitate use of biodiversity data to address environmental and economic challenges. The national coordinating unit, iDigBio, located at the University of Florida and Florida State University, is charged with enabling digitization of natural history collections data; responding to cyberinfrastructure needs; developing research, education and outreach collaborations; and planning for the long-term sustainability of the national digitization effort. Digitization is being completed at institutions that are organized as Thematic Collections Networks (TCNs). Ten TCNs, which involve a total of 190 institutions distributed across all 50 states, have been funded.

**0743 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Charles Painter¹, Lee Fitzgerald², Daniel Leavitt³

¹New Mexico Dept Game and Fish, Santa Fe, NM, USA, ²Texas A & M University, College Station, TX, USA, ³Arizona Game and Fish Department, Phoenix, AZ, USA

CCA's and CCAA's - What are they, and are they adequate for use by the Oil/Gas energy companies to provide for the long-term conservation of the Dunes Sagebrush Lizard (*Sceloporus arenicolus*) and other species that may be endangered?

The recent proposed listing of *Sceloporus arenicolus*, Dunes Sagebrush Lizard, under the federal Endangered Species Act was controversial and the ultimate outcome was clearly influenced by political pressure and economics associated with oil and gas interests and other land uses. Research carried out over the past 20 years has consistently shown that change in vegetative cover through herbicide application, and habitat loss and fragmentation by oil and gas development, cause significant declines in populations of this narrowly-distributed habitat specialist. However, the resource management agencies responsible for its management decided that the species could be best protected through implementation of voluntary Candidate Conservation Agreements (CCA) and Candidate Conservation Agreements with Assurances (CCAA) that are designed to prevent the need for federal listing of species such as the Dunes Sagebrush Lizard. During this presentation we will define CCAs and CCAAs, explain their strengths and weaknesses, and provide case histories of their use in endangered species conservation, with particular emphasis on the Dunes Sagebrush Lizard. We integrate ecological and life history data on dispersal, habitat specificity, nesting migrations, and population structure to explore how well these voluntary agreements fit the ecology of the Dunes Sagebrush Lizard. Further, we offer potential future directions for conservation of this species given its current status.

**0653 NIA BEST STUDENT POSTER, Poster Session II, NW Exhibit Hall,
Saturday 13 July 2013**

Maura Palacios Mejia¹, John Gold¹, Gary Voelker¹, Nestor Herrera², Jose Enrique Barraza², Lenin Arias-Rodriguez³

¹Texas A&M University, College Station, TX, USA, ²Ministerio de Medio Ambiente y Recursos Naturales, San Salvador, El Salvador, ³Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, Mexico

Conservation implications based on the assessment of genetic diversity and population structure of the freshwater tropical gar (*Atractosteus tropicus*) in Middle America

Current populations of gar are relicts of an ancient worldwide group. Gars inhabit slow moving sections of rivers, swamps, and lagoons where they are top predators. They face threats of habitat loss and overfishing. Despite these threats, few studies have focused on the genetic variability of gars. The tropical gar, *Atractosteus tropicus*, inhabits freshwater habitats across both slopes in Middle America (Southern Mexico to Northern Costa Rica). This species has faced human pressures through modification of habitats for irrigation and water consumption, in addition to being fished for food consumption. The loss of tropical gar populations has been previously documented in Central America and sharp declines in abundance reported in Mexico. This study aims to evaluate the genetic variability and connectivity of tropical gar populations over their distribution. We test and apply nuclear microsatellite markers developed in *A. spatula* to measure genetic diversity and assess population structure across the tropical gar's range, including an aquaculture population. The population genetic analyses results show moderate genetic connectivity between the four Atlantic southern Mexican populations with shared alleles to the single Pacific population in Mexico. The additional Pacific slope population located in El Salvador share alleles with the Guatemelan population although gene flow does not occur. The Atlantic slope population in Costa Rica is isolated and demonstrates the presence of private alleles. The patterns observed reflect the presence or lack of waterways connecting the populations across Middle America. Based on our results, we identify populations that require protection and make management suggestions.

**0791 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Wendy J. Palen, Viorel D. Popescu, Evgenia Dubman, Robin Munshaw

Earth to Ocean Research Group, Simon Fraser University, Burnaby, BC

Balancing species conservation and small hydropower development in British Columbia

Small, distributed sources of renewable energy are increasingly used to meet future energy demand, and are viewed as minimum-impact alternatives to traditional technologies. We examined the trade-offs between small hydropower development and species conservation objectives in British Columbia, Canada using the spatial conservation prioritization framework Zonation. We concentrated on evaluating potential impacts to a suite of protected aquatic (e.g. *Oncorhynchus spp.*) and riparian (*Ascapthus spp.*) vertebrates due to their economic, cultural, and conservation importance. Of the ~7000 potential development locations for small hydropower in the province, approximately 1500 are economically feasible in present energy markets, and are concentrated on Vancouver Island, the coastal mainland, and Rockies. The density of potential hydropower projects per watershed ranges between 0.02 and 1.5 projects/100 km². The highest potential conflicts with tailed frog conservation occur in southern coastal (*A. truei*) and Rocky mountain interior (*A. montanus*) watersheds, overlapping with ~400 potential development locations with a proposed cumulative total of ~1500 km of diverted river reaches. Similarly, we find that between 15-40% of watersheds in coastal BC and Vancouver Island may present conflicts between salmonid conservation and small hydropower development. However, we identified a range of future scenarios that balance energy development and species conservation goals, suggesting that conflicts between energy and environment may be partially mitigated by strategic spatial planning.

0013 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Lynne Parenti¹, Harry Grier², MariCarmen Uribe³

¹National Museum of Natural History, Smithsonian Institution, Washington, DC, USA,

²Florida Fish and Wildlife Research Institute, St. Petersburg, FL, USA, ³Universidad Nacional Autónoma de México, México DF, Mexico

Phylogenetic patterns of reproductive morphology in teleosts: the egg

Characters of reproductive morphology have long been used to postulate evolutionary and phylogenetic relationships among teleost fishes. Notably, two such character states--

a restricted lobular testis and fluid yolk-- corroborate monophyly of the Series Atherinomorpha, a clade strongly supported in recent molecular as well as morphological studies. As part of our ongoing survey of gonad morphology in bony fishes, we report here further on characters of the egg that may be phylogenetically informative among teleosts and their close osteichthyan relatives. The osteichthyan egg, from oogenesis through fertilization, exhibits wide variation in features such as number and position of oil droplets, form of the yolk, relative thickness of the egg envelope (zona pellucida or chorion), number of micropyles, form and arrangement of egg envelope (chorion) attachment filaments and homology and form of the egg envelope, among others. Much of the data on these features is anecdotal as it has been reported for just one or several species outside a comparative framework. Homology of the structures is rarely tested and definitions--such as those for pelagic versus demersal eggs-- are often functional rather than structural. Our original observations were made on freshly-fixed histological materials as well as histological preparations of preserved museum specimens, underscoring the utility of such collections for broad comparative surveys. We describe conserved morphology and processes and identify phylogenetically informative characters. Our ultimate goal is a comprehensive understanding of the phylogenetic patterns of reproductive morphology among teleosts and their close relatives.

0528 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Mickey Parker, Matt Goode, Kristin Albert

University of Arizona, Tucson, AZ, USA

Effects of Translocation on Flat-tailed Horned Lizards (*Phrynosoma mcallii*) in Southwestern Arizona

The Flat-tailed Horned Lizard (*Phrynosoma mcallii*, FTHL) is a state-protected species whose range in Arizona is located primarily within the Barry M. Goldwater Range (BMGR), an expansive tract of land used for military training. The western portion of BMGR, where the FTHL occurs, is located near Yuma, Arizona and is managed by the Marine Corps Air Station-Yuma. Military activity on BMGR is confined to localized areas, leaving the vast majority of land undisturbed Sonoran Desert (Lower Colorado Subdivision) habitat. In 2012, construction of an airfield and infrastructure to accommodate the F-35 Joint Strike Fighter (JSF) Program commenced on the BMGR in an area of high-quality FTHL habitat. As part of a larger project designed to assess the overall effects of the JSF Program on the FTHL, we are currently examining translocation as a mitigation strategy. Before construction of the airfield began, the entire footprint of the facility was fenced; we removed 497 FTHLs from the enclosed area. To examine the effects of short- and long-distance translocation, we placed some lizards directly over the exclusion fence, while we translocated others to sites several kilometers away. We outfitted a subset of these lizards with radiotransmitters and located them several times per week. We compared movement patterns, survival, and body condition of lizards

translocated varying distances with non-translocated individuals. We also examined potential effects of translocated lizards on lizards residing at translocation sites.

0386 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Scott Parker

Coastal Carolina University, Conway, South Carolina, USA

Physiological ecology of the ground skink, *Scincella lateralis*, in South Carolina: thermal biology, water loss, metabolism and seasonal patterns

Scincella lateralis (ground skink), is widely distributed across the southeastern US, yet much of its basic physiological ecology remains enigmatic. I measured field body temperature (T_{bf}), selected body temperature (T_{bs}), metabolic rate, heating/ cooling, and total water loss of *S. lateralis* during spring/summer and fall/winter 2012 in a population of skinks from South Carolina, USA. T_{bf} was measured using an infra-red thermometer and T_{bs} was measured in thermal gradients using a thermocouple thermometer. *Scincella lateralis* maintains a narrow range of relatively cool body temperatures (central 50% T_{bf}: 26.8-30.4 °C) regardless of season. VO₂ was measured at 4 °C intervals from 24-36 °C. VO₂ increased as a function of temperature, but there was no difference in VO₂ within the preferred temperature range (28 & 32 °C). VO₂ was higher at 28 and 32 °C during spring/summer than in fall/winter. Thermal time constants were used to compare heating and cooling rates in dry versus humid air. In dry air, skinks heated more slowly than they cooled. Heating and cooling rates in humid air did not differ. Total evaporative water loss was measured at 28, 32, and 36 °C. Evaporative water loss increased with temperature, and was more than twice as high at 36°C (12.6 mg g⁻¹ h⁻¹) than at 32 °C (5.8 mg g⁻¹ h⁻¹). These results suggest that distribution of *S. lateralis* is constrained within open forest patches offering a mixture of sun and shade which provides a moderate but heterogenous thermal environment for thermoregulation while also reducing evaporative water loss.

0637 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Zachary Parker, Joshua Lynn, W. Beckett Hills, Scott Parker

Coastal Carolina University, Conway, SC, USA

An analysis of vegetation and terrestrial characteristics of *Malaclemys terrapin* nest sites at North Inlet, South Carolina

Diamondback terrapin, *Malaclemys terrapin*, are primarily aquatic turtles, yet each year a female terrapin must access terrestrial environments with appropriate conditions for

nest construction. Nest sites and associated characteristics along the SC coastline are not well documented. Surveys occurred weekly at high tide, May-July 2012, in areas above tidal inundation. For each nest found ($n_a=91$), a simulated nest site was randomly ($n_r=104$) chosen and measured for analysis purposes. Using a centered 1m quadrat to represent the nest site, we identified all vegetation to species level, estimated % ground cover (0=bare, 1-4 in 25% intervals), % canopy cover (above nest within 1m height, 0=open, 1-4 in 25% intervals), measured distance to vegetation (cm), and recorded GPS coordinates. While twenty-two species were identified, 99% of nest sites had 4 or less species present (max=6), with *Spartina patens* occurring at 42% of actual nests. Minimal groundcover was present at 100% of nest sites, but there was no significant correlation between the cover amount categories. Nest sites had a variety of canopy cover within 1m above the nesting surface, 16% were completely open, 65% had at least 50% of coverage. Nests were occasionally constructed within vegetative clumps (18%), and an additional 60% occurred within 40cm from the nearest vegetation. Our data suggest terrapin nests are associated with varying amounts of vegetation. Typical nesting habitat consists of expanses of open areas with clumps of vegetation, highlighting that terrapins may be selecting some sort of groundcover and proximity to vegetation for nest construction.

0677 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Wesley Parsons, James "Mitch" Mercer, Richard D. Durtsche

Northern Kentucky University, Highland Heights, KY, USA

Diurnal Activities and Metabolism of *Podarcis muralis* as an Introduced Species to the Greater Cincinnati Region

The European wall lizard (*Podarcis muralis*) is an introduced species that was originally brought to Cincinnati from Italy in 1952. Over the past 60 years, what started as a small founder population of ten individuals has since grown exponentially to a large population that can be found throughout the Greater Cincinnati area. This explosion of "wall" lizards is due to their ability to thrive in urbanized saxicolous microhabitats, such as sidewalks, concrete cracks, and rock walls. This research was conducted as the initial analysis of the niche occupied by these introduced lizards to determine if they 1) occupy a vacant urban niche, and 2) pose a threat to the local ecosystem. Our objectives were to study the food ecology of these lizards, as well as to determine their allocation of time and energy on daily activities. Lizards were observed for 10-minute focal samples, recording: location, sex, age (juvenile or adult), time spent in behavioral activities, microhabitats occupied, foraging success/ failure, and the climate exposure selected. Stomach contents were then obtained for future comparative analysis of preferred prey to that of the native lizard species. A range of size-classes of individuals (ages) within the species was tested for differences in gas exchange with a Sable Systems flow-through respirometry system to determine ontogenetic variation in metabolic rates. Metabolic

rates of local lizard species (*Sceloporus undulatus*, *Plestiodon fasciatus*) were also determined for interspecific comparisons.

0527 Amphibian Conservation, Galisteo/Aztec, Friday 12 July 2013

Cynthia Paszkowski, Erin Bayne

University of Alberta, Alberta, Canada

Using Automated Acoustic Recorders to Model the Occurrence and Habitat Associations of Anuran Amphibians in Northern Alberta, Canada

In 2012, the Environmental Monitoring Committee of the Lower Athabasca monitored wetlands in the oil-sands region of Alberta for anuran amphibians using automated acoustic recorders (Wildlife Acoustics Songmeter SM2). Wetlands were clustered within 29 sites each monitored at six to 10 recording stations. Between 1 April and 15 July, recordings were made daily for 10 minutes of every hour. We measured habitat variables (e.g., vegetation cover, wetland type, human footprint) within 100 m and 1,000 m circular buffers around each station. Four amphibians were recorded: *Pseudacris maculata* at 60% of 273 stations, *Lithobates sylvaticus* at 48%, *Anaxyrus boreas* at 13%, and *A. hemiophrys* at 3%. The optimal time for detecting anurans was 23:00 to 02:00. Annual peaks in calling varied across species from 10 May to 8 June. For 23,060 recordings, we distinguished counts of 0, 1, 2, 3, 4, 5, >5 individuals. Western Toad and Canadian Toad reached maximum counts of 2; Wood Frog and Boreal Chorus Frog counts were regularly >5. We created spatial distribution models, to predict presence/absence for each species, which assessed different combinations of habitat covariates. Model fit and parsimony were compared using Akaike Information Criterion. Models indicate that each of the species is associated with diverse wetland types: fens, bogs, swamps, and marshes. Distance to open water is an important predictor of the occurrence of anurans, however, calling was regularly recorded at considerable distances from permanent water. We are evaluating if the use of count-based data and multinomial regression improves habitat models.

0234 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Corinne N. Paterson, Larry G. Allen

California State University, Northridge, Northridge, CA, USA

The Genetic Diversity and Population Structure of Barred Sand Bass (*Paralabrax nebulifer*)

Barred sand bass (commonly, sand bass), *Paralabrax nebulifer*, is part of the largest recreational fishery in southern California as well as a large artisanal fishery in Mexico. This species ranges from Santa Cruz, California to the southern tip of Baja California, Mexico, but is common only south of Pt. Conception. Sand bass form large spawning aggregation in the summer months of June-August which makes them highly susceptible to overfishing. In the last decade, populations of sand bass in southern California have experienced a severe decline in numbers and subsequently the recreational fishery has been seriously impacted. The population structure and genetic diversity of barred sand bass populations was previously unknown. This study looks at both using the d-loop region of the mitochondrial DNA for populations in California and Mexico. Populations in southern California lack genetic structure and have high levels of genetic diversity, characteristics that are indicative of panmixia across the region.

0060 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Mark Paulissen

Northeastern State University, Tahlequah, OK, USA

Environmental cues and learning bias in the Little Brown Skink Lizard, *Scincella lateralis*

Many small lizards escape predators by running under an escape retreat such as a rock, log, or pile of leaves. Previous work has shown the Little Brown Skink Lizard, *Scincella lateralis*, is able to learn to escape under one of two possible retreats in laboratory trials. In this study, I explored the role of visual cues in lizards' learning to identify one retreat as "correct". Little Brown Skinks were presented with two retreats side-by-side: one backed with a vertical striped background and the other backed with a horizontal striped background. Each lizard was enticed to run from one end of an observation tank to the opposite end with the two retreats; the retreat that each lizard chose for escape was recorded through a series of 15 trials conducted over three days. Half of the lizards

were trained to escape to the "vertical" retreat; half were trained to escape to the "horizontal" retreat. The "vertical" lizards escaped to the correct retreat in significantly more trials than the "horizontal" lizards. In addition, significantly more of the "vertical" lizards met the learning criterion of escaping to the correct retreat 5 consecutive times within 15 trials than did the "horizontal" lizards. This suggests Little Brown Skinks have an innate bias toward learning to escape to retreats associated with vertically aligned visual cues. This may be correlated with the tendency of this species to escape to debris around the base of vertical tree trunks.

0710 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Gregory Pauly¹, Phillip Spinks², James Godwin³, Brad Shaffer²

¹Natural History Museum of Los Angeles County, Los Angeles, CA, USA, ²University of California, Los Angeles, CA, USA, ³Auburn University, Auburn, AL, USA

Phylogenetic Relationships and Species Boundaries among River Cooters, with a Focus on the Federally Endangered Alabama Red-bellied Turtle

Species boundaries and phylogenetic relationships among members of the North American turtle genus *Pseudemys* have challenged systematists for over half a century. Understanding species boundaries in *Pseudemys* is especially important because the genus includes the federally endangered Alabama Red-bellied turtle (*Pseudemys alabamensis*). This species occurs in only eight drainage basins in southwestern Alabama and southeastern Mississippi. As such, *P. alabamensis* has one of the most restricted ranges of any turtle species in the world.

We use two different multi-locus DNA sequence datasets to examine species boundaries among hypothesized lineages of *Pseudemys*. In the first analysis, we examine ten nuclear loci and three mitochondrial genes from the nine currently recognized taxa of *Pseudemys* using geographically-widespread sampling of each taxon. These analyses recover little or no evidence supporting most hypothesized taxa of *Pseudemys*. In the second analysis, we then focus on a narrow geographic area, and use intensive sampling to examine whether genetic variation was structured more by geography or taxonomy. We examine *P. alabamensis* and their sympatric congeners from six drainage basins. In total, our dataset includes 177 individuals for up to 10 nuclear loci. These more geographically focused analyses strongly support the recognition of *P. alabamensis*, although they do not support recognizing *P. concinna* and *P. floridana* as distinct. These results indicate that species delimitation in *Pseudemys* will require gathering intensively sampled range-wide datasets that use multi-locus molecular approaches in combination with morphological analyses of characters relevant to field identifications.

0678 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Joseph Pechmann, John Tupy

Western Carolina University, Cullowhee, NC, USA

Providing Resting Places at All Depths Does Not Increase Growth or Survival of Tadpoles Raised in Vertical-sided Artificial Ponds

Artificial ponds constituted in cattle-watering tanks are a common venue for experiments with amphibian larvae. These tanks have a uniform depth with no shallow areas. The tank bottom provides the only resting area, and larvae swim frequently from there to the surface to gulp air. The energetic cost of this travel may decrease growth rates. Temperature varies with depth, and growth rates may also be limited by the inability of larvae to thermoregulate without expending energy to remain above the bottom. We hypothesized that providing resting places at all depths in tanks would increase larval growth and survival. We raised *Rana sevososa* tadpoles in 1.8 m-diameter outdoor tanks filled to 45 cm depth with well water. Each tank contained 18 larvae, 1 kg of dried leaves, was frequently stocked with plankton, and had a screen cover. We replicated 4 experimental treatments 8 times: 1) a 175.7 X 17.5 cm board extending from the water surface on the west edge of the tank to the bottom along the east edge, 2) same as 1) but with the board facing west, 3) two 43.9 X 17.5 cm vertical boards, both facing east and west, and 4) no boards. The slanted boards provided tadpole resting places at all depths, and the vertical boards provided a control having the same board area for periphyton growth. Mass at, snout-vent length at, survival to, and days to metamorphosis did not differ significantly among treatments. Choice of resting depth provided no detectable benefits to *R. sevososa* larvae.

0396 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Maíra Pereira¹, Rosana Mazzoni¹, Eugenia Zandonà¹, Carla Rezende², Christopher Dalton³, Alexander Flecker³

¹*Universidade do Estado do Rio de Janeiro, Rio de Janeiro/RJ, Brazil*, ²*Univerdidade Federal do Ceará, Fortaleza/CE, Brazil*, ³*Cornell University, Ithaca/NY, USA*

Nutrient recycling and stoichiometry of two grazing fishes: Are native and non-native species ecologically redundant?

The ichthyofauna composition of the Ubatiba River has been studied since the early 1980s and for many years the loricariid catfish *Hypostomus punctatus* was one of the most constant and abundant species found in this system. In the late 1990s another loricariid catfish *Parotocinclus maculidauda* was introduced and for more than a decade the native *H. punctatus* has declined as the non-native species has increased in abundance. Here we

examine whether species replacement has largely involved similar ecological players by measuring nutrient recycling and stoichiometry of these two species. Both fish species were collected at nighttime during the 2012 dry and rainy seasons, NH₄⁺ and PO₄³⁻ excretion measurements and stoichiometry of body and fore/hindgut contents were performed. Periphyton, the main food source of both species, was collected to estimate food nutrient content. *Hypostomus* excreted significantly more NH₄⁺ than *Parotocinclus*, while PO₄³⁻ rates were similar between the two species. In contrast, when comparing body stoichiometry by weight and size, both %P and %N differed between species, both being greater in *Parotocinclus*. *Hypostomus*' gut content elemental composition was similar to that of periphyton, but gut contents of *Parotocinclus* were nutrient rich compared to periphyton, presumably due to a higher proportion of invertebrates in its diet. These results suggest that *Parotocinclus* has greater body nutrient demands associated with higher body phosphorus and nitrogen concentrations. We speculate that water high concentrations of dissolved nutrients associated with livestock and surrounding plantations may have facilitated increases in density of this non-native species with greater nutritional requirements.

0112 Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Juan Carlos Perez

El Colegio de la Frontera Sur, Lerma, Campeche, Mexico

The Reproductive Cycle of the Cownose Ray *Rhinoptera bonasus* in Southern Gulf of Mexico: it Can be Biennial?

The cownose ray *Rhinoptera bonasus* is one of the most abundant batoid species in southern Gulf of Mexico, where represents a significant component of the by-catch in the target fishery for the spotted eagle ray *Aetobatus narinari* in western Campeche Bank. Previous studies estimate an annual reproductive cycle for the cownose ray in north-western Atlantic and northern Gulf of Mexico; however, such studies lacks the information to support the concurrence between gestation and vitellogenesis. In this study, the analysis of 76 adult females with a size range of 88-106 cm disk width (DW) suggest that the female reproductive cycle is apparently biennial. The gestation lasts about 12 months, and the gestation and vitellogenesis are consecutive (gravid females containing full term embryos, > 34 cm DW, had small non-vitellogenic oocytes, < 18 mm diameter). Alternative hypothesis are analyzed and discussed (biannual and annual reproductive cycles) in order to support the estimation of the biennial reproductive cycle.

0111 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Juan Carlos Perez, Elizabeth Cuevas, Ivan Mendez, Nicté Cu

El Colegio de la Frontera Sur, Lerma, Campeche, Mexico

The Small-Scale Target Fishery for Spotted Eagle Ray *Aetobatus narinari* in Southern Gulf of Mexico: Considerations for Management

The spotted eagle ray *Aetobatus narinari* is listed as Near Threatened by the IUCN red list. A target fishery for this species is carried out since about 150 years in Southern Gulf of Mexico. Fishery data collected since 2009 indicates that the spotted eagle ray is seasonally target by at least 30 small-scale out-board motored boats (7.7 m long) with gill-nets made of silk (mesh size of 30.5-36.5 cm) in a fishing area of 8-50 km off the coast of the states of Campeche and Yucatán. The catch is composed by juvenile of both sexes and adult males, and the overall size range for females was 54-202 cm DW and for males 44-150 cm DW. Catch rate varied from 3.0 to 6.6 rays per fishing trip, the highest catches occurred between November and March (during the winter cold front season), and large rays (>130 cm DW) are more commonly caught in fishing areas far from the shore (>20 km). There are no management strategies for this fishery in spite of according to fishermen catches have diminished in the last three decades. Fishermen do not require special license for this fishery and the Mexican Official Catch statistics lack the information of catch and effort for the fishery. Specific fishing license to participate in this fishery should be required and a logbook system by fishing boat should be encouraged in order to generate catch statistics to determine the trend of the catches and provide more elements for future specific fishery management strategies.

0447 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Natasha Perrinne¹, Evin T. Carter², Mark A. Jordan¹

¹Indiana University - Purdue University, Fort Wayne, IN, USA, ²University of Tennessee, Knoxville, TN, USA

An Independent Observation of Facultative Parthenogenesis in the Copperhead (*Agkistrodon contortrix*)

In general, vertebrates reproduce sexually, thereby promoting genetic variation that could lead to increased fitness and a reduction in the accumulation of harmful mutations in the species' genome. Although sexual reproduction is most common, some species reproduce asexually using parthenogenesis and may do so facultatively. The Copperhead (*Agkistrodon contortrix*) is one such species. To date, this alternative reproductive strategy has been observed in one population in North Carolina, but the widespread use of this tactic is not known. In this study, we explore a possible instance

of parthenogenesis in a snake from southern Indiana. In 2010, after eight years in captivity, a female copperhead produced a litter containing four infertile ova and one near-term stillborn neonate. To test the hypothesis that the neonate was produced asexually, we developed a panel of ten microsatellite loci to genotype the mother and her offspring, as well as wild-caught individuals in the maternal population. Based on previous research, we expected heterozygous maternal loci to be homozygous in the offspring, indicating terminal fusion automixis. Four loci displayed this pattern. Using allele frequencies in the female's population of origin we also show that the probability of a paternal contribution to the offspring is negligible. Together, these results further confirm that Copperheads are facultatively parthenogenic and extend the geographic range of this reproductive mode in the species.

0404 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Christopher Petersen¹, Zinta Rutins¹, Robin Van Dyke¹, Helen Hess¹, Charles Wray²

¹College of the Atlantic, Bar Harbor, Maine, USA, ²Mount Desert Island Biological Laboratory, Salisbury Cove, Maine, USA

Parasites and population genetics of *Fundulus heteroclitus* in New England: variation among several Maine estuaries

Fundulus heteroclitus, the mummichog, is the most common estuarine fish in New England, and the genetic structure of populations has been well documented throughout most of its range. In the late 1960's the Goose Cove estuary was blocked, and the site became an open pit mine for several years, until it was again opened to the sea and re-established itself as a salt marsh. This old mine is now an EPA Superfund site with high concentrations of several heavy metals in the sediments and tissues of local organisms. In this study, we compared the genetic structure of this population with those in other nearby estuaries, and also compared the species of parasites exploiting fish from the mine site with those of other estuaries in nearby bays. Results from eight microsatellite loci suggest low to moderate restrictions to gene flow in *F. heteroclitus* among estuaries, with modest divergences in allele frequencies among sites; there were no remarkable patterns at the mine site regarding these putatively neutral loci. Most *F. heteroclitus* have some form of metazoan parasite in all salt marshes, but the fish from the superfund site had strong similarities to a separate study at another contaminated site in New Bedford, and had unique parasite profiles compared with the fish from three nearby estuaries. We are currently examining several genes and promoters as well as gene expression patterns specific to immune systems and metal detoxification to look for potential local adaptation in *F. heteroclitus* at the Superfund site.

0188 AES Ecology, Mesilla, Thursday 11 July 2013

Cheston Peterson¹, Dean Grubbs²

¹Florida State University Department of Biological Sciences, Tallahassee, FL, USA, ²FSU Coastal and Marine Laboratory, St. Teresa, FL, USA

Sharks and Large Teleosts of Florida's Big Bend: Abundance, Distribution, and Community Structure

The Florida Big Bend contains one of the world's largest continuous seagrass beds. This 300 km stretch of coastline in the northeast Gulf of Mexico supports a high diversity of sharks and larger teleost fishes, but the community structure of these faunas are poorly described in the area to date. Data from spatially-balanced fishery-independent surveys employing experimental longlines and gillnets conducted from 2009 to 2012 were used to describe the shark and larger teleost assemblages along the Florida Big Bend. Species richness, diversity, and evenness were compared spatially over the survey area. Non-metric multidimensional scaling (NMDS) was used to explore species associations and to infer what environmental factors may influence the observed patterns of species distribution and abundance in the system. We found species assemblages were spatially variable and the northern portion of the Big Bend was more species rich and diverse. Environmental factors such as bottom profile (proxy for habitat complexity), depth, and salinity are correlated with the data structure found using NMDS, and these may be important when considering the influence of environmental parameters or habitat quality on spatially-variable catch data.

0292 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY, Galisteo/Aztec, Friday 12 July 2013

Christopher Peterson¹, Jason Ortega¹, Si Hong Park¹, Irene Hanning², Jacques Hill¹, Steven Beaupre¹

¹University of Arkansas, Fayetteville, AR, USA, ²University of Tennessee, Knoxville, TN, USA

Gastrointestinal Microbes Do Not Influence Digestive Efficiency in African House Snakes (*Boaedon fuliginosus*)

Gastrointestinal bacteria influence digestive performance in herbivores and omnivores, but few studies have examined their effects in representative carnivores. Our study investigated the effects of altering gastrointestinal microbial communities on the digestive efficiency of African house snakes (*Boaedon fuliginosus*). Twelve snakes were divided into control (n=7) and treatment groups (n=5) and housed under bacterially controlled conditions. Snakes in the treatment group were given repeated oral dosages

of antibiotic (Baytril), while control animals were given repeated oral dosages of sterile water. Standardized feeding trials were used to measure digestive variables, where each snake was fed one sterile mouse per week. Frozen mice were sterilized by exposure to gamma radiation; sterility was verified using standard plating and culturing tests. Cages were checked daily for feces and uric acid, which were collected, dried, weighed, and homogenized. The energy densities of mice, feces and uric acid were determined by bomb calorimetry. T-tests detected that fecal and uric acid energy densities were not significantly different between experimental groups. Analysis of covariance detected no effect of antibiotic treatment on the relationship between energy consumed and the energy produced in fecal material and uric acid. Our results show that snake assimilated energy and metabolizable energy may not be affected by antibiotic dosing. Although snakes exhibit gastrointestinal microbial diversity similar to mammalian herbivores/omnivores, our work suggests that these microflora provide no benefits to digestive efficiency in this obligate carnivore. Further microbial work is being conducted to determine the effect that antibiotic dosing had on snake gastrointestinal microbial diversity.

0367 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, AES CARRIER AWARD

Mariah O. Pflieger¹, R. Dean Grubbs², Toby S. Daly-Engel¹

¹University of West Florida, Pensacola, Florida, USA, ²Florida State University, Tallahassee, Florida, USA

Dogfish Shark Speciation in the Gulf of Mexico

Sharks of the genus *Squalus* are slow-growing, long-lived, and have long gestation periods, as is typical of most deep-water sharks. In addition, low genetic diversity is frequently observed, making this group slow to rebound from depletion due to overfishing. The shortspine spurdog shark (*Squalus mitsukurii*) is a putative circumglobal deep-water shark that was originally described from Japanese waters. These sharks are easily misidentified due to the high degree of similarity with their congeners, and recent taxonomic research on this species from the Pacific has indicated that *S. mitsukurii* may in actuality comprise a species complex, a group of separate but closely related species. In an effort to understand the global taxonomy of the *S. mitsukurii* complex, we are using a combination of morphological evidence and genetic techniques to identify separate dogfish stocks throughout the Pacific and elsewhere. Thus far, preliminary data have indicated that *Squalus cf mitsukurii* from Hawaii is likely an isolated, distinct species. Using meristics as well as approximately 700 base pairs of mitochondrial DNA (barcode region), we will investigate this question in dogfishes from the Gulf of Mexico and West Atlantic. We hypothesize that due to geographic distance, *Squalus cf mitsukurii* in the Gulf of Mexico may also have become isolated from the type population in the West Pacific.

0346 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

John Phillips¹, Dante Fenolio³, Sarah Emel², Ron Bonett¹

¹University of Tulsa, Tulsa, OK, USA, ²Washington State University, Pullman, WA, USA, ³San Antonio Zoo, San Antonio, TX, USA

Phylogeography and conservation genetics of the Grotto Salamander, *Eurycea spelaea*

Endemic to the Ozark Plateau, the Grotto Salamander, *Eurycea spelaea* is protected throughout much of its geographic distribution. This is largely due to the *E. spelaea*'s limited niche; constrained to caves and underground aquifers, this species is highly susceptible to environmental disturbances such as climate change and ground water contamination. Although there is only one currently recognized species within the *E. spelaea* clade, recent work has revealed high levels of genetic diversity, indicating the presence of cryptic species.

In this study, we further investigate the fine scale genetic diversity and geographic structure within the *E. spelaea*. Mitochondrial DNA sequence variation shows evidence of at least three highly divergent lineages across the Ozark Plateau. To further examine the relationships among the lineages and define species boundaries, we will also present results from high throughput sequencing of a vast panel of nuclear loci. We will compare patterns of mitochondrial divergence with nuclear divergence and test if these patterns are correlated with geographic features of the Ozark Plateau.

0157 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Alexandria Pickard¹, Brad Wetherbee², Jeremy Vaudo¹, Richard Nemeth³, Elizabeth Kadison³, Jeremiah Blondeau³, Mahmood Shivji¹

¹The Guy Harvey Research Institute, Oceanographic Center, Nova Southeastern University, Florida, USA, ²The Guy Harvey Research Institute, Nova Southeastern University and the University of Rhode Island, Florida, Rhode Island, USA, ³University of the Virgin Islands, St. Thomas, Virgin Islands, USA

Characterization of shark movements on a mesophotic Caribbean coral reef and temporal association with fish spawning aggregations

Little is known about the importance of mesophotic coral reefs as habitat for sharks. Since many fish species aggregate to spawn on mesophotic reefs, seasonal concentration of potential prey biomass may influence the use of these habitats by large sharks. We employed acoustic telemetry to examine the movements of three shark species (lemon

shark, *Negaprion brevirostris*; tiger shark, *Galeocerdo cuvier*; and Caribbean reef shark, *Carcharhinus perezi*) to determine 1) whether there was a spatio-temporal relationship between sharks and grouper aggregations at two fish spawning aggregation (FSA) sites (Hind Bank and Grammanik Bank) along the southern reef shelf edge off St. Thomas, USVI, and 2) the comparative spatio-temporal patterns of mesophotic reef habitat use by the three shark species. Lemon sharks were present at the two FSA sites significantly more often during the grouper spawning (Dec-May) than non-spawning season (Jun-Nov) in each of the five years of monitoring ($p=0.008$), indicating orientation in relation to the presence of spawning grouper. In contrast, there was no relationship between the presence of tiger and Caribbean reef sharks at FSA sites and grouper spawning season. Tiger sharks occupied the largest activity space within the monitored array (887km²), closely followed by lemon sharks (863km²); Individuals were detected across nearly the entire area of the array. Caribbean reef sharks utilized a much smaller activity space within the monitored array (8km²), composed exclusively of mesophotic reef habitat located within FSA sites. This mesophotic reef serves as habitat to all three shark species with varying degrees of fidelity.

0275 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Josh Pierce, Craig Rudolph

USFS, Southern Research Station, Nacogdoches, TX, USA

Louisiana Pine Snake (*Pituophis ruthveni*) Population Declines

Research suggests the Louisiana Pine Snake (*Pituophis ruthveni*) is a semi-fossorial species that requires frequently burned sites with a well developed herbaceous understory capable of supporting populations of its primary prey, Baird's Pocket Gopher (*Geomys breviceps*). Ongoing surveys suggest that this species is rapidly declining; and currently occupied habitat is limited to a few small, isolated blocks of degraded and fragmented habitat. Threats to Louisiana Pine Snake populations include; road mortality, collection, habitat degradation due to fire suppression, and loss of genetic variability and demographic viability due to small population sizes. In recent years, habitat has been improved on some of the areas that support Louisiana Pine Snake populations, however populations apparently continue to decline. Outside of augmentation, it appears there is an inability to reverse the apparent population declines, which may ultimately result in the extinction of "natural" populations of Louisiana Pine Snakes.

**0421 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Kristen Pilcher, Rebecca Blanton Johansen

*Austin Peay State University, Center of Excellence for Field Biology and Department of
Biology, Clarksville, TN, USA*

**Filling the gap: current and historical factors influencing fish diversity in a
poorly studied west Tennessee coastal plain stream**

Rutherford Fork (Obion River) in northwest Tennessee has been impacted by channelization for agriculture and wastewater discharge containing heavy metals generated by the adjacent Milan Army Ammunitions Plant (MLAAP). How these anthropogenic activities have impacted the fish community has not been evaluated, but published distributional data indicate Rutherford Fork has a depauperate ichthyofauna relative to other Obion River systems. Fishes were collected from eight sites throughout Rutherford Fork during spawning and non-spawning periods to determine whether species common elsewhere in the Obion system were absent due to degraded habitat conditions associated with anthropogenic activities. Habitat assessments and stream habitat variables were documented during each collection to evaluate how these factors influence fish community composition and more specifically, how they influence the distribution and abundance of intolerant benthic species of madtom catfishes (Genus *Noturus*). Of the 32 species collected, 26 from 10 families, including several intolerant benthic fishes (e.g., Percidae and Ictaluridae), were new records for Rutherford Fork, indicating species diversity is higher than previously reported. These observations suggest species have re-established due to improved conditions, or alternatively, have persisted in Rutherford Fork but were previously undetected due to low collection effort or low densities. Ongoing work to assess historical collection effort and to link specific habitat parameters, such as microhabitat variation, to the occurrence and abundance of intolerant benthic fishes will provide additional insight to the historical and current factors influencing the fish community of Rutherford Fork.

0315 Genetics, Development, & Morphology, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY

Tyler Pilger, Thomas Turner

Museum of Southwestern Biology and Department of Biology, University of New Mexico, Albuquerque, New Mexico, USA

Intrinsic and Extrinsic Factors Affecting Genetic Diversity and Gene Flow: Comparative Landscape Genetics of Gila River Fishes

Genetic diversity and gene flow are predicted to have differential responses to intrinsic (e.g., life history and population dynamics) and extrinsic (e.g., distance between populations and dispersal barriers) factors. The upper Gila River Basin in southwestern New Mexico is one of the last unimpounded basins in North America and a stronghold for a threatened and largely endemic fish fauna. We used microsatellite DNA markers to examine genetic structure and dynamics of native species with varying life history strategies and distributions in this riverine landscape. Small-bodied, opportunistic life history species include Spikedace (*Meda fulgida*), Loach Minnow (*Tiaroga cobitis*), Speckled Dace (*Rhinichthys osculus*), and Longfin Dace (*Agosia chrysogaster*). Large-bodied, periodic life history species are Headwater Chub (*Gila nigra*), Desert Sucker (*Catostomus clarkii*), and Sonora Sucker (*Catostomus insignis*). Genetic diversity of opportunistic species increased longitudinally upstream to downstream and tests of genetic divergence indicated significant population substructure within the basin. A canyon-bound reach with high densities of nonnative predators was identified to be a substantial barrier to gene flow of opportunistic species. Analyses of periodic species indicated higher genetic diversity at upstream sites than those downstream but no appreciable population substructure. Comparative landscape genetic study shows that migration and persistence of patchily-distributed opportunistic species will be most strongly affected by anthropogenic and natural factors that limit habitat connectivity in the Gila River.

0078 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Kyle Piller¹, Aaron Geheber²

¹*Southeastern Louisiana University, Hammond, LA, USA*, ²*University of Oklahoma, Norman, OK, USA*

Fish kill in the Pearl River: The good, the bad, and the ugly

The Pearl River is a moderately diverse Gulf Coastal Plain system in eastern Louisiana and southern Mississippi that harbors over 100 species of freshwater fishes. The

ichthyofauna of the Pearl River has been surveyed on a quarterly basis for more than half of a century (1956-present). In August 2011, the release of “black liquor”, an industrial by-product of the paper making process, caused a reduction of dissolved oxygen in the river that resulted in a total local extirpation of fish and freshwater mussels in a 40 mile stretch of the river’s main channel downstream of the discharge site. We surveyed the fish community, both upstream and downstream of the discharge site, from August 2011 through December 2012 and noted a significant shift in fish community structure in the impacted section. Although the effects of the event are seen as a shift in fish community structure, and a loss of species richness directly following the event, the fish community displayed a rapid increase in richness within only a few months of the perturbation. In addition, the present situation of the fish community mimics the impacts observed after other natural events (i.e. drought and hurricanes) that have previously occurred in the basin. However, this spill represents a more “localized” disturbance and the impacted stretch of river has returned to pre-spill richness levels in a timely manner. These results suggest that connectivity with upstream unimpacted reaches may have aided in fish community rebound in the impacted section.

0585 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Hudson Pinheiro¹, Eric Mazzei², Thiony Simon³, Jean-Cristophe Joyeux³, Rodrigo Moura⁴, Luiz Rocha⁵

¹University of California Santa Cruz, Santa Cruz, CA, USA, ²Universidade Estadual de Santa Cruz, Ilhéus, Brazil, ³Universidade Federal do Espírito Santo, Vitória, Brazil, ⁴Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil, ⁵California Academy of Sciences, San Francisco, CA, USA

Reef fishes of the Vitória-Trindade Seamount Chain, southwestern Atlantic

The Vitória-Trindade Chain (VTC) is a volcanic formation in shape of a straight line, where seamounts are distributed from near the continental margin to oceanic islands located 1,200km away from mainland Brazil. Three scientific diving expeditions were conducted between 2009 and 2011, where reefs and rhodolith beds of eight seamounts were surveyed at depths between 18 and 120m. A total of 128 fish species were recorded, which represented 110 new records (86% of the records) for the seamounts, and depth range extensions for 44 species. A total of 209 species are now known from the VTC seamounts, 159 of which are considered reef-associated. Five endemic species and another three undescribed species were recorded. Most species are widely distributed along the Atlantic and the world (83%), while a few are endemics of the Brazilian Province (12%). Perciformes (102 species), Tetraodontiformes (15), Anguilliformes (14), and Labridae (17), Epinephelidae (16) and Carangidae (15) were the richest orders and families, respectively. Most species are macro-carnivores (42%), followed by mobile invertebrate feeders (26%), planktivores (9%) and roving herbivores (7%). Thirty-six species were found exclusively in reefs and 26 in rhodoliths, whereas 94 species are found in more than a single habitat. Ten species are considered endangered by the IUCN

or Brazilian red list, and six are considered over-exploited in Brazil. These few expeditions which used technical diving increased the VTC seamount fish richness by 53%, revealing the occurrence of endemic and unknown species. Seamounts with shallow summits support a much higher biodiversity than previously thought.

0460 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Steven Poe

University of New Mexico, Albuquerque, NM, USA

Identification Key for *Anolis* Lizards

Anolis lizards are notoriously difficult to identify. In 1995 Ernest Williams and collaborators published a landmark paper describing their "computer approach" to identification of *Anolis*. This work employed the program Hypercard to produce an application that matched a set of character scores from an unknown specimen to scores in Williams' vast database of *Anolis* lizards. This "*Anolis* Handlist" had obvious advantages over its paper dichotomous counterparts. In matching keys, accurate identification is not dependent on correct decisions on early couplets, as it is in dichotomous keys, and a set of similar and possible species rather than a single final verdict may be rendered.

The Williams et al. approach was ahead of its time. Today such electronic matching-based keys are commonplace. The Lucid platform has become the commonest means to present such keys, probably due to its widespread availability, functionality, and ease of use. Here I apply the Lucid platform to produce a key to all species of *Anolis* lizards.

0455 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Steven Poe

University of New Mexico, Albuquerque, NM, USA

Phylogeny of *Anolis*

We present new DNA sequence data from two mitochondrial (ND2, COI) and one nuclear gene (*ecel*) to elucidate the phylogeny of *Anolis*. We combine these data with morphological data and published DNA data to produce a comprehensive phylogenetic estimate of *Anolis*. We use this estimate to assess taxonomic and biogeographic issues in *Anolis*.

0040 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Aghdas Poostpasand¹, Paria Parto², Setareh Asoudeh³, Masoud Sajjadi³

¹Shiraz Medical School, Shiraz, Iran, ²Razi University, Kermanshah, Iran, ³Hormozgan University, Bandar Abbas, Iran

Lead Nitrate Induced Histopathological Changes in Kidney of Milk Fish (*Chanos chanos*)

The hazardous effect of lead nitrate on the histopathology of kidney of the freshwater fish, Milk fish (*Chanos chanos*) was investigated. 96h-LC₅₀ value of this metal salt for this species estimated about 426.48 mg/l. Juvenile milk fish (W:64±1.2 g, SL:16.7±0.4 cm) were treated with 1/5th, 1/10th, 1/20th of LC50/96 for a period of 12 h, 96h, 1 and 2 weeks. Kidney samples were collected after these exposures and analyzed by using light microscopy. There was Hypertrophy of epithelial cells of the renal tubules with the consequent reduction in tubular lumens was observed. Some of the epithelial cells showed distinct vacuolization. Contraction of glomeruli and disruption of haematopoietic tissues were also observed. In the high dosage of lead nitrate general edema, atrophy of renal tubules, detachment of renal tubule epithelia from their basement membrane, degeneration of Bowman's capsules and luminal casts were more distinct. The head kidney, the endocrine component, constituted of interrenal and chromaffin cells. After acute exposure the interrenal cells, functional equivalent of mammalian adrenal cortex, showed hypertrophy and degranulation in all treatments. The result showed that acute lead nitrate toxicity severely affects the vital organs and normal behavior which may be deleterious for fish populations.

0770 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

David Portnoy¹, Melissa Giresi¹, Bryan Frazier², John Gold¹

¹Texas A&M University, College Station, TX, USA, ²South Carolina Department of Natural Resources, Charleston, SC, USA

Genetic Population Structure of the Finetooth Shark (*Carcharhinus isodon*) in the U.S. Atlantic

The finetooth, *Carcharhinus isodon*, is a small coastal shark found along the Atlantic coast of the southern United States and in the Gulf of Mexico. The presence of gravid females as well as neonate and juvenile finetooth sharks in estuarine and nearshore habitats of South Carolina and the Gulf coasts of Florida and Alabama suggest that these areas are nursery grounds. We assessed patterns of variation in 15 nuclear-encoded microsatellites and sequences of the entire mitochondrial (mtDNA) control region among samples collected from the three putative nursery sites. Analyses based on

microsatellite alleles and genotypes revealed modest levels of variation within samples and significant heterogeneity among samples. By contrast, analyses of mtDNA sequences revealed low haplotype diversity within samples and homogeneity among samples. The results suggest that unlike in larger coastal carcharhinid sharks where females exhibit philopatry to nursery areas, both male and female finetooth sharks engage in reproductive migrations. In addition, the lack of congruence between marker types likely reflects historical demographic processes related to the Wisconsin glacial period, highlighting the difficulty inherent in using molecular markers to examine population structure in temperate/tropical species inhabiting coastal waters of the U.S.

0767 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

David S. Portnoy, John R. Gold, Kevin W. Conway

Texas A&M University, College Station, TX, USA

Unraveling the Phylogenetic Relationships of New World Searobins (Triglidae; Prionotini)

Searobins of the tribe Prionotini are common inhabitants of shallow coastal areas throughout the western central Atlantic and eastern central Pacific. As currently defined, the Prionotini includes 31 species, divided between two genera: *Prionotus* (23 species) and *Bellator* (8 species). Despite their abundance in shallow coastal areas, the intrarelationships of *Prionotus* and *Bellator* remain relatively unexplored. We utilized sequence data from two mitochondrial (COI and *cyt b*) and one nuclear gene (RAG 1) acquired from 13 species of *Prionotus*, three species of *Bellator*, and appropriate outgroup taxa, to assess phylogenetic relationships of New World searobins. Results derived from parsimony and maximum-likelihood analyses of concatenated data sets support monophyly of Prionotini and *Bellator*, but not *Prionotus*. Specifically, *Prionotus* is rendered paraphyletic due to the recovery of a sister group relationship between *Bellator* and a clade of *Prionotus* that includes five species (*P. punctatus*, *P. rubio*, *P. longispinosus*, *P. tribulus*, and *P. evolans*). We refer to this group as the 'core' *Prionotus* clade. The remaining species of *Prionotus* examined (*P. scitulus*, *P. martis*, *P. carolinus*, *P. stearnsi*, *P. roseus*, *P. alatus*, and *P. paralatus*) were recovered as a grade leading to the *Bellator*+ 'core' *Prionotus* clade, the relationships of which were unstable. Though preliminary, our results indicate that the current classification of the Prionotini is not consistent with the evolutionary relationships of New World searobins.

0130 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Gregg Poulakis¹, Harry Grier²

¹Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute, Port Charlotte, FL, USA, ²Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute, St. Petersburg, FL, USA

Reproductive Biology of the Cownose Ray (*Rhinoptera bonasus*) in the Charlotte Harbor Estuarine System, Florida

The cownose ray, *Rhinoptera bonasus*, is an abundant species in the western Atlantic, but its reproductive biology is not completely known because of the difficulty in obtaining year-round samples in large portions of its range where the species is migratory. To address this knowledge gap, cownose rays were studied in a subtropical estuarine system where individuals are available year-round. For females, based on ovary length and weight, maximum follicle diameter, and mating wounds and scars, the size at 50% maturity was 701 mm disk width (DW) and the size at 100% maturity was 712 mm DW. For males, based on clasper morphology, testis length and weight, and epididymis width, the size at 50% maturity was 681 mm DW and the size at 100% maturity was 712 mm DW. Overall testis size and mean testis lobe diameter peaked up to two months prior to ovary size and maximum follicle diameter, indicating that males were preparing to inseminate females during the entire parturition and mating period. Mating behaviors were observed mostly between April and June. Ovulation peaked in May, and parturition occurred primarily in March and April after an 11-12 month, single embryo, gestation period suggesting that females are synchronous in Charlotte Harbor. Size at birth was 202-383 mm DW. Concurrent vitellogenesis and gestation indicated a clearly defined annual reproductive cycle that may be completed within the estuary. Germinal epithelia were actively producing follicles in embryos, suggesting that folliculogenesis in *Rhinoptera* occurs primarily before parturition.

0133 AES Ecology, Mesilla, Thursday 11 July 2013

Gregg Poulakis¹, Jill Olin², Philip Stevens¹, Jacquelyn DeAngelo¹, Amy Timmers¹, R. Dean Grubbs³, Aaron Fisk⁴

¹Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute, Port Charlotte, FL, USA, ²Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, LA, USA, ³Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA, ⁴Great Lakes Institute for Environmental Research, University of Windsor, Windsor, Ontario, Canada

Use of Stable Isotopes to Infer Feeding Habits and Ontogenetic Diet Shifts by the Endangered Smalltooth Sawfish (*Pristis pectinata*), in Florida

The smalltooth sawfish, *Pristis pectinata*, is an endangered species in the western Atlantic Ocean. Little research had been conducted on this species prior to its protection under the Endangered Species Act in 2003. Since listing, research focused primarily on juveniles has provided insights into life history including habitat use during their first three years of life when they reside in estuarine nurseries. The goal of this study is to analyze the feeding biology of the smalltooth sawfish on a trophic-level scale. Our hypothesis is that neonates initially feed like other invertebrate specialist batoids when they still have their rostral sheath; then eventually switch to feeding like piscivorous sharks once the rostral sheath disappears and they become more experienced predators. To test this hypothesis, trends in stable isotopes of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) from fin clips of sawfish, cownose rays, and bull sharks collected from the same nursery are being analyzed. These analyses are ongoing, but preliminary data suggest that an ontogenetic diet shift does occur from secondary consumer (diet composed primarily of invertebrates) to piscivore (diet composed primarily of estuarine fishes) during the first few months that juvenile sawfish are in the Charlotte Harbor nursery. Recent acquisition of samples from adult sawfish may indicate an additional dietary shift and provide insight on whether or not maternal physiology influences neonate isotopic signatures. Documenting ontogenetic diet shifts in this species may help explain the timing of changes in habitat use that have been observed during long-term acoustic studies.

0348 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Mary Power, Keith Bouma-Gregson, Jack Sculley

Univ. California Berkeley, Berkeley CA, USA

Fish, Algae, and Food Webs under “Drought vs Deluge” Hydrologic Regimes in a River with Mediterranean Seasonality

Hydrology exerts major control over river food webs, starting with the algae and cyanobacteria that dominate primary production in many sunlit rivers. In the Eel River of northwestern California, consumers downstream of channels that drain > 10 km² derive most of their carbon from algae. Twenty-five years of field observations, a diatom stratigraphic record of ~100 years, and five field experiments in the Eel River suggest that hydrologic regimes influence the magnitude of algal blooms as well as the roles and food acquisition of fish in river food webs. Winter floods large enough to scour the bed rejuvenate food web to earlier successional states that better support salmonids and other fish. In summers after scouring floods, the meters-long turfs of the macroalga *Cladophora glomerata* proliferate. *Cladophora* turfs are colonized by highly edible diatoms, which in turn support midges, mayflies, and other soft, mobile invertebrates that are readily consumed by fish. Following drier winters without flood scour, many more heavily armored or sessile invertebrates, invulnerable to fish, survive to suppress algae and block energy flow to predators like fish. These inferences, developed from field experiments during drought and flood years, were extended back 100 years using diatom counts in cores from a deep marine canyon off the mouth of the Eel. If summer droughts (including anthropogenic droughts from water withdrawals) intensify, food chains could shorten from two to one level, as hydrologic conditions favor toxic cyanobacteria, recently implicated in several dog deaths in the Eel River.

0680 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Sean Powers, Marcus Drymon

University of South Alabama, Mobile, AL, USA

Spatial and temporal patterns of predation by cownose rays determines source and sink locations in bay scallops populations

We examined the foraging behavior of cownose rays (*Rhinoptera bonasus*), which perform seasonal migrations along the U.S. Atlantic Coast and feed on hard-shelled prey, to determine their impact on local populations of bay scallops (*Argopecten irradians*) within North Carolina (USA) sounds. Observational data and experimental manipulations demonstrate that cownose rays selected feeding sites from among spatially discrete seagrass beds during their late summer/fall (southward) migration based on local

density of bay scallops. Consequently, mortality of bay scallops during the brief two-week period of passage through the high-salinity sounds of North Carolina exhibited a density-dependent relationship best described by a Gompertz curve with a threshold value of 3 bay scallops per m². Because this intense predation occurs prior to annual spawning of bay scallops, resulting in local densities below threshold levels potentially required for successful spawning and fertilization (i.e., Allee effects), local population sinks were created and, in some instances, maintained over multiple years. Bay scallop mortality during the spring (northward) cownose ray migration was low suggesting that cownose rays may not feed intensely in the sounds as they move north. Our results imply that migratory predators can greatly influence metapopulation population dynamics over large spatial scales via significant, even if pulsed, mortality.

0747 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Heather L. Prestridge, Sarah Potvin, Mark Lennox, Kevin W. Conway

Texas A&M University, College Station, TX, USA

The Collection of Fishes at the Biodiversity Research and Teaching Collections: an under-utilized Ichthyological resource deep in the heart of Texas

The Biodiversity Research and Teaching Collections (BRTC; formerly the Texas Cooperative Wildlife Collection) at Texas A&M University is the largest Vertebrate Natural History Collection within the state of Texas and one of the largest University based collection of vertebrates in the United States. With over 46,000 lots and 700,000 specimens, the Collection of Fishes at the BRTC is currently one of the largest Ichthyological collections in Texas and continues to grow on an annual basis as new specimens are acquired through the research efforts of Curators, Faculty and Graduate Students associated with the Texas A&M University system. Our recently established cryogenically curated collection of tissues is rapidly growing, and becoming an important resource for genetic and phylogenetic studies on marine fishes from the Gulf of Mexico and the southwestern United States. A new web based interface at the BRTC, including a database search portal, has significantly increased accessibility to specimen and supplementary data. Continued participation in distributed data networks (FISHNET II, GBIF, and VertNET), and new partnerships with the University Libraries and Texas Institute for Preclinical Studies (TIPS) at Texas A&M University has also enhanced use and accessibility of the collection. Despite our diverse holdings and increased online presence, the Collection of Fishes at the BRTC remains underutilized by the broader Ichthyological research community and we wish to change this. We present an overview of Collection of Fishes, highlighting its taxonomic and geographic strengths, and explain ongoing initiatives currently underway to digitally archive specimens and specimen related data.

0125 HL Detectability Symposium, Brazos, Friday 12 July 2013

Steven Price¹, Jacquelyn Guzy², Michael Dorcas²

¹University of Kentucky, Lexington, KY, USA, ²Davidson College, Davidson, NC, USA

Detection and Occupancy Estimates of Anuran Amphibians: The Manual Calling Survey and Beyond

Detection and documentation of anuran vocalizations through manual calling surveys (MCS) has become the de facto method for studying and evaluating anuran populations across large spatial scales. Although amphibian researchers have long-used MCS for ecological investigations, statistical advances that incorporate detection probability have provided a framework for resurrecting a number of questions pertaining to imperfect detection of anurans using MCS. These studies collectively highlight the importance of accounting for factors that influence detection as they provide for more precise occupancy estimates. However, MCS do have some drawbacks. Many species, especially those that vocalize sporadically, are poorly detected via MCS. Furthermore, MCS provide limited information on anuran abundance, no information on population structure, and cannot document the presence of eggs masses, tadpoles or metamorphosing juveniles in populations. Thus, MCS may be most useful in conjunction with other survey methods. We review the literature on MCS as it relates to detection and occupancy estimation and examine how factors relating to survey protocol, study design, species-specific calling behavior, and abiotic and biotic conditions influence anuran detection probabilities. We highlight natural history aspects of anuran species that appear to be adequately assessed via MCS, and contrast these species with others that are poorly assessed via MCS. We then compare species-specific detection probabilities obtained from MCS to detection probabilities obtained via active search methods and dipnetting surveys. Finally, we illustrate how the use of multiple survey methods can increase detection probability for certain species and provide protocol flexibility for amphibian researchers.

0564 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Bianca Prohaska¹, Paul Tsang², William Driggers III³, Eric Hoffmayer³, James Sulikowski¹

¹University of New England, Biddeford, ME, USA, ²University of New Hampshire, Durham, NH, USA, ³National Marine Fisheries Service, Pascagoula, MS, USA

Development of a Non-lethal, Minimally Invasive Protocol to Study Elasmobranch Reproduction

Currently, circulating levels of plasma steroid hormones are used as a non-lethal method to determine reproductive maturity and reproductive cycles in elasmobranchs. However, this method can prove problematic to perform on large and/or endangered species, because of difficulties involved with specimen handling. These constraints make it imperative for new techniques to be developed for studying the reproductive biology of elasmobranchs. Previous work conducted on other vertebrates has shown that steroid hormones can be successfully extracted from muscle tissue. The process of collecting muscle tissue samples is quick, minimally invasive, and may be conducted without removing the animal from the water, facilitating its use on larger, and/or endangered species of elasmobranchs. Thus, the objective of the current study was to develop a valid method for extracting steroid hormones from the skeletal muscle tissue of the lecithotrophic aplacental viviparous spiny dogfish (*Squalus acanthias*), the oviparous little skate (*Leucoraja erinacea*), and the placental viviparous Atlantic sharpnose shark (*Rhizoprionodon terraenovae*). The results suggest that concentrations of muscle progesterone [P₄], testosterone [T], and estradiol [E₂] can be successfully quantified to study reproduction by radioimmunoassay. Additionally, there were significant correlations between plasma and muscle [E₂] concentrations in *S. acanthias*, as well as plasma and muscle [P₄], [T] and [E₂] concentrations in *R. terraenovae* and *L. erinacea*. The results of the present investigation demonstrated that skeletal muscle is a non-lethally harvested tissue that is well suited for studying the reproductive biology of elasmobranchs.

0739 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Diogo B. Provete¹, Lilian Franco-Belussi², Lia R. Santos⁵, Rodrigo Zieri², Rafaela M. Moresco², Itamar A. Martins⁴, Silvio C. Almeida³, Classius Oliveira²

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Phylogenetic signal and variation of visceral pigmentation in eight anuran families

Visceral pigmentation is found in several organs and structures of ectothermic animals, comprising the extracutaneous pigmentary system. Its function is not well defined, although it is known that melanin is produced and stored inside pigmented cells. Previous studies demonstrated that the distribution of visceral pigmentation is neither homogeneous among organs nor among anuran species. We describe the diversity of visceral pigmentation in 12 organs/structures from 32 anuran species belonging to eight families using a comparative phylogenetic method. We also determined in which node(s) of the phylogeny there is more variation in the pigmentation categories and whether this variation has phylogenetic signal. We tested for the pigmentation in all organs and each organ separately. The visceral pigment cells in organs and structures of the abdominal cavity varied among genera. All species had pigmentation in the urogenital and cardiorespiratory systems, whereas the stomach lacks pigmentation in all species. We also found a phylogenetic signal for pigmentation in all organs and structures taken together, besides heart, testes, lumbar parietal peritoneum and lumbar nerve plexus when considered separately. Overall, considering all organs, the highest diversity of categories of pigmentation was found in the nodes corresponding to Craciabatrachia and Athesphatanura. This study constitutes the first step towards understanding the evolution of visceral pigmentation in anurans.

0586 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Alberto R. Puente-Rolón¹, Jaime Collazo², Harold Heatwole³, Sondra I. Vega-Castillo⁴

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²North Carolina Cooperative Fish and Wildlife, Research Unit, Raleigh, NC, USA,

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Translocation as a Management Technique *Epicrates inornatus* in the Northern Karst Region of Puerto Rico

The relocation of animals is perceived by home and business owners and the general public as a humanitarian way of dealing with the problems associated with natural loss of habitat. In Puerto Rico the relocation of *Epicrates inornatus* is an increasingly common wildlife management strategy. However, no studies have addressed the effects of relocation on the snake itself, nor its effectiveness as a management technique. Due to the prominence of relocation programs as a management strategy, we compared spatial ecology and survivorship of resident adult *E. inornatus* with those translocated to the study area. The sample included six resident and ten translocated snakes. Snakes equipped with transmitters were located one to three times per week. Resident *E. inornatus* were active $44 \pm 13\%$ of the times they were found. Relocated individuals were active $48 \pm 11\%$ of the times they were found. Home ranges overlapped extensively among individual resident and translocated *E. inornatus*. Average home ranges for resident snakes were 8 ha and varied from 3 ha to 23 ha. Translocated individuals showed an average home range of 16 ha, with values that ranged from 3 ha to 30 ha. Translocation programs need to recognize that translocated snakes can harbor diseases to which the resident population may not be resistant and the impact could be disastrous. Relocation of this species cannot be recommended as a standard conservation practice because it may have long-term negative impact.

0781 Fish Genetics I, Ruidoso/Pecos, Friday 12 July 2013

Catherine Purcell, John Hyde

National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California, USA

Genetic variability in wild and hatchery populations of California yellowtail, *Seriola lalandi*

On the west coast of the United States, the California yellowtail, *Seriola lalandi*, is considered a great candidate for mariculture due to its high market demand and value.

While most yellowtail production relies on capture of wild juveniles and fattening in offshore pens, successful spawning and rearing techniques for *S. lalandi* have been developed at the Hubbs-SeaWorld Research Institute (HSWRI) with the intent to translocate reared individuals to offshore pens to raise to market size. The impact of unintentional releases on wild populations has become an increasingly important issue. As such, most future aquaculture projects will likely require a genetic analysis component for the permitting process. This study aims to examine the genetic diversity of yellowtail in the California-Mexico region, and to examine the genetic variability of broodstock and hatchery populations at HSWRI (San Diego, CA) using nuclear microsatellites. Parentage will be determined for broodstock populations, and the current broodstock will also be compared to local wild populations to ensure that genetic diversity is similar between groups. By creating the framework for a genetic diversity monitoring program, substantial progress can be made towards establishing *S. lalandi* as a commercially viable aquaculture species on the west coast. Results of the genetic assessment of wild and hatchery populations will be presented.

0782 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Catherine Purcell, John Hyde

National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California, USA

Using pedigree and gene expression analysis to study and improve fitness and survival in early-life stages of reared California yellowtail (*Seriola lalandi*)

Larval rearing methods for California yellowtail (*Seriola lalandi*) are constrained by highly variable survival rates and levels of fitness. Given the fast growth and the major physical changes that occur during the earliest life stages, one way to explore differences in fitness and survival is to examine variability at the gene and molecular levels across those early-developmental periods. We are comparing gene expression profiles for several early life stages of yellowtail, categorized as having either high or low levels of fitness. In order to help identify, characterize and understand factors contributing to offspring deformities and growth rate variability, we are also conducting pedigree analyses using 16 nuclear microsatellite markers to evaluate the impact of parent-progeny relationships on this variability. Larval and juvenile yellowtail were collected from aquaculture production runs at the Hubbs-SeaWorld Research Institute (San Diego, CA). Initial genetic analyses of juveniles show significant differences in parental contribution between offspring with deformities and randomly sampled offspring. These results suggest a connection between certain brood individuals and deformed juveniles. While this project is still in progress, initial results will be presented. It is expected that insights gained through this research into the causes of variability in fitness and survival will ultimately help to identify ways to increase survivorship, reduce deformities, and improve fitness in these and subsequent yellowtail rearing stages in an aquaculture setting.

0014 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Mark Pyron¹, Kyle Broadway², Brent Murry²

¹*Ball State University, Muncie, IN, USA*, ²*Central Michigan University, Mount Pleasant, MI, USA*

Regime shift in a large river fish community: body size structure and trophic change

We analyzed fish assemblage data for the Wabash River that were collected from 1974-2008, to evaluate temporal variation in body-size structure, taxonomic composition and dominance, and trophic composition. We analyzed the size structure of the assemblage using annual community size spectra: regression slope is an index of ecological efficiency, and the spectral elevation serves as a proxy for food web capacity. The dominant species changed dramatically during three periods defined as before, during, and after regime change. The assemblage was dominated by planktivore and omnivore functional groups from 1974-1994. In the mid-1990s, the assemblage composition became dominated by benthic invertivores. During 2002-8, the relative abundance of planktivores and omnivores decreased, and in 2008 the combined planktivore and omnivore relative abundance was 15.5%. Although regime shifts have been identified in multiple ecosystems, this is the first example for a large river ecosystem lacking flow regulation from mainstem reservoirs. We discuss potential drivers in the Wabash River: multiple anthropogenic impacts, with a large influx of nutrients and an altered hydrologic regime as the strongest influences.

0239 Fish Ecology, Doña Ana/Cimarron, Sunday 14 July 2013

Fan Qiu¹, Andrew Kitchen², J. Gordon Burleigh¹, Michael Miyamoto¹

¹*Department of Biology, University of Florida, Gainesville, FL, USA*, ²*Department of Anthropology, University of Iowa, Iowa City, IA, USA*

Scombroid Fishes Provide Novel Insights into the Trait/Rate Associations of Molecular Evolution

The study of which life history traits affect molecular evolutionary rates is often confounded by the covariance of these traits. Scombroid fishes are a rare group in which the mass-specific metabolic rate is positively associated with body size. This study exploits this novel pattern of trait variation to distinguish between metabolic rate and body size as predictors of molecular evolutionary rates. We inferred a phylogenetic hypothesis for scombroid fishes from a supermatrix of available molecular and

morphological data. We then used new statistical approaches to assess the associations of body size and metabolic rate with substitution rate in a phylogenetic context. As predicted by the body size hypothesis, there is a negative correlation between body size and substitution rate. However, unexpectedly, we also find a negative association between metabolic and substitution rates. These relationships are supported by analyses based on the total molecular dataset, separate mitochondrial and nuclear DNA datasets, and individual genes and are robust to phylogenetic uncertainty. The patterns of scombroid molecular rate variation are affected by body size or one or more of its covariates, and not metabolic rate. Groups with novel patterns of trait variations can be uniquely informative for identifying which life history traits affect the pace of molecular evolution.

0351 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Irani Quagio-Grassiotto¹, Clarianna Baicere-Silva², Luis Malabarba³, Fernando Carvalho⁴

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²*Universidade Federal do Mato Grosso, Sinop, MT, Brazil,* ³*Universidade Federal do rio Grande do Sul, Porto Alegre, RS, Brazil,* ⁴*Universidade Estadual Paulista Julio de Mesquita Filho/IBILCE, São José do Rio Preto, SP, Brazil*

Recognizing Homology in Sperm Data Through the Analysis of the Spermiogenesis: Phylogenetic Implications Using Family Characidae (Teleostei: Characiformes) as a Model

Since its proposition the philosophical concept of homology, as well as its applications, have been discussed. It is a common sense that recognition of homologies reduces the noise in phylogenetic analyses and is one of the first steps for understanding the mechanisms by which new features arise. Spermatozoa in Teleostei present a reduced number of features to be analyzed, related to the shape of the nucleus, midpiece and flagellum; position of the centriolar complex relative to the nucleus and flagellum; and number and distribution of a few organelles (mitochondria and vesicles). The analysis of the spermiogenesis (the ontogenetic process of cellular differentiation by which spermatids give rise to spermatozoa), according to the presence/absence of migration of the centriolar complex toward the nucleus and to the presence/absence of nuclear rotation on the flagellar axis, has shown that spermatozoa with similar shapes or organelles distribution may have originated from distinct ontogenetic processes and consequently are not homologous. In order to test this hypothesis, a phylogenetic analysis based on testicular structure, spermiogenesis and sperm ultrastructure based on primary hypotheses of homology is made on some representatives of the Characidae. The results are mostly congruent with previous hypotheses based on other characters. The greatest morphological diversity was observed in Stervardiinae and Cheirodontinae that show inseminating species, both supported as monophyletic based on sperm morphology. Considering all Characidae is possible to hypothesize that insemination

appeared at least five times. Therefore, spermiogenesis cannot be ignored during the search of characters in spermatozoa for phylogenetic analysis.

0772 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Morgan Raley

NC Museum of Natural Sciences, Raleigh, NC, USA

Comparative Mitogenomics of the Fieryblack Shiner, *Cyprinella pyrrhomelas* (Cope 1870)

A summer internship at the North Carolina Museum of Natural Sciences and a DNA barcoding effort of tissues in the collection led to the discovery of significant DNA variation among populations of Fieryblack Shiner, *Cyprinella pyrrhomelas*, one of the most strikingly colored of the Carolina endemic fishes. As part of the continuing investigation into this previously unrecognized diversity, mitogenomes have been developed for representative individuals drawn from the major clades recognized from the initial DNA barcoding study. Here, complete mitogenomes are presented for those major lineages as described in 2009.

0307 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Zachary Randall, Lawrence Page

Florida Museum of Natural History, Gainesville, FL, USA

On the Paraphyly of *Homaloptera* (Teleostei: Balitoridae)

Homaloptera van Hasselt 1823 is the most species-rich genus of the subfamily Balitorinae, comprising 35 valid species. This genus as treated historically exhibits a large amount of morphological diversity. *Homaloptera* is paraphyletic and the following three genera are removed from its synonymy based on morphological diagnosability: *Homalopteroides* Fowler 1905, *Homalopterula* Fowler 1940, and *Balitoropsis* Smith 1945. *Homaloptera* consists of six species and is known to occur in southern Myanmar, Thailand, Peninsular Malaysia, Sumatra, Java, and Borneo. *Homaloptera parclitella* and *H. ogilviei* are the only species belonging to this genus known to occur sympatrically, and only in the Endau Drainage, Malaysia. *Homalopteroides* currently consist of eleven species and is known to occur in northeastern India, Myanmar, Thailand, Vietnam, Peninsular Malaysia, Java, and Borneo. The following species of *Homalopteroides* are known to occur sympatrically: *H. nebulosus* and *H. tweediei* in the Endau Drainage, and *H. modestus* and *H. smithi* in the Mae Khlong Drainage, Thailand. *Homalopterula* is only known to occur in Sumatra and

consists of four species, three of which were described from Aceh Province, Sumatra. There have been no reports of species of *Homalopterula* occurring sympatrically. *Balitoropsis* consists of nine species and is known to occur in China, Laos, Cambodia, Thailand, Peninsular Malaysia, Sumatra, Java, and Borneo. There have been no reports of any species of *Balitoropsis* occurring sympatrically.

**0295 SSAR SEIBERT AWARD PHYSIOLOGY & MORPHOLOGY,
Galisteo/Aztec, Friday 12 July 2013**

Jolene Rearick, Angelica Swanson, Joseph Cook

University of New Mexico, Albuquerque, NM, USA

Freeze Endurance: A Novel Measure to Compare Extreme Physiological Tolerances

In the face of rapid global change it becomes increasingly important to understand factors driving species distributions. Thermal limitations are known drivers of species occupation; however, underlying causes of thermal tolerance variation and the potential for rapid adaptation within and among vertebrate taxa remains largely unexplored. Freeze tolerance is an extreme vertebrate thermal adaptation, allowing species to survive extracellular freezing, suspension of metabolic processes, and long term exposure to subzero temperatures. Published definitions of freeze tolerance fail to provide a standardized measure for comparison within or between species. Here we propose "**freeze endurance**," a value integrating time, temperature, and survivorship of species that experience freeze events under either natural or experimental conditions. Freeze endurance allows direct comparison over time, space, and taxonomic levels, from populations to species or higher level taxa. A standardized measure also allows reevaluation of data from previous studies. Freeze endurance is an intuitive measure of thermal limitations among freeze tolerant and intolerant species within a changing global climate.

0469 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Jolene Rearick, Angelica Swanson, Joseph Cook

University of New Mexico, Albuquerque, NM, USA

Is Environmental Niche Correlated with Freeze Endurance?

The ability to survive freezing appears to have independently evolved multiple times in amphibians. We use the newly proposed measure “freeze endurance,” to identify environmental variables correlated with survival of freeze events. Only twenty-one species of amphibians have been tested for freezing survival under conditions we consider biologically relevant (minimum acclimation time and temperature of at least 12 hours below 10°C, high subzero initiation of freezing). We use museum specimen collection points to extract environmental niche data for each of the tested twenty-one species. We found a strong correlation ($R^2 = 0.4006$, $p << 0.001$) between freeze endurance and precipitation in the coldest quarter of the year (Hijmans et al, 2005). Though significant correlations were found between freeze endurance and other temperature or precipitation layers, the strongest includes both temperature and precipitation. Correlations were also calculated each variable used to calculate freeze endurance (minimum temperature, number of hours, and survivorship). Individual variable analyses were also significant and consistent with freeze endurance relationships. Precipitation and temperature were found to be highly correlated to survival of freeze events. We use these data to propose additional amphibian species to be tested for freeze endurance based on environmental niche space.

0783 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

David Reavill, Steven Wagner, Robert Weaver, Brandon Fessler

Central Washington University, Ellensburg, WA, USA

Odor Discrimination in the Coastal Giant Salamander (*Dicamptodon tenebrosus*)

Chemical cues are used as ubiquitous markers in salamanders (Urodela), and serve as the primary modality for conveying interspecific information such as species identity, kinship, and individual information, as well as territorial markers. Although the role of chemical cues has been widely studied in many Urodela families, particularly plethodontids, studies on the family Dicamptodontidae are very scarce. In order to test if Coastal Giant Salamanders (*Dicamptodon tenebrosus*) are able to use chemical cues to

discriminate among self-marked, conspecific marked and blank substrates, we performed unforced two-choice trials. One of 15 individuals was provided with two shelters (plastic tubes), and tested under three scenarios: (i) self-marked vs control, (ii) conspecific marked vs control, and (iii) self-marked vs conspecific marked. Trials were filmed for 12 hour periods and the video analyzed to determine time spent in each shelter. Our results show that *D. tenebrosus* were able to (i) discriminate between self-marked vs blank tubes, (ii) preferred a tube marked by a conspecific over a blank tube and (iii) preferred a self-marked over a conspecific marked tube. We suggest that attraction to previously marked refuge sites serves as an economical indicator of site quality, which may reduce the risk of unnecessary exposure.

0070 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Bettina Reichenbacher¹, Christoph Gierl¹, Jean Gaudant²

¹*Department of Earth and Environmental Sciences, Palaeontology & Geobiology, Ludwig-Maximilians University, Munich, Germany,* ²*Muséum national d'Histoire naturelle, Département Histoire de la Terre, Paris, France*

The Oldest Record of a Butid Gobioid and the Complexities of Morphological Characters in Extinct Forms

The gobioid lineages Eleotridae and Butidae remain difficult to resolve because synapomorphies are rare (Eleotridae) or have not yet been determined (Butidae). †*Lepidocottus*, known from the Palaeogene (Oligocene) of Europe and previously considered as a representative of *Gobius*, shows a complex set of characters. It bears an interneural gap between the two dorsal fins (as in Gobiidae and Gobionellidae), six branchiostegal rays, an L-shaped palatine, and the entopterygoid (as in Eleotridae and Butidae), 13 branched and segmented caudal rays (as in Eleotridae and the butid *Kribia*), and a pterygiophore arrangement of the first dorsal fin and rectangular otoliths as seen in most Butidae. We suggest that the pterygiophore arrangement (2211) and a rectangular shaped otolith of the gobioid type can be used as new, and at present the only discovered, synapomorphies for the Butidae. The development of a further otolith character, i.e. an anteriorly extended sulcus, and also the development of secondary cycloid scales are recognised as characters that can contribute significantly to resolve the phylogenetic relations within the Butidae. Our study reveals that the butids, today largely restricted to W-Africa, the Indo- and West-Pacific, were a common member of the non-marine fish faunas during the Oligocene and Early Miocene in Europe (Mediterranean area, Paratethys, Upper Rhine Graben). Their disappearance from these areas probably occurred during the Early Miocene (Aquitainian) and may be linked with the radiation of the Gobiidae during that period of time.

0210 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Roberto Reis¹, Mariangeles Arce H.³, Christian Cramer⁴, Pablo Lehmann A.², Edson Pereira¹, Vivianne Sant'Anna¹, Hector Vera-Alcaraz¹

¹PUCRS, Porto Alegre, RS, Brazil, ²UNISINOS, São Leopoldo, RS, Brazil, ³ANSP, Philadelphia, PA, USA, ⁴UNIR, Porto Velho, RO, Brazil

The Impact of Morphology in Total Evidence Phylogenies of Fishes

The present work includes phylogenetic hypotheses obtained from purely molecular data and from mixed molecular and morphological data of four different fish families, the doradid, callichthyid, and loricariid catfishes, and the belonid needlefishes. For each family, nucleotide sequences from multiple mitochondrial and nuclear genes were obtained, aligned, and analyzed simultaneously under different optimality criteria. Also, external morphology, osteology and myology (for doradids only) were investigated in order to obtain transformational series as evidence of phylogenetic relationships and to generate a data matrix. Both molecular and morphological data were concatenated into a mixed data matrix and analyzed under parsimony in a total evidence approach. The comparative quality of the hypotheses generated under total evidence versus purely molecular analyses is well documented in the literature, being centered in the concept of explanatory power. Moreover, we add to those ideas some biological and biogeographic examples that make hypotheses more plausible when morphology is included. For the catfish's studies, well established groups not recovered as monophyletic by the molecules alone were well supported as a clade in the total evidence analysis. Among the needlefishes, the inclusion of morphological evidence made some Indo-Pacific region groups monophyletic, highly increasing its biogeographic meaning. These examples indicates that results of the total evidence analyses are more robust, and in several instances present plausible solutions for relationships difficult to explain in the purely molecular analyses. These ideas clearly document that evolutionary morphology have a permanent and fundamental presence in ichthyology and high impact in phylogenetic systematics.

**0311 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER
ICHTHYOLOGY AWARD**

Qiu Ren, Richard Mayden

Saint Louis University, St Louis, MO, USA

Morphological Divergence and Evolution of Species in the Enigmatic and Diverse Genus *Sinocyclocheilus* (Cypriniformes, Cyprinidae)

The genus *Sinocyclocheilus* is one of the most morphologically and behaviorally interesting monophyletic groups in the Cyprinidae family, and is endemic to China. Species are found in the karst areas where springs and caves are abundant. Currently there are close to 60 species in this genus with a broad range of morphological adaptations to their different habitats. Shape differences vary from a “normal” cyprinid shape with normal eyes, fins, scales, pigmentation and sensory system to a shape with reduced eyes, reduced pigmentation and highly developed sensory system, and even to completely cave-adapted forms that lack eyes and pigment, have complex patterns of the sensory system, and have extreme morphological features and body shapes. In this study, we examine shape differences and change of these various species using geometric morphometrics. Using photographs of 50 species, 46 of which are of type specimens, we use 31 landmarks for the study. Using a previously published phylogenetic hypothesis we examine differentiation in shape in an effort to evaluate changes in an evolutionary context.

0411 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Stephen Ressel¹, Bruce Connery², Enoch Alpert-Knopp², Sarah Colletti³

¹*College of the Atlantic, Bar Harbor, Maine, USA*, ²*Acadia National Park, Mount Desert Island, Maine, USA*, ³*US Forest Service, White Sulphur Springs, West Virginia, USA*

Using citizen scientists to assess relative species abundance of terrestrial salamanders in Acadia National Park, Maine, USA

Whether amphibians face threats to their future existence on earth that are more imminent than that of other vertebrate taxa has been the focus of much discussion and research over the past quarter century. For a great many amphibian species, little or nothing is known about fluctuations in population size over time, which impedes attempts to elucidate a population decline that deviates from modal fluctuations for a given species. From 2008 to present, we enlisted citizen scientists in an effort to collect first-ever species abundance data on terrestrial salamanders native to Acadia National Park located on Mount Desert Island, Maine, USA via coverboard sampling. We placed 100 wooden coverboards in a grid array at two different Northeast Temperate Network

(NETN) sites within park boundaries. Following a brief training period, volunteers examined the microhabitat under coverboards either weekly or once/month in the spring and fall for the presence of salamanders. Field data included species identification, snout-vent and vent-tail length, color phase, and general assessment of body condition. The demographics of volunteers who conducted monthly surveys ranged from middle-school age children to adult island residents. Regardless of age or level of scientific background, volunteers were able to collect reliable data for all parameters except body length measurements of small juvenile salamanders. Preliminary data analysis of salamander abundance and a general assessment of the use of citizen scientists within the context of this study are discussed.

0485 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

AHM Ali Reza¹, Shahriar Rahman², Rupa Dutta²

¹Delta State University, Cleveland, MS, USA, ²Independent University, Dhaka, Bangladesh

Niche partitioning and population structure of an assemblage of water snakes (Homalopsidae) from Bangladesh

Colubrid subfamily Homalopsinae includes 10 genera and 34 species of medium sized, mildly venomous, aquatic snakes that inhabit in coastal habitats of South and Southeast Asia to Australia. Homalopsines are opisthoglyphous, usually associated with mud substrates, primarily nocturnal, and live at low elevations. Despite their widespread distribution, homalopsines are one of the most understudied snake groups. We studied these snakes at Sonadia Island in southeastern Bangladesh, 9 km northwest of Cox's Bazaar. We spent ~20 days between June and August 2012 in Sonadia to record data. We categorized Sonadia into 5 microhabitat types and snakes were surveyed during low tides using 2 different methods: 1) opportunistically collected from fishermen's net, and 2) visual encounter survey.

We captured 531 *Cerberus rynchops* - 244 females, 283 males. Adult sex ratio (m:f = 1.16:1) was not significantly different from equality. 36 *Fordonia leucobalia* were captured - 21 females, 14 males. Adult sex-ratio (0.67:1) was not skewed from equality and 2 sexes attained similar sizes in SVL and body mass. Among 86 *Gerarda prevostiana*, 51 adult females, 28 adult males. Adult sex-ratio (0.55: 1) was significantly skewed towards females. 258 snakes of 3 species were used for microhabitat use analyses. *Cerberus rynchops* was the most abundant and microhabitat generalist species. Two other species were more specialized and linked to mangroves. The food analysis data indicated that *Cerberus rynchops* was piscivorous, *Gerarda prevostiana* fed on soft-shelled crustaceans, and *Fordonia leucobalia* fed on hard-shelled crustaceans. A comparative study in other parts of Asia, prevails different prey species.

0291 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Justin Rheubert¹, Robert Aldridge¹, Dustin Siegel², David Sever³, Kevin Gribbins⁴

¹*Saint Louis University, St. Louis, Missouri, USA*, ²*Southeast Missouri State University, Cape Girardeau, Missouri, USA*, ³*Southeastern Louisiana University, Hammond, Louisiana, USA*, ⁴*Wittenberg University, Springfield, Ohio, USA*

Reproductive Biology of *Sceloporus consobrinus* (Phrynosomatidae): Male germ cell development and reproductive cycle comparisons within Spiny Lizards

Lizard reproductive cycles have long been studied in both field and laboratory scenarios. However, comparisons of spermatogenic cycles and germ cell development strategies in different populations across a large geographic range have yet to be explored. The purpose of this study is to (a) describe the spermatogenic cycle and germ cell development strategy of a southern population of *Sceloporus consobrinus* in southeast Louisiana, (b) compare this cycle to a more northern population of this species and (c) to compare the reproductive cycles of species within *Sceloporus* (n = 21). In *S. consobrinus* from Louisiana recrudescence begins in the fall (Oct-Nov) and the peak of spermatogenesis is reached in the following spring/summer (May, June, July). This spermatogenic cycle is similar to that of the more northern population of *S. consobrinus* from Missouri. Within the genus *Sceloporus* there are two seasonal patterns of spermatogenesis, those that initiate spermatogenesis in the summer/fall and those that initiate spermatogenesis in the spring. In both summer/fall and spring spermatogenic patterns, spermiogenesis occurs in the spring and may continue into the summer. The seasonal timing of recrudescence is an extremely plastic trait that has evolved multiple times throughout the *Sceloporus* clade. However, there appears to be an association of summer/fall and spring recrudescence with latitude. Tropical populations have a higher frequency of spring recrudescence and temperate populations have a higher frequency of summer/fall recrudescence.

0669 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Jonathan Richmond¹, Michael Westphal², Dustin Wood¹, Larry Saslaw³

¹U.S. Geological Survey, San Diego, CA, USA, ²Bureau of Land Management, Hollister, CA, USA, ³Bureau of Land Management, Bakersfield, CA, USA

When lizards, fracking, and solar panels collide: landscape genetics of the endangered blunt-nosed leopard lizard *Gambelia sila* in California's San Joaquin Valley

We studied the landscape genetics and phylogeography of the endangered blunt-nosed leopard lizard *Gambelia sila* in the San Joaquin Valley desert of California, where the species is currently restricted to less than 15% of its historic range. Habitat loss, modification and fragmentation due to agriculture and urban development represent the greatest threats to population persistence on the Valley floor, with future threats potentially arising from so-called 'green energy' efforts that include large land areas slated for solar and hydraulic fracking development. Although *G. sila* has been listed as endangered for over 40 years, the conservation status of the species is poorly understood from a genetic perspective, and the degree to which proposed green energy infrastructure would affect the population dynamics of this species remains unknown. We use mitochondrial DNA and 20 microsatellite markers to estimate gene flow within and among all core areas occupied by leopard lizards, identify regions of admixture between divergent populations, and to test for genetic signatures of population bottlenecks that coincide with known historical demographic declines. We also compare latitudinal trends in diversity to investigate whether purported hybridization with *G. wislizenii* at the southern margin of the species range acts to elevate diversity compared to populations forming the northern range margin in the central Coast Ranges.

0104 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Julia Riley¹, Steve Freedberg², Jacqueline Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada, ²St. Olaf College, Northfield, Minnesota, USA

Natural Variation in Incubation Temperatures influence Locomotor Performance of Snapping Turtle (*Chelydra serpentina*) and Painted Turtle (*Chrysemys picta marginata*) Hatchlings

Differences in fitness and phenotype generated by differences in incubation environment could provide variation in traits upon which natural selection can act. In order to determine if biologically-meaningful levels of phenotypic variation are generated in natural ecosystems, it is crucial to study the effects of natural incubation

environments on the phenotype of young. To date, studies that have documented the relationship between incubation temperature and post-hatching phenotype have predominately been conducted in the laboratory. The purpose of our study was to examine the effects of incubation temperatures in the wild on the phenotypic variation of hatchling turtles. In 2010 and 2011 in Algonquin Provincial Park, Ontario painted turtle (*Chrysemys picta marginata*, N = 45) and snapping turtle (*Chelydra serpentina*, N = 49) nests were located, and a data logger was placed in each nest to record temperature. After emergence, hatchling righting response was measured. Mean daily nest temperatures did not affect righting response, measured as latency period and righting period, in snapping turtles or painted turtles. Daily nest temperature variance did not affect latency period in either species; however, righting period was affected by daily temperature variance in both species. Overall in natural nests, mean temperature was not found to produce differences in hatchling locomotor performance, which differs from previous laboratory research. Instead, our findings indicate that in natural nests temperature variance affects motor performance in two species of freshwater turtles.

0102 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Julia Riley, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

Predation of Snapping Turtle (*Chelydra serpentina*) and Painted Turtle (*Chrysemys picta marginata*) Nests is not Restricted to Early Incubation

Previous studies have found that turtle nest depredation is concentrated immediately post-oviposition, perhaps because cues alerting predators to nest presence are most obvious during this time. In Algonquin Provincial Park, Ontario the frequency of nest depredation throughout incubation was examined in Snapping Turtles and Painted Turtles. In both species, nest depredation was not highest immediately after oviposition, but rather occurred throughout incubation. In fact, only 17.24% and 14.29% of Snapping and Painted Turtle nests, respectively, were depredated in the first week post-oviposition. A minor peak in nest depredation occurred late in incubation and may coincide with hatching. These findings have great implications for both research and conservation of turtles. Studies that examine nest predator ecology and behavior should ensure that sampling coincides with the timing of depredation risk at each study site. Additionally, in areas where protective nest caging is used as a recovery action to counteract the threat of subsidized predators, it may be important to ensure that nest protection measures remain in place throughout incubation until hatchling emergence.

0611 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Jesus Rivas, William Jaremko-Wright

New Mexico Highlands University, New Mexico, USA

Bottom-up factors affecting pregnancy rate of green anacondas (*Eunectes murinus*): trophic level interactions in a hyperseasonal tropical system

Populations of many species are often influenced by bottom-up forces depending on their food supplies, as well as top-down forces influenced by predators. While organisms at lower trophic levels may be influenced by both, top predators suffer mostly bottom-up regulation. The green anaconda (*Eunectes murinus*), a large predator occupying most of tropical South America, preys on a wide range of species from birds to reptiles and mammals. Capybara (*Hydrochaeris hydrochaeris*), white tailed deer (*Odocoileus virginianus*), and other mammalian herbivores, make up a large portion of diet of female anacondas. Anacondas are capital breeders, meaning that the energy used in reproduction is largely from the fat tissues stored in the body rather than from meals that females may consume during pregnancy. The decision to breed in a given year largely depends on the condition of the female by the time the breeding seasons arrives. Thus only females that have a minimum body condition can reproduce in a given year. We use data from females captured in the field over a 6-year period and determine pregnancy based on their condition. We explore bottom-up forces affecting percentage of pregnant females in a given year. Percentage of pregnancy is not related to precipitation in the prior year but it can be predicted by combined precipitation in the prior two years. Apparently the trophic effect of increased precipitation has a lag time of two years before it produces a bottom-up effect on anaconda pregnancy rates.

0486 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER ICHTHYOLOGY AWARD

Adela Roa-Varón, Jan R. McDowell, Eric J. Hilton

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Back from the Dead or Alive and Well All Along? The Family Lyconidae (Gadiformes)

The gadiform family Lyconidae, traditionally including the genus *Lyconus* with two species and the monotypic Lyconodes (known from a single specimen, which has been lost), was resurrected by von der Heyden and Matthee (2008) based on analysis of Cytb and COI sequence data. Their results showed conclusively that the Steindachneridae are a monophyletic group sister to Moridae, and that *Lyconus*, *Macruronus*, and *Merluccius*,

which all had been previously included in an expanded Merlucciidae, do not form a monophyletic group. Given the topology of their phylogenetic hypothesis and the sequence divergence of *Lyconus* from its sister group (*Macruronus*), these authors suggested that the family Lyconidae should be recognized. Roa-Varón and Ortí (2009) analyzed nuclear (nDNA) and mitochondrial DNA (mtDNA) sequences for the most extensive taxonomic sampling compiled to date for the order Gadiformes, representing all of the then-recognized families and subfamilies in the order – all except representatives of Lyconidae. In order to corroborate the resurrection of the family and its relationships among families of Gadiformes, we analyzed nDNA and mtDNA sequences including the two species available for the family (*Lyconus brachycolus* and *L. pinnatus*) and five additional species of *Merluccius*, for a total of 124 species. We use this study to suggest that combining a large taxonomic sampling effort, together with future next-generation sequencing efforts to increase the number of loci examined will help to further clarify the phylogenetic relationships of Gadiformes.

0548 Fish Behavior, Galisteo/Aztec, Monday 15 July 2013

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Bright Coloration in Juvenile Damselfishes Reduces Aggression from Territorial Adults

Many reef fishes are more colorful as juveniles than as adults, and one explanation is that juvenile coloration reduces the agonism juveniles receive from adults. We tested the effect of juvenile coloration and size on the territorial defensive behavior of adults of two damselfishes, *Stegastes planifrons* and *S. adustus*. We presented adults with wooden "intruder" models which differed by both color and size. We then recorded four common indicators of agonism (approaches, displays, touches and bites) exhibited by the adults. Overall *S. planifrons* territory-holders had higher levels of agonism than *S. adustus*. Juvenile coloration significantly decreased agonism from conspecific adults, but model size had no effect. The pattern of intraspecific agonism supports the hypothesis that juvenile coloration reduces agonism from conspecific adults. Juvenile coloration surprisingly did not decrease agonism from heterospecific adults, however, and actually led to an increase in agonism against *S. planifrons* from *S. adustus*. This last result might be because *S. planifrons* are more aggressive as adults, and *S. adustus* benefit from chasing juvenile *S. planifrons* from their territories before they become too large to evict. In any event, the effect of juvenile coloration on adult aggression is not necessarily transferable across species.

276 HL Detectability Symposium, Brazos, Friday 12 July 2013

Gordon Rodda¹, Bjorn Lardner²

¹USGS Fort Collins Science Center, Fort Collins, CO, USA, ²Colorado State University, Fort Collins, CO, USA

Stability of detection probabilities over 17 years at a single site

Occupancy and count-based models use detection probabilities pooled over time or space. Some methods assume that detectability is estimable from measured covariates of search conditions. We characterized detection stability and estimability from covariates over 17 years in a single site in northern Guam, a relatively benign situation. Our targets were two skink species (both day-active and terrestrial) and two gecko species (both night-active and arboreal) from 1993-2012 in *Leucaena* forest. The skinks were sampled by glueboards placed on the ground in the shade for 3 hours on rainless mornings, yielding 9765 skink captures. Geckos were more easily detected visually, as *Leucaena* has tiny (smaller than a gecko) leaflets and folds these closed at night, providing us with 15,212 sightings. These detections included nearly 10,000 that were obtained during 9475 tightly controlled searches of 224-m long transects 2005-2011. These count samples were compared to a series of censuses taken from four or more total removal plots (everything removed to mineral soil) totaling 400 m² (about 1% of study site) in each of the years 1995, 1999, and 2012, providing time-stamped quantification of detectability for each of the four species. The comparisons among methods and analysis of covariates indicated that nearly 40 parameters were demonstrably influencing detectability, but that the bulk of the variation in detectability was not among these 40. Population trajectories were masked by unexplained variation in detectability. This observation undercuts our trust in population estimation techniques that estimate detectability from covariates or rely on pooled detection probabilities.

0557 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Dawn Roje

American Museum of Natural History, New York, NY, USA

Phylogenetic placement of flatfishes (Percomorpha: Pleuronectiformes) and the phylogenetic utility of three new molecular markers

Flatfishes (order Pleuronectiformes) are a group of approximately 650 species in 14 families that, like most other marine teleosts, begin life as bilaterally symmetrical larvae. As they mature, they undergo a remarkable metamorphosis in which one eye migrates

across the dorsal margin of the cranium resulting in their defining asymmetry. The placement of Pleuronectiformes within the species-rich Percomorpha has been elusive. To test both the monophyly of flatfishes, as well as the phylogenetic placement of flatfishes within Percomorpha, a phylogenetic analysis was carried out on a molecular dataset. DNA sequences (totaling approximately 5,200 bp) from the nuclear protein-coding loci Rhodopsin 1 (Rho), ring-finger protein 213 (RNF213), trans-membrane protein 22 (TMEM22), suppressor of cytokine signaling 6 (SOCS6) and carbohydrate sulfotransferase 2 (CHST2) were generated for 140 species from 10 flatfish and 26 non-flatfish families. TMEM22, SOCS6 and B3GALT6 are all single-exon genes (SEGs) that have not been used as phylogenetic markers. To test for congruence six phylogenies (one for each marker and a concatenated, total-evidence dataset) were analyzed using maximum likelihood methods and compared using the approximately unbiased (AU) and Shimodaira-Hasegawa (SH) topology tests. The results of those tests suggest that the signal provided by Rho is incongruent with those from the other datasets. The recovered topologies suggest that Pleuronectiformes is most likely monophyletic and is most closely related to the monotypic Nematistiidae (rooster fish). The implications of this topology on the evolution of bilateral asymmetry will be discussed as well the intraordinal taxonomy and systematics.

0189 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Javier Rojo¹, Claudia Boy², Daniel Figueroa¹

¹Laboratorio de Ictiología, Departamento de Ciencias Marinas, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Mar del Plata, Buenos Aires, Argentina, ²Centro Austral de Investigaciones Científicas, CADIC-CONICET, Ushuaia, Tierra del Fuego, Argentina

Age and growth of puyen, *Galaxias maculatus*, from Parque Nacional Tierra del Fuego, austral Patagonia (54°S)

We present the first results on age-growth of a diadromous population of *Galaxias maculatus* at the southernmost limit of its distribution (Parque Nacional Tierra del Fuego, Patagonia, 54°S). Individuals were captured monthly during spring-summer (October 2003 - February 2004), which is the growing and reproductive season. Age of 169 individuals was estimated through growth layers on otoliths. Then, the von Bertalanffy growth model was fit to age-length data through non-linear methods with R language (<http://www.R-project.org/>). Maximum age was established on 3 years. During the first two months of the reproductive season (October and November) two-year individuals represented 60% of the population, whereas during the last three months (December - February) one-year individuals represented 90% of the population. At the beginning of the summer (December) it was observed the incorporation of juveniles (whitebait) returning from feeding at sea and this whitebait represents 90% of the one-year individuals. Study of length shows the growth of the one-year cohort, given that mode shifts from 60 to 65-70mm between December and February. Towards the end of

the reproductive season, there were not observed three-years individuals, suggesting natural mortality and those older individuals will not survive to the next winter. Parameters from the von Bertalanffy model were for females: $L_{inf}=89.3562 \pm 3.9656$, $k=2.5589 \pm 2.2951$, $t_0=0.4837 \pm 0.4226$; and for males: $L_{inf}=81.909 \pm 4.161$, $k=1.698 \pm 1.082$, $t_0=0.138 \pm 0.462$; suggesting that females reach a higher maximum length than males.

0088 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Stephen Ross

University of New Mexico, Albuquerque, NM, USA

Eco-Evolutionary Change and the Conundrum of Darwinian Debt

Evolutionary change has been viewed primarily as a long-term process shaped by natural selection on organisms in their environments. The recent realization that feedback between ecology and evolution can occur on ecological time scales emphasizes that ecological studies cannot assume evolutionary stasis. The cyclical interaction of ecology and evolution, eco-evolution, suggests that both directions of effect, ecology to evolution and evolution to ecology, are substantial. Much of the work on eco-evolutionary interactions has focused on natural systems where organisms with strong effects on their environment result in changes to their ecosystems that then drive further evolutionary change. However, humans also exert major effects on the environment through exploitation, dam building, climate change, etc. Reservoirs have major impacts on species and ecosystems and offer an opportunity to study rather rapid behavioral, morphological, and genetic changes in populations of fishes, often allowing a comparison between the source and reservoir populations. Blacktail and Red shiners show shifts in morphology in reservoir compared to stream environments, but the changes are generally species-specific. Studies of feeding behavior between reservoir and stream populations show that Blacktail Shiner become more surface-oriented in reservoirs whereas Red Shiner do not. In general, conservation efforts to recover populations that have changed in response to human-altered habits could be compromised because of Darwinian debt, namely that evolutionary recovery from harmful genetic changes caused by anthropogenic impacts takes longer than the time required to induce the changes, resulting in evolutionary costs for future generations.

0776 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Alex Roszkowski, Ryan Manders

University of Wisconsin Stevens Point, Stevens Point, Wisconsin, USA

The Effect of Handling and Training/Feeding on Breathing Rate of the University of Wisconsin-Stevens Point's American Alligator (*Alligator mississippiensis*)

In husbandry, it is important to ensure the well-being over the long term for that animal. Numerous factors can cause stress for an animal in captivity, which can have negative consequences for the health of that animal. We examined the breathing rate of the University of Wisconsin-Stevens Point's American Alligator (*Alligator mississippiensis*) during regular handling and training/feeding periods. The goal of this study was to determine whether handling and training/feeding potentially increased stress of this animal. Breathing rate was recorded both inside and outside the enclosure in 30 second intervals during each treatment. One treatment included handling which involved securing and lifting the alligator where he was held at an elevated position while measurements were taken. The second treatment was a training/feeding period which involved managers using a training pole to control navigation of the alligator throughout his enclosure, being rewarded with food. Lastly, the alligator's breath rate was recorded during a period of no treatment to represent control data. Average control breath rate was 18.9 ± 5.1 . Whereas handling treatment had an average of 22.6 ± 5.2 and the training/feeding had an average of 26.6 ± 5.4 . This study will allow UWSP's vivarium managers to better care for the alligator and will also encourage other captive animal facilities to monitor their animals to lower stress levels.

0530 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Sean Rovito

Museum of Vertebrate Zoology, UC Berkeley, Berkeley, CA, USA

Patterns of climatic niche divergence across a latitudinal gradient in Neotropical salamanders

Many explanations for the latitudinal gradient in species diversity focus on the influence of climate. The degree of climatic overlap between sister species has been used to test for variation in speciation mechanisms between the tropics and temperate zone. Lower intra-annual climatic variation in the tropics could lead to adaptation to narrower climatic niches, resulting in increased rates of allopatric divergence without much climatic niche divergence. Alternatively, stronger climatic gradients in the tropics could provide more opportunities for parapatric speciation, resulting in higher climatic niche

divergence between species. Previous studies showed that sister species of plethodontid salamanders have lower overlap in monthly temperature range in the tropics compared to the temperate zone, suggesting more climatic niche divergence in the tropics, while the opposite pattern was seen in other vertebrate groups. In all of these studies, species were classified as either tropical or temperate, without incorporating latitude explicitly as a predictor. I used a phylogeny based on a multilocus species tree backbone, including all species for which sequence data are available, to test for a relationship between latitude and monthly temperature overlap within Neotropical plethodontids. Using nearly 70 sister species pairs across 25 degrees of latitude, I found that latitude is positively correlated with monthly temperature overlap but explains little of the variation in temperature overlap between sister species. These results suggest that, while the degree of niche divergence between sister species may increase with decreasing latitude, this may not be the primary driver of differences in species diversity between regions.

0151 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Sara Ruane¹, Frank Burbrink², Christopher Raxworthy¹

¹American Museum of Natural History, NY, NY, USA, ²CUNY Graduate Center, NY, NY, USA

Phylogenetics of the Malagasy Pseudoxyrhopiine Radiation

Although Madagascar has a diverse endemic snake fauna, the most complete phylogeny to date for the largest Malagasy snake radiation, the Pseudoxyrhopiinae, is highly incomplete. Recent studies include < 50% (34 species) of the currently recognized taxa (85 species). Furthermore, there are likely cryptic species yet to be discovered. Here, using all available molecular data both generated by the authors and from GenBank, we infer a phylogeny for the Pseudoxyrhopiines that includes > 66% of described species in order to determine support for currently accepted genera and relationships. Results show the Pseudoxyrhopiines originated during the Late Oligocene and the placement of three non-Malagasy species (*Ditytophis vivax*, *Liophidium mayottensis*, and *Lycodryas santijohannis*) indicates there has been dispersal out of Madagascar, contrasting with the most recently published phylogeny. In addition, we find that there are several paraphyletic genera and species that consist of non-monophyletic lineages. A preliminary examination of our results also indicates that arboreality as well as fossoriality has evolved convergently multiple times. Next-generation sequencing data that includes multiple individuals and additional taxa will allow for the discovery of cryptic species, giving a better estimate of Pseudoxyrhopiine diversity, as well as providing robust inference for a species tree of this spectacular species radiation.

0723 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Samantha Rumschlag, Michelle Boone

Miami University, Oxford, OH, USA

How Time of Exposure to the Amphibian Chytrid Fungus affects Cope's Gray Treefrogs (*Hyla chrysoscelis*) in the Presence of an Insecticide

Host susceptibility to pathogens can be influenced by changes in the immune system that occur during development and by environmental factors that negatively affect immune system function. Amphibians worldwide are suffering population declines from chytridiomycosis, a fungal disease caused by *Batrachochytrium dendrobatidis* (Bd). Outbreaks may be influenced by timing of exposure to Bd and by abiotic stressors, like pesticides, that influence susceptibility. To examine the effects of larval pesticide exposure and timing of Bd exposure, we exposed Cope's gray treefrogs (*Hyla chrysoscelis*) to the insecticide malathion throughout larval development and to Bd at 1 or 3 weeks post-hatching, or following metamorphosis. We reared tadpoles through metamorphosis and then for 28 days in the terrestrial environment to examine effects on survival, time to and mass at metamorphosis, and growth following metamorphosis. We predicted that survival, time to and mass at metamorphosis, and terrestrial growth would be negatively affected by malathion and Bd exposure. We predicted that effects of Bd would be greatest when exposure occurred at metamorphosis. We found that malathion exposure resulted in an 8% decrease in mass at metamorphosis and a 6% decrease in terrestrial growth. Bd exposure at metamorphosis decreased terrestrial growth by 30%. However, we saw no interaction between Bd and malathion. Our study indicates that metamorphs are more affected by Bd exposure than larvae, but metamorph susceptibility is not increased by larval exposure to malathion. Post-metamorphic life stages are a vulnerable time of disease exposure, and sublethal effects occur that could reduce population levels.

0243 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Leslie Ruyle¹, Brian Todd², Donald Miles³, Chad Montgomery⁴, Stesha Pasachnik⁵, John Maerz⁶

¹Texas A&M University, College Station, TX, USA, ²University of California- Davis, Davis, CA, USA, ³Ohio University, Athens, OH, USA, ⁴Truman State University, Kirksville, MO, USA, ⁵Institute for Conservation Research, San Diego Zoo Global, Escondido, CA, USA, ⁶University of Georgia, Athens, GA, USA

Population Ecology of the Micro-endemic Iguana *Ctenosaura melanosterna*

Demographic data are important for population viability analyses and evaluating management needs. We present data on the life history patterns of a critically endangered, microendemic lizard, *Ctenosaura melanosterna*. We used a four-year capture-mark-recapture study to estimate individual growth rates, age structure, annual adult survival, and population growth rate. We had 747 captures of 454 individuals (129 males, 187 females, and 138 hatchlings). Adult males were longer than adult females and had a higher estimated growth rate. Females attain reproductive size in approximately two years. Males had lower estimated annual survival rate (73%) than females (94%).

Based on our demographic data, we estimated that the population growth rate was 0.91 (SE= 0.09; 95% CI= 0.76- 1.11), which would indicate that the population is declining. We discuss potential biases and future data needs to improve our population model.

0219 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD GENERAL HERPETOLOGY

Mason Ryan

University of New Mexico, Albuquerque, NM, USA

Long-term Intraspecific Population Changes of Five Leaf-litter Frogs at Low and Middle Elevations in Costa Rica

Roughly 43% of amphibian species are in decline with habitat loss, disease, and climate change being the most cited and serious threats. The monitoring of single populations and communities (i.e., one site) has been useful in understanding general patterns and putative causes of population declines, but such single-locality studies lack the scope to assess intraspecific population responses to decline threats. Heterogeneity of extrinsic (i.e. local climate) and intrinsic (i.e. local population adaptations) factors across a species range should influence local population response to environmental change and threats.

Here, we examine patterns of population change in five direct-developing leaf-litter frogs by repeating Norman Scott's 1969 survey in 2009 - 2012, at low- and mid-elevation sites in SW Costa Rica. We find that both low- and mid-elevation populations have

declined in most species, but to significantly varying degrees. The common species showed the largest variation in magnitude of decline between elevations whereas rare species show no decline, but remained rare. These population changes correspond to climate warming, divergent changes in rainfall, and associated decrease and increase in leaf litter at low- and mid-elevations respectively since the 1960s. Our results suggest that leaf-litter frogs exhibit intraspecific population differences in response to multiple environmental threats. We suggest a potential causal role of changing seasonal rainfall patterns and litter depth in explaining these long-term population declines.

0310 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Wade Ryberg, Lee Fitzgerald

Texas A&M University, College Station, TX, USA

Using landscape ecotones to identify biogeographic sets of lizards in the Mescalero Sands

Historically, local and regional scale processes have been common focal points for understanding patterns of diversity. Current research, however, highlights the importance of understanding contributions of metapopulation and metacommunity dynamics to patterns of diversity, as they provide a functional link between local and regional scale processes. Because metapopulations and metacommunities are embedded within landscape mosaics, their dynamics are thought to be sensitive to composition and spatial geometry of different habitat types across landscapes. Despite the perceived importance of such landscape contexts, few studies consider the explicit spatial relationships of different landscape features when trying to understand patterns of metacommunity structure. Here, we employ a landscape approach that uses scale-defined criteria based on the principle of geographic constraint to identify landscape features that shape species distributions and generate patterns of metacommunity structure in an assemblage of lizards in the Mescalero Sands ecosystem. We show how spatial relationships of different habitats in landscape mosaics can create landscape ecotones that define the geographic boundaries of species' populations and create distinguishable biogeographic sets of lizard species with explicit, scale-invariant spatial extents. We also document for the first time that spatially distinct biogeographic sets with unique histories of community assembly can be comprised of the same species, which has far-reaching consequences for studies using patterns of α -, β -, and γ -diversity to infer mechanisms of community assembly. Our findings support calls for community perspectives that focus on the distributions of species' populations to better understand patterns of metacommunity structure and their associated assembly mechanisms.

0305 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Wade Ryberg, Megan Young, Toby Hibbitts, Lee Fitzgerald

Texas A&M University, College Station, TX, USA

Influence of weather conditions on activity of lizards in the Monahans Sands

Animal activity varies dramatically over time. Seasonal drops or peaks in activity are often associated with biological events such as hibernation, mate searching, egg-laying, and hatching. Over shorter time scales, however, animal activity can also vary dramatically from day to day. Although weather conditions are often inferred as causes of short-term variation in activity, evidence to support such relationships is surprisingly meager. In this study, we use a large data set on the activity of 3 species of lizards to explore the relationship between weather conditions and day-to-day variation in activity. Specifically, using multiple regression we show that, 1) *Uta stansburiana* activity is positively associated with temperature, barometric pressure, and precipitation, 2) *Aspidoscelis marmorata* activity is positively associated with wind speed, and 3) *Sceloporus arenicolus* activity is positively associated with temperature. Our study confirms the existence of weather-induced, short-term variation in activity levels, but also shows that standard weather variables (temperature, humidity, precipitation) are surprisingly poor at predicting the activity of certain lizards in this ecosystem.

0755 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Mark Sabaj Pérez¹, Mariangeles Arce¹, Leandro Sousa²

¹*The Academy of Natural Sciences, Philadelphia, PA, USA*, ²*Universidade Federal do Pará, Altamira, Pará, Brazil*

An Eschatological Look at the Xingu's Big Bend: Volta Grande

The Rio Xingu is the third largest tributary to the Amazon with a catchment area approaching the size of France and largely confined to the Brazilian Shield. Xingu waters run clear as it drains a cratonic terrane long stripped of sediments. The Lower Xingu is an extensive cataract complex completed by the basin's most outstanding aquatic landmark: Volta Grande, a bell-shaped curve of the main channel over 130 km long, up to 10 km wide, and braided by numerous islands and rocky outcrops into a reticulate maze of small to large and powerful rapids. Once the Xingu departs the shield, Volta Grande's scattered distributaries abruptly coalesce into a singular channel that gradually opens into a small archipelago and long mouth bay to the Amazon. About 500 fish species inhabit the Xingu, of which 25% are endemic; 26 species are known only from the Lower Xingu rapids. Those rapids have attracted barrageiros (dam builders) intent on harnessing hydroelectricity via three dams (Pimental, Belo Monte, Bela Vista), numerous dikes, and a large canal to divert impounded water from Volta Grande. In

2013, NSF funded an aquatic inventory and ecological survey of the Lower Xingu (DEB-1257813) led by researchers at the Instituto Nacional de Pesquisas da Amazônia, Universidade Federal do Pará-Altamira, Texas A&M University, and The Academy of Natural Sciences. In 2012, we completed a successful pilot expedition to the Lower Xingu. The unique diversity of fishes and habitats sampled on that expedition will be vested in an image-rich travelogue.

0306 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Allison Sacerdote-Velat

Lincoln Park Zoo, Chicago, Illinois, USA

Use of comparative brumation and release approaches for headstarting and recovery of smooth green snakes (*Opheodrys vernalis*)

Many headstarting efforts keep reptiles active year-round to maximize growth. However, there may be post-release tradeoffs related to overwintering survival and reproduction when reptiles are kept active. Using smooth green snake recovery as a model framework, we compared efficacy of headstarting and release approaches, focusing on incorporation of brumation and soft release for achieving recovery goals. In 2011 and 2012, half of the headstarts were brumated and half were kept active. Despite decreased body condition index during winter, brumated headstarts exhibited remarkable compensatory growth such that body size and condition did not differ among active and brumated headstarts within one month post-brumation. Brumated females had greater body condition indices than active females at the time of release and exhibited evidence of earlier reproductive maturity. In winter 2012-2013, most headstarts were brumated including snakes that were previously kept active. Post-brumation body conditions among two-year olds that were previously brumated and those naïve to brumation were similar. In all years, we examined growth from hatching to release, body size and condition at release, and post-release survival to brumation in the field. Headstarts were released in 2011 using hard and soft release with no difference in survival to brumation. Releases in 2012 used only soft release with no documented mortalities prior to brumation. Only 18% of the 2011 headstarts, all brumated females, were encountered in 2012. However, Illinois experienced record drought in 2012, limiting captures of wild and headstarted snakes. Assessment of headstart survival from the 2011 and 2012 releases is ongoing.

0655 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Allison Sacerdote-Velat¹, Richard King²

¹Lincoln Park Zoo, Chicago, Illinois, USA, ²Northern Illinois University, DeKalb, Illinois, USA

An invasive plant secondary metabolite disrupts embryo development in *Xenopus laevis* and a native amphibian, *Pseudacris triseriata*.

We demonstrate direct effects of an invasive plant European buckthorn (*Rhamnus cathartica*) metabolite, emodin, on embryo development in the model organism, *Xenopus laevis* and in the native ephemeral pool breeding frog, *Pseudacris triseriata*. European buckthorn grows aggressively in amphibian breeding sites releasing emodin into soil and water. Emodin has several, often deleterious, bioactive properties in mammals and birds, but no prior assessments of effects on amphibians have been conducted. We quantified emodin in the breeding pond environment to determine concentrations in invaded sites that have experienced recent declines in amphibian diversity and abundance. We performed the FETAX protocol (Frog Embryo Teratogenesis Assay-*Xenopus*) to assess if emodin affected amphibian development in *Xenopus laevis*, and we used a modification of the assay with *Pseudacris triseriata* (referred to here as FETAP) to determine if effects were upheld in a native species occurring within the invaded range of buckthorn. Using a gradient of concentrations of emodin including those detected in the environment, the FETAX demonstrated significant embryo mortality and malformation with exposure to emodin concentrations within the range detected in the environment. The FETAP produced similar patterns of embryo mortality and malformation as observed in the FETAX. However, *P. triseriata* were more sensitive to emodin than *X. laevis*. Teratogenicity indices >2 for *X. laevis* and > 40 for *P. triseriata* indicate strong development-disrupting potential of emodin in amphibians. Such effects could contribute to amphibian declines through hatching suppression and poor larval survival and may represent an unrecognized impact of invasive plants.

0290 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Daniel Saenz¹, Taylor Hall², Matthew Kwiatkowski³

¹US Forest Service, Nacogdoches, Texas, USA, ²Angelina College, Lufkin, Texas, USA, ³Stephen F. Austin State University, Nacogdoches, Texas, USA

Differences in Occurrence of the Amphibian Chytrid Fungus, *Batrachochytrium dendrobatidis*, Between Urban and Forested Habitats

Batrachochytrium dendrobatidis (*Bd*) is a widespread pathogenic fungus that is known to cause the disease, chytridiomycosis, which can be lethal to many amphibians. It is well

documented that altitude, latitude, and season all play an important role in the occurrence and infectiousness of the pathogen on amphibian populations, with temperature being the underlying relevant factor in most cases, as cooler climates tend to increase the risk of infection to amphibians. Less is known about how specific habitat types influence the rates of occurrence of *Bd* on amphibians. We conducted a study to compare *Bd* occurrence rates on spring peepers (*Pseudacris crucifer*) in urban and forested breeding sites in eastern Texas. All of our study sites were at approximately the same latitude and altitude, and samples were collected at the same time of year to eliminate these biases. We found significant differences ($P > 0.001$) in the occurrence of *Bd* between the habitats, with dramatically lower rates of occurrence at urban sites (19.5%) compared to forested sites (62.9%). The exact reason for the observed differences in the occurrence of *Bd* is not known, however we suspect that warmer urban temperatures could play a role in our results. Our findings suggest that urban environments may provide a refugium for some amphibian species from the pathogen.

0598 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Eva Salas¹, Giacomo Bernardi², Luiz Rocha¹

¹California Academy of Sciences, San Francisco, CA, USA, ²University of California Santa Cruz, Santa Cruz, CA, USA

Biogeography of *Chromis* in the Eastern Pacific and Atlantic oceans

Chromis is a species-rich genus of reef fish, with approximately 98 species, which belongs to the family Pomacentridae, one of the most diverse reef fish families. Here we present a partial phylogeny that addresses the evolutionary history of *Chromis* species found in the Atlantic and Eastern Pacific oceans. These species were compared with *Chromis* from adjacent localities (Red Sea and Indo-Pacific). Preliminary data with mitochondrial genes COI and CytB suggest that new world species group in two separate clades. One ancestral group includes *C. cyanea*, *C. multilineata* and *C. atrilobata*. The second group diverged more recently, and includes eastern Pacific *C. alta*, and a closely related cluster of western Atlantic species. Most of the members in this second group are found in intermediate to deeper waters (>15-100m), and at least one sister pair seems to split according to depth rather than geography. The Eastern Atlantic species are more closely related to Indo-Pacific species than Western Atlantic ones, and may have originated through invasions from the Indian Ocean around South Africa.

0051 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Norma Salcedo

College of Charleston, Charleston, South Carolina, USA

Plates missing, bones teasing: external morphology, osteology, and the interrelationships of the genus *Chaetostoma* (Siluriformes: Loricariidae)

For more than 150 years the taxonomy of the genus *Chaetostoma* has remained unresolved. The goal of this work is the revision of the morphology of 16 nominal *Chaetostoma* species, including the type species, in order to clarify the taxonomy and phylogenetic position of *Chaetostoma*. In this revision I have studied external morphology and osteological characters. Among these characters, a short fourth branchiostegal is a synapomorphy of the clade that includes the type species of *Chaetostoma*. *Chaetostoma anomala* is basal to this clade. The *Chaetostoma* clade, that includes *C. anomala*, is supported by the presence of a plate between the infraorbital 6 and the suprapreopercle. An unnamed clade, sister to *Chaetostoma*, is supported by three synapomorphies: three to eight evertible cheek odontodes, five anal-fin pterygiophores, and a fleshy prominence on the anterior border of the dentary. *Chaetostoma* and the unnamed clade share one synapomorphy: narrow lateral edge of the accessory sheet of the first ceratobranchial. *Cordylancistrus*, *Dolichancistrus*, and *Lipopterichthys* are part of a clade supported by a flared anterior border of the mesethmoid. *Lipopterichthys* is basal to *Cordylancistrus* and *Dolichancistrus*. *Lipopterichthys* has a naked snout, which suggests that plates on the snout is a reversal state from the naked snout condition. This clade is basal to *Chaetostoma* and the unnamed clade. The articulation of the first branchiostegal to the posterohyal, and the lack of contact between the anterior processes of the basipterygia are synapomorphies of the *Chaetostoma*-group without including a new species. *Chaetostoma*, as currently known, is not monophyletic.

0267 Amphibian Conservation, Galisteo/Aztec, Friday 12 July 2013

Christopher Salice, Scott Weir

Texas Tech University, Lubbock, TX, USA

Risks of Pesticides to Amphibians: Are Widely Available Fish Toxicity Data Protective or Not?

There are long standing concerns that pesticides adversely affect exposed amphibian populations. Because amphibian toxicity data are not required for pesticide registration, current approaches for assessing risks of pesticides to amphibians utilize more readily available and legally mandated fish toxicity data. We sought to compare the relative sensitivity of fish and amphibians to determine whether fish toxicity data were

representative of amphibian pesticide sensitivity. We compared fish and amphibian toxicity data (LC50s) for 21 pesticides making sure to compare data from the same study design (e.g., acute 48 hr). For the 21 pesticides we evaluated, there was an average of 18.8 fish toxicity studies but only 1.7 comparable amphibian toxicity studies. On average, fish LC50s were approximately 10 times lower than amphibian LC50s. However, for 6 of the 21 chemicals we evaluated, amphibian LC50s were lower than fish LC50s by as much as 1.4 to 25 times. To determine whether we could generate a reasonably predictive model of amphibian toxicity compared to fish toxicity, we generated a linear regression with median fish LC50s as a predictor of amphibian LC50s and obtained a positive significant slope with an adjusted r-squared of 0.70. In total, this analysis provides useful insight into the use of fish toxicity data for amphibian risk assessments. While generally fish seem to be more sensitive than amphibians, there are some chemicals for which amphibians are more sensitive. More importantly, the lack of amphibian toxicity data precludes a strong conclusion regarding the suitability of fish toxicity data for amphibians.

0631 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Steven Salinas, Micah Daboub, Justin Saíz, Robert Ortega, Jesús Rivas

New Mexico Highlands University, Las Vegas, New Mexico, USA

Diet of Invasive Frogs in Northeastern New Mexico on the Mora River

Invasive species are the single worst conservation problem at the species level worldwide. Invaders can negatively affect the diversity of native species via predation or competition for resources. American Bullfrogs was introduced in Northern New Mexico since the 1940s and because the introduction was so long ago there have been no quantification on the impact bullfrogs cause on the native aquatic fauna. In this study analyzed 286 stomach contents of bullfrogs in the Mora River. Most of the stomachs contained crayfish (likely *Orconectes* sp) followed by whatever insect was abundant at the time. We found often some unidentified white slime that we believe may be from eggs masses of other amphibians or fishes. Surprisingly, we did not find any leopard frogs in the diet of bullfrogs. The fact that leopard frogs are not present in the diet of bullfrogs, yet they are locally common, suggest that there may have experienced a microevolutionary process that allows them to coexist with the invasive predator. We believe that this population may be used to restock other sites where leopard frogs have been driven extinct by bullfrogs.

**0709 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Barbara Sanchez

California State University, Northridge, Northridge, CA, USA

Impact of organic pollutants on the growth and fecundity of *Paralabrax nebulifer* (barred sand bass) from Southern California

Pollution is widespread in marine environments, where pollutants can accumulate in sediments and in the tissues of marine organisms. Many pollutants have carcinogenic and mutagenic properties. Polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and heavy metals can cause physiological stress in fishes by limiting the abilities to acquire resources for growth, reproduction, and survival. Benthic associated species are more impacted by pollutants by their direct and indirect contact with the substrate, especially in areas of high pollutant concentrations, like harbors. This study evaluated the impacts of pollutants on growth and fecundity of a recreationally important coastal marine fish in Southern California. This study was conducted at four sites: two highly polluted sites within harbors and two less polluted sites located outside of harbors. Tissue concentrations of pollutants, growth, physiological condition, and reproductive potential were compared among the sites. There was a significant difference of pollutant type and concentration among sites, with fish in harbors having the highest tissue concentrations. Measures of growth, physiological condition, and reproductive potential did not differ among sites, implying that the concentrations of pollutants in the harbors studied were not high enough to affect these variables. Organic pollutants are still present in the marine environment of Southern California, but this research indicates that the concentrations are too low to significantly impact the growth and reproductive potential of the barred sand bass population.

0400 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Jessica Sanchez, Joel Trexler

Florida International University, Miami, FL, USA

Cyanotoxin Detoxification and Effects on the Ecology and Evolution of the Sailfin Molly, *Poecilia latipinna*

Periphyton is the prominent basal resource in the Everglades and is primarily composed of cyanobacteria, which are thought to be a poor food source for consumers. Toxins produced by cyanobacteria have proven to be harmful to several fish species by inducing liver hemorrhaging. However, species that can use this food source in nature have been shown to up-regulate production of glutathione-s-transferase (GST), an

enzyme which biotransforms the toxin to a less harmful conjugate. The sailfin molly is a small herbivorous fish native to the Everglades and periphyton, composed of algae and cyanobacteria, is a primary component of their diet. Results suggest that GST activity in sailfin molly livers from the Everglades is higher, relative to sailfins from a comparison population (where cyanobacteria is not a common food source). Therefore, GST up-regulation may be adaptive in response to the cyanotoxins in Everglades periphyton mats. Further, I hypothesize that there exist geographic differences between Everglades mollies and those who inhabit areas with other basal resources (i.e. populations found in spring or estuarine habitats where algal resources include greater frequency of green algal species). This information could be used to evaluate the costs of GST activity on life history characteristics (i.e. growth, reproduction, etc.), to assess the potential for local adaptation, and to ultimately evaluate the evolution of herbivory in poeciliid fishes.

0518 Fish Conservation, San Miguel, Sunday 14 July 2013

Sonia E. Sánchez-Banda¹, Fredys F. Segura-Guevara², Charles. W. Olaya-Nieto²

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Evaluation of the Growth Basic Parameters of Blanquillo (*Sorubim cuspicaudus*) for Several Annual Cycles in the Sinu River, Colombia

In order to evaluate the growth basic parameters of Blanquillo (*Sorubim cuspicaudus*) for several annual cycles in the Sinu River, before, during and after the implementation of the Urra Hydroelectric, 7951 specimens were collected between March 1998 and December 2006. The sizes ranged between 18.3 and 94.2 cm in total length (TL) and the total weight (TW) between 34.0 and 4720.0 gram (g). The length-weight relationship and the condition factor for both sexes were estimated with the equation $TW = a TL^b$ and $CF = TW/TL^b$, respectively. The equation estimate was: $TW = 0.001 (\pm 0.03) TL^{3.32 (\pm 0.02)}$, $r = 0.97$, $n = 7951$. The growth coefficient ranged from 2.97 (1999 year) and 3.49 (2006 year), with significant statistical differences, and the condition factor ranged from 0.005 (1999 year) and 0.001 (2001, 2002, 2003 and 2006 years), with significant statistical differences too; indicating that the welfare state of the species has been declining since the filling of reservoir (year 1999) and after the implementation of the Urra Hydroelectric (2000 year) so it is inferred that the growth in length and weight of blanquillo has not adapted to the new hydrological conditions of the Sinu River.

**0440 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday
13 July 2013**

Millicent Sanciangco¹, Ricardo Betancur-R.², Kent Carpenter¹

¹*Department of Biological Sciences, Old Dominion University, Norfolk, VA, USA,*

²*Department of Biological Sciences, The George Washington University, Washington, DC, USA*

ETOL: up in the percomorph tree

The order Perciformes (*sensu* Nelson) is the largest order of vertebrates with 10,033 species in 160 families and 20 suborders, with Percoidei as the most species-rich suborder, comprising 3,176 species in 79 families of unknown integrity. Previous studies have established the limits and relations of some families within the perciforms and percoids using morphological and molecular data, but have not been successful in defining the monophyly of the order and subtending suborders or in determining broad interfamilial relationships within the group. One of the most important contributions of the broader Euteleost Tree of Life Project (EToL) was the disambiguation of the percomorph "bush at the top" into nine well-supported (new) supraordinal groups, which also allowed a monophyletic definition of Perciformes. Some 49 families traditionally placed in Perciformes were, however, not examined by the EToL. Here, we provide evidence for the phylogenetic affinities of 11 of those 49 families, four of which have remained enigmatic. We included 21 genes previously used to infer a global phylogeny of fishes and added two additional fast-evolving mitochondrial genes to account for rapid percomorph radiations. We restricted the taxonomic sampling to 1037 percomorph species, including expanded sampling for many of the families currently classified as *incertae sedis*. Preliminary analyses suggest that false trevallies (Lactariidae) are close to flatfishes, jacks, and allies (Carangimorphariae), while galjoen fishes (Dichistiidae), banjofishes (Banjosidae), and picarel porgies (Centracanthidae) are placed within the "new bush at the top" (Percomorpharia). None of the newly examined families belong in the order Perciformes (*sensu* EToL).

0407 Reptile Ecology, Mesilla, Monday 15 July 2013

Shawna L. Sanders¹, Matthew G. Keevil¹, Ronald J. Brooks², Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada, ²University of Guelph, Guelph, Ontario, Canada

The Effects of Habitat Productivity and Population Density on Juvenile Growth Rates of Painted Turtles, *Chrysemys picta*

In long-lived organisms, juvenile life stages are often sensitive to density dependence. Previous studies have revealed that turtle abundance and growth rates can be positively related to primary productivity of the habitat. However, intraspecific competition at higher densities may depress juvenile growth. We hypothesized that if productivity has a greater influence on juvenile growth rates, then growth rates would be correlated with productivity regardless of density. However, if density has a significant effect on growth, then growth rates will be depressed at high densities despite higher productivities. Open water nitrogen, phosphorous and euphotic depth were measured at five water bodies in Algonquin Provincial Park, Ontario, Canada, in order to determine the relationship between habitat productivity on population densities and juvenile growth rates of Painted Turtles (*Chrysemys picta*). Abundance estimates were obtained using mark-recapture analysis and growth rates were estimated by measuring the spacing of carapacial growth rings. Our results show that in our study populations, density and productivity were correlated. Although nitrogen had no effect on density, greater phosphorous levels were found at sites with high turtle densities. Secchi disk readings revealed that wetlands with thin, but dense, layers of primary producing organisms at their surfaces may support higher turtle densities. Density appeared to have limited effects on juvenile growth rate except at extremely high densities, at which growth rates were lower. This coincided with the highest estimated productivity and suggests that density dependent effects can override the positive effect of habitat productivity on growth in natural populations.

0790 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Julia Sandoval, Vicente Mata-Silva, Jerry Johnson

University of Texas at El Paso, El Paso, TX, USA

Thermal Ecology of *Urosaurus ornatus* in the Northern Chihuahuan Desert

The main goal of this ongoing study is to determine the thermal ecology of the tree lizard *Urosaurus ornatus* in a Chihuahuan Desert landscape. Our study site is located at Indio Mountains Research Station (IMRS), Hudspeth County, Texas. We obtained body

temperature (T_b) data on 111 lizards collected from April 2007 to October 2012 during the active period using a cloacal thermometer. Additionally, we recorded air temperature (T_a) and substrate temperature (T_s) of lizard microhabitats. Our preliminary results showed that the mean T_b for all lizards was 33.73°C, with a range of 24.00-38.50°C. This average T_b was lower than those found in other populations in Southwestern United States. There was no statistical difference between the average T_b for males and females, between gravid females and non-gravid females, or between lizards found in the sun and lizards found in the shade. Our results also indicated a positive correlation between T_b and T_s and T_b and T_a. However, the highest correlation was between T_b and T_s, suggesting that *U. ornatus* at IMRS displays a thigmothermic behavior.

0209 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Vivianne Sant'Anna¹, Bruce Collette², Nathan Lovejoy³, Roberto Reis¹

¹PUCRS, Porto Alegre, RS, Brazil, ²NOAA, Washington, DC, USA, ³UTSC, Toronto, ON, Canada

A new classification of Beloniformes based on a total evidence analyses

Beloniformes is a diverse group that includes ricefishes, halfbeaks, needlefishes, sauries and flyingfishes. Molecular phylogenies suggest that some morphologically defined beloniform families are not monophyletic, including the Belonidae and Hemiramphidae. In the present study, we performed a total evidence analysis based on 100 morphological characters and 2424 base pairs from two mitochondrial genes (cytochrome *b* and 16s) and two nuclear genes (RAG2 and TMO-4C4), including 46 terminal taxa representing all traditional families and two fossil species from the Oligocene, †*Cobitopsis acutus* from Puy de Dôme, France and †*Belone harmati* from Eger, Hungary. We used the cyprinodont *Fundulopanchax gardneri* to root the trees. The analysis yielded six most parsimonious trees with 3279 steps. We suggest a new classification and the recognition of seven families. Ricefishes (Adrianichthyidae) are the basal members and sister group of the remaining Beloniformes. Sauries (Scomberesocidae) are nested within the Belonidae and should be recognized as a junior synonym. The internally fertilizing halfbeaks (Zenarchopteridae) are the sister group of the Belonidae and form the new superfamily Belonoidea. The other halfbeaks and the flyingfishes are included in the superfamily Exocoetoidea. †*Belone harmati* is closely related to †*Cobitopsis acutus*, both basal members of Exocoetoidea. Halfbeaks are divided into three families: Cobitopsidae (fossil species), Hyporhamphidae (*Hyporhamphus*, *Melapedalion*, *Arrhamphus* and *Chriodorus*) and Hemiramphidae (*Hemiramphus*, *Oxyporhamphus* and *Euleptorhamphus*). Flyingfishes (Exocoetidae) remain a monophyletic group and are the sister-group of Hemiramphidae *sensu stricto*. *Rhynchorhamphus* is left as *incertae sedis* in Exocoetoidea, until new molecular data can be included in the analysis.

0395 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Julio Cesar Santana¹, Daniela Calcagnotto², Irani Quagio-Grassiotto³

¹*Pós-Graduação em Biologia Celular e Estrutural, Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil,* ²*Departamento de Genética e Biologia Evolutiva, Instituto de Biociências, Universidade de São Paulo (USP), São Paulo, SP, Brazil,* ³*Departamento de Morfologia, Instituto de Biociências, Universidade Estadual Paulista (UNESP), Botucatu, SP, Brazil*

Sperm characteristics indicate the existence of two different lineages within pencilfish genus *Nannostomus* (Characiformes: Lebiasinidae)

Nannostomus is composed of 18 species distributed in South America drainages mainly in Amazon basin. Although those are very known species for ichthyologists, there is currently no phylogenetic definition for the genus. Evidence for a close relationship among fish species is provided by a variety of sources including reproductive characters. Herein is described the spermiogenesis process and sperm ultrastructure with the purpose to test if there is evidence in this character complex to support a hypothesis of a close relationship among some *Nannostomus* species. In this study two sperm morphotypes were observed based on variations of spermiogenesis: Group A: *N. beckfordi*, *N. eques*, *N. nitidus* and *N. unifasciatus*; and Group B: *N. digrammus*, *N. marginatus* and *N. trifasciatus*. The Group A spermiogenesis differs from Group B by the lateral spherical nucleus relative to the flagellum in earliest spermatids *versus* medial spherical nucleus, the anterior, lateral and slightly oblique proximal centriole relative to the distal centriole *versus* anterior and slightly oblique proximal centriole relative to the distal centriole. The Group A sperm differ from Group B by lateral spherical nucleus relative to the flagellum *versus* medial spherical nucleus, presence of the cytoplasmic canal *versus* absence (except in *N. trifasciatus*). All species have a short midpiece containing the elongate mitochondria and a few vesicles. Spermiogenesis so far has been considered a very conservative process within a monophyletic fish genus. The spermiatic data presented strongly suggest the existence of at least two different lineages within *Nannostomus*.

0159 Amphibian Conservation, Galisteo/Aztec, Friday 12 July 2013

Louis A. Santiago¹, Jennifer L. Stabile², Patricia A. Burrowes¹, Rafael L. Joglar¹

¹University of Puerto Rico, Río Piedras Campus, San Juan, Puerto Rico, USA,

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Several Aspects of the Biology of the Mona Island Coqui (*Eleutherodactylus monensis*)

Eleutherodactylus monensis is endemic to Mona Island and of the 17 species of Puerto Rican frogs of the genus *Eleutherodactylus* is the least studied. During March, April and September 2011 we studied several aspects of the biology of *E. monensis* in several localities of Mona Island. Tissue samples were taken from some individuals in order to study the presence of the chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*). Population densities were estimated in three different habitats: (1) bromeliads, (2) caves, and (3) a well. During our study we were able to discover the first egg clutch known for this species. The clutch contained nine eggs (mean = 4.62 mm in diameter; 4.0-5.2; n = 9) and was found on a *Cocos nucifera* palm frond buried at approximately 28 cm deep within a pile of accumulated vegetation and debris that was 0.5 m high. *E. monensis* is more active during the wet season than in the dry season, with 146 and 11 frogs respectively for an area of 50 m². Results from qPCR revealed 83 % of *Bd* prevalence with a minimum intensity of infection. An ex situ captive breeding program for *Eleutherodactylus monensis* was started in order to (1) establish a captive assurance population; and (2) learn about its reproductive biology. The reproductive study included 5 males and 5 females collected from Mona Island in May of 2012. Two pairs from this founder group produced a total of 4 fertile clutches including a double clutch.

0761 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Enrique Santoyo-Brito¹, Herman Núñez², Stanley Fox¹

¹Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, USA,

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Ecology and Parental Care in *Liolaemus leopardinus* at High Elevations in the Andes of Chile

Liolaemus leopardinus is long-lived, viviparous and colonial on exposed rock outcroppings at high elevations in the Andes of central Chile. During two field seasons (2012 and 2013), we made 906 sightings of 145 marked subjects and plotted locations on a map of our site. We tracked 22 adults fixed with radio transmitters. Late in the season, adults and juveniles grouped together and faithfully occupied rocky chambers up to 3 m

deep, usually above ground level. Probably this is where the lizards overwinter. In 2012, we caught 39 adult females and 33% were pregnant. We found no neonates, although previous laboratory studies indicate that births occur in March and litter size is only 3-4. In 2013, we caught 21 adult females and 61% were pregnant. Of females pregnant in one or both years that were recorded in both years, 60% were pregnant in both years. In 2013 we found three natal chambers in the field and using a borescope observed and videotaped mothers giving birth inside. The mother stayed inside with the neonates up to 24 hours, probably protecting them. In one case the female bit the borescope, a behavior never seen in other contexts. After 24 hours, when the mother left the natal chamber she closed the entrances with soil, sealing neonates inside. Neonates of one chamber stayed inside for five days. After occupying the chambers for 2-5 days, neonates dug out and left the chambers. It is unknown if the neonates overwinter with the older juveniles and adults.

0661 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Alan Savitzky¹, Shabnam Mohammadi¹, Dylan Bills¹, Dwight Springthorpe²

¹Utah State University, Logan, Utah, USA, ²University of California, Berkeley, California, USA

A Miniature Transmitter for Recording Cardiac Function in Reptiles

For a study of the physiological effects of prey toxins on toad-eating snakes, our work required an electrocardiography (ECG) system to record the cardiac response of snakes before and after ingestion of both toxic and nontoxic prey. Pilot studies conducted with a hardwired ECG system revealed several limitations associated with transmission of the ECG signal from the electrode leads to an amplifier and computer located outside the experimental chamber. To circumvent these limitations, one of us (DS) designed and fabricated a miniaturized ECG transmitter that can be attached to the back of the subject and transmits the ECG signal to a base station connected to the USB port of a laptop computer. Subcutaneous electrodes carry the ECG signal to the backpack, which also includes a sensor for air temperature and an accelerometer, so heart activity can be correlated with temperature and movement. All signal processing is performed by the backpack's electronic components before transmission to the base station. A MATLAB script displays the ECG, temperature, and movement and writes the data to an Excel file. The transmitter weighs less than 2 g, before encapsulation in epoxy. It is powered by a battery weighing less than 1.5 g that can be recharged through the USB base station. This ECG telemetry system has several advantages over a hard-wired system, allowing unrestrained movement of the subject, the ability to record from a closed respirometry chamber, and easy portability for international and field applications.

0225 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Lindsay Scarpitta, W. Cal Borden, Terry Grande

Loyola University Chicago, Chicago, Illinois, USA

EToL: Molecular Systematics of Zeiformes: New Hypotheses About an Old Group

The Zeiformes (e.g., dories, armoreye dories, lookdown dories, smooth dories, tinselishes, and oreos) are Recent derivatives of ancestors at least as old as the early Late Cretaceous (95 mya). Ranging in size from 0.5 to 95 cm, they are deepwater fishes (reported to 1000 m) that are globally distributed in marine waters, although some lineages demonstrate localized endemism (i.e., New Zealand). Some 32 nominal species are spread across 16 genera in 6 families as determined in large part by the only comprehensive phylogenetic analysis to date by Tyler and colleagues. That study and a subsequent analysis that incorporated three fossils relied on phylogenetic inferences drawn from osteology. However, these studies assumed a tetradontiform-zeiform sister-group relationship. Recent studies suggest instead that zeiforms are more closely related to gadiforms and fall within the group Paracanthopterygii. Here, we present the first zeiform phylogenetic analysis, based on mitochondrial and nuclear genes, within the context of their revised phylogenetic position as paracanthopterygians. The new phylogeny, using an extensive taxon sampling, provides a novel perspective on zeiform evolution. For example, the basal zeiform clade is not the Cyttidae, and *Parazen* is not closely related to the other "Parazenidae," the latter conclusion in agreement with Tyler and Santini. A review of osteological and myological characters finds support for many of the novel relationships.

0032 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Jake Schaefer¹, David Duvernell², Brian Kreiser¹

¹*The University of Southern Mississippi, Hattiesburg, MS, USA*, ²*Southern Illinois University Edwardsville, Edwardsville, IL, USA*

Variation in contact zone dynamics between two species of topminnows, *Fundulus notatus* and *F. olivaceus*, across isolated drainage systems

Spatially variable selection pressure within heterogeneous environments can result in the evolution of specialist phenotypes that facilitate co-occurrence of closely related species. If divergent selection pressures maintain reproductive isolation, hybridization rates are expected to correlate with the strength of underlying ecological gradients. Anthropogenic disturbances that weaken these gradients may then increase rates of hybridization. We sampled ten replicate topminnow (*Fundulus olivaceus* and *F. notatus*)

hybrid zones in isolated drainages throughout central and southern North America. In all drainages, species were distributed in an upstream-downstream manner with contact zones localized at confluences featuring abrupt shifts from tributary to river habitat. Phenotype differences between the species reflect predicted selection differences along stream gradients. Downstream populations (lower food availability and greater predator pressure) generally showed larger investment in reproduction (higher gonadal somatic index), smaller body size and lower somatic condition compared to upstream populations. Phenotypes of individuals of hybrid origin (F1 hybrids or backcrosses) were not significantly different from the average of the two parental forms, though there were trends towards reduced fitness. The prevalence of hybridization among drainages ranged from no hybrids in two drainages to near random mating. The strongest correlates of hybridization rate among replicate hybrid zones were similarity in body shape and the homogeneity of habitat through tributary-river confluences.

0283 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Christopher Schalk, Carmen Montaña

Texas A&M University, College Station, TX, USA

Community Assembly of Anurans in the Gran Chaco: A Morphological Approach

Using patterns from morphology, we can make inferences whether the processes of limiting similarity or environmental filtering driving community assembly. Morphological traits define the niche hypervolume, allowing one to infer on species relationships within and between communities. We examined patterns of anuran morphological diversity in relation to species richness and habitat within the Bolivian Gran Chaco, a semiarid thorn forest. We examined 13 morphological traits of 39 frog species and compared community structure among 12 sites using multivariate analysis, linear regression analysis, and Euclidean distance techniques to assess relative support for species packing vs. niche expansion as mechanisms organizing anuran communities. Principal components analysis revealed a gradient of species, from shorter legs and smaller heads to larger legs and larger heads, corresponding with an ecological gradient of increasing aquatic habitat preferences. Average nearest neighbor distance (NND) of local morphological distances decreased with increasing species, indicating increased species packing at higher species richness. Standard deviation of NND showed a nonsignificant but positive increase in relation to species richness indicating high morphological similarity with increasing species richness. Mean values of distance to centroid were high indicating an increase in the community morphological space. Results from this study suggest that when more species are added to local assemblages, assemblage morphospace increases, species become more similar on average, and species dispersion in morphological space increases. These trends were similar across

habitats suggesting that environmental filtering rather than interspecific interactions are the main drivers of these anuran assemblages in the Bolivian Gran Chaco.

0284 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Christopher Schalk, Carmen Montaña, Lee Fitzgerald, Kirk Winemiller

Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX, USA

Trophic plasticity of tropical tadpoles along environmental gradients

Anuran larvae previously thought to be detritivores or herbivores have been shown to be omnivorous, and also display dietary and trophic plasticity. Such studies have primarily been conducted in temperate zones with species that possess little ecomorphological diversity. Tadpoles in the Neotropics have high ecomorphological diversity yet their trophic status is not well understood. We used stable isotopes to examine the trophic positions of 11 tadpole species representing 5 ecomorphological guilds from the Gran Chaco of Bolivia. We collected individuals from ponds that varied in their hydroperiod and at the beginning and end of the rainy season. On average, most species and ecomorphs were omnivorous. However, there was substantial variation within individual species both spatially and temporally, with some species ranging from primary consumers to secondary carnivores. Specific-specific changes in trophic position varied across pond type, but there was a general trend for species in the late rainy season to possess a higher trophic level. The sources supporting these taxa varied across time and space and could provide some explanation as to the variation in trophic position. A species' trophic position appears to be strongly influenced by environmental gradients which need to be accounted for if we wish to understand their function within aquatic ecosystems. Understanding that tadpole species are trophically plastic in relation to the environment can help us better predict how they might affect the structure and function of food webs.

0558 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Hans-Peter Schultze, Gloria Arratia

Biodiversity Institute and Department of Systematics and Ecology, University of Kansas, Lawrence, KS, USA

Bony Fishes, their Morphology and Complex Evolutionary History: State of the Art

Extant bony fishes comprise two main lineages, Actinopterygii and Sarcopterygii. With about 30,000 species of teleosts, actinopterygians are by far the most dominant group of vertebrates today. Sarcopterygians are successful throughout several tetrapod lineages, and notably one powerful and dominant species, *Homo sapiens*. While today piscine sarcopterygians are represented by two coelacanth and six dipnoan species, their major diversification was in the past. During the Paleozoic, sarcopterygians reached their highest morphological rate of diversity. Thus, understanding the morphology of extant coelacanths and dipnoans requires investigating morphological patterns found in their fossils. Due to their phylogenetic importance in the origin of tetrapods, piscine sarcopterygians have been the subject of major investigations starting in the 19th century. The influence of the famous Swedish School and its followers have been fundamental to this development. In contrast to extant piscine sarcopterygians, extant actinopterygians are represented by four groups, Polypteriformes, Chondrostei, Holostei, and the immense Teleostei. With the exception of polypteriforms, all others have a rich fossil record that, when included in phylogenetic studies, have produced conflicting hypotheses of phylogenetic relationships. Part of this disagreement emanates from different interpretations of homologous features or, far worse, disregard of the concept of homology. As a consequence of the immense actinopterygian taxonomic and morphological diversity and difficulties interpreting homologous features, phylogenetic studies have been biased in the selection of taxa, so that a common phylogenetic hypothesis including fossil and extant actinopterygians from palaeonisciforms to advanced teleosts is still missing.

**0019 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Michael R. Schwemm

Department of Zoology, Oklahoma State University, Stillwater, OK, USA

**Evolution of the Upland Fish Fauna of Southern Oklahoma: Insights from a
Phylogeographic Study of *Notropis suttkusi***

The genetic structure and historical demography of Rocky Shiner (*Notropis suttkusi*) are used to evaluate the hypothesis that the unusually high aquatic biodiversity of Blue River, a tributary of the Red River in southern Oklahoma, is explained by environmental stability relative to other streams of the region. Blue River harbors an unusual combination of upland fishes: two species endemic to the river, one species that is endemic to Blue River and other south-flowing tributaries of the Red River in Oklahoma and Arkansas, and four species that represent disjunct populations of Ozark species.

Cytochrome b sequences and analysis of eight microsatellite loci suggest that divergence among populations of Rocky Shiner is post-Pleistocene. Molecular-based analyses of historical demography indicate that the Blue River population has been stable through time, whereas other populations of the species show evidence of a late Pleistocene expansion and a Holocene decline in effective population sizes. Population stability in Blue River likely reflects the fact that the river is the largest springfed environment in southern Oklahoma. Populations in Blue River would have been buffered against climatic oscillations of the Quaternary and this likely explains the unusually high degree of biodiversity in the river. It is postulated that the two species endemic to Blue River are relicts of Mayden's Pre-Glacial Ouachita River, and that environmental stability has allowed them to persist in Blue River.

0214 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Ryan Seddon, Matthew Klukowski

Middle Tennessee State University, Murfreesboro, TN, USA

**Secondary Sexual Coloration is Related to White Blood Cell Counts and
Testosterone in Male Southeastern Five-lined Skinks (*Plestiodon
inexpectatus*).**

The immunocompetence handicap hypothesis posits that secondary sexual coloration can serve as an honest measure of male quality because elevated testosterone, which is necessary for the expression of the sexual coloration, also handicaps males through immunosuppression. Thus only high quality males can express the showiest coloration in spite of immunosuppression. Here we report a preliminary test of the

immunocompetence handicap hypothesis in male southeastern five-lined skinks, *Plestiodon inexpectatus*, which exhibit a reddish-orange head coloration during the breeding season. We tested whether head coloration in male skinks is related to circulating testosterone concentrations and reflects the status of a male's immune system, as measured by total leukocyte counts. Head coloration was scored both by independent observers who categorized digital images of skink heads as dull, moderate, or high reddish-orange and by quantifying the hue, saturation, brightness, and extent of head coloration through image analysis software. As predicted, male skinks judged to have reddish-orange heads had higher plasma testosterone concentrations than dull colored males. Hue, saturation, and extent of head coloration were correlated with plasma testosterone concentrations. Head coloration was also predictive of total circulating leukocyte numbers as males judged to have dull colored heads had higher leukocyte counts than males with the most reddish-orange heads, and head brightness was negatively related to total circulating leukocytes. While our preliminary results are consistent with the immunocompetence handicap hypothesis, additional studies that include experimental manipulations of testosterone levels and measure other aspects of immunity are warranted.

0141 Fish Systematics & Biogeography, Doña Ana/Cimarron, Sunday 14 July 2013

Greg Seegert

EA Engineering, Deerfield, IL, USA

Revisiting the Wabash River Fish Community 20 years after a Power Plant's Retirement

In the 70s and 80s, the fish community on the Wabash River near the Breed Power Plant was studied on a regular basis. The current study was designed to see how that community has changed since the plant shut down about 20 years ago. The Wabash supports the most diverse fish community in the Midwest with 100 species known from the 15 mi study reach alone. Electrofishing and seining were conducted monthly from July through October in 2011 and 2012 at 5 locations near the former plant site. With a year yet to go, a total of 77 species have been collected including 13 species not collected previously. *Notropis photogenis* was collected in 2011, the first record ever of this species from Illinois. The electrofishing results appear to show similar or somewhat improved community structure compared to the 70s and 80s, whereas the seining results suggest the opposite pattern. I attribute this apparent discrepancy to differences in the species typically collected by these two gears. The seining results showed depressed darter richness in 2011 and both lower numbers and diversity of darters in 2012. *Percina phoxocephala*, which was the dominant darter in the 70s and 80s, was rare during the current study.

0526 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Fredys F. Segura-Guevara¹, Glenys Tordecilla-Petro², Charles W. Olaya-Nieto¹

¹Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas, Universidad de Córdoba, Lórica, Córdoba, Colombia, ²Institución Educativa Román Chica Olaya, Alcaldía Municipal de Lórica, Córdoba, Colombia

Reproductive biology of Blanquillo (*Sorubim cuspicaudus*) in the Sinu River seven years after filling of Urra Dams, Colombia

Reproductive biology of Blanquillo in the Sinu River seven years after filling of Urrá Dams, Colombia, was studied. Individuals with total length (TL) ranged between 25.2 and 81.0 cm and total weight (TW) ranged between 72.0 and 3360.0 g were collected. The gonads were placed in Gilson solution, the Vazzoler scale was applied and sexual proportion, maturity index, spawning season, length at first maturity, oocyte diameter and fecundity were estimated. 184 females and 125 males were encountered, with sexual proportion female: male 1.5:1, different than expected. Length at first maturity was estimated in 62.8, 49.7 y 51.8 cm TL for females, males and both sexes, respectively. Oocyte diameter was 887 μm . Direct correlation between the condition factor, levels of the Sinu River and the spawning season of the species was not found, but it was observed that the curve representing the spawning season resembles that of partial spawning fish, which is a physiological change that may be related to the constant rise and fall of the river level downstream caused by handling the reservoir for electricity production.

0020 Plenary, Brazos, Thursday 11 July 2013

David Sever

Southeastern Louisiana University, Hammond, Louisiana, USA

HistoHerpetologist

Receiving the Distinguished Herpetologist award from the Herpetologists' League is especially gratifying to me. I joined HL at the age of 15 in 1963 (and also ASIH and the Ohio Herpetological Society). Thus, this my 50th year of membership in the three societies. Herpetologica, however, has always been my favorite herp journal, in part because my first paper was published in 1972 in Herpetologica, and I was good friends with long-time editor Bob Jaeger. I have published 23 papers in Herpetologica or Herpetological Monographs, making them my most frequent outlets after Journal of Morphology (with 33 papers). Also, it is welcome recognition that many of herpetologists are not at research institutions where the focus is on publishing, getting grants and training Ph.D. students. I spent the first 30 years of my career at Saint Mary's College, Notre Dame, Indiana, a small comprehensive college (1500 total students) that

grants only Bachelor's degrees, and since 2004 I have been at Southeastern Louisiana University, at which the Masters is the terminal degree. Still, I have had a productive career, with 100 publications and three NSF grants at Saint Mary's, and an additional 40+ publications and NSF funding at Southeastern. I carved out my own unique niche in comparative histology and ultrastructure of reproduction in amphibians and reptiles. My message: if you love your research, you will find time and funding to do it, and you will find undergraduate students who will be eager to participate.

0690 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

H. Bradley Shaffer¹, John Abramyan², Patrick Minx³, Robert Thomson⁴

¹UCLA, Los Angeles, CA, USA, ²UBC, Vancouver, BC, Canada, ³Washington University, St. Louis, MO, USA, ⁴University of Hawaii, Honolulu, HI, USA

The First Turtle Genome

2013 marked the publication of the first turtle genome, the painted turtle *Chrysemys picta bellii*. Here, we focus on the genome-enabled inferences of 1) the phylogenetic position of turtles, 2) their overall evolutionary rate of nucleotide substitutions, and 3) the evolution of turtle and amniote tooth loss. Our analysis of 1955 rigorously screened gene orthologs for eight vertebrate species (human, platypus, chicken, zebrafish, anole, turtle, python, alligator), analyzed separately or as a concatenated dataset, place turtles as the sister group to Archosauria with strong support. Based on a subset of 309 orthologs with minimal missing data, we estimated that turtles have the slowest rate of nucleotide substitution among the eight amniote lineages analyzed, perhaps reflecting their long generation times. Finally, previous studies in birds and edentulous whales demonstrated that tooth loss is closely associated with the pseudogenization and subsequent degradation of five tooth-specific genes: enamelin (*ENAM*), amelogenin (*AMEL*), ameloblastin (*AMBN*), dentin sialophosphoprotein (*DSPP*), and enamelysin (*MMP20*). We screened the turtle genome, identified the majority of these genes in their chromosomally syntenic regions, and identified stop codons and highly degenerated sequences in a pattern consistent with a single origin of amniote teeth followed by independent loss in all three lineages. We close by noting that three additional turtle genomes (Chinese softshell, green sea turtle, Galapagos tortoise) are currently being released, and many opportunities for comparative analyses across turtles and amniotes are now possible. What better time to become a genome-enabled cheloniophile?

0172 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Ashley Shaw¹, Bryan Frazier², Gorka Sancho¹

¹College of Charleston, South Carolina, USA, ²South Carolina Department of Natural Resources, South Carolina, USA

Trophic Ecology of an Estuarine Predatory Fish Community in South Carolina Assessed by Stable Isotope Analysis

Estuaries serve as habitats and nurseries for many recreationally and commercially important fish species. Understanding the diet and trophic relationship dynamics of the fish populations within the estuarine community is essential to effectively managing these species. Upper-level predatory fish are among the most sought-after fisheries species, and studying the dietary niche overlap of this community can infer the probability of competition and niche partitioning within this highly productive ecosystem. In attempt to establish these trophic relationships, dietary niche overlap of the predator community in the Cape Romain National Wildlife Refuge (specifically Bulls Bay and its surrounding tidal creeks) were assessed using stable isotope analysis ($d^{13}C$ and $d^{15}N$) on 7 elasmobranch and 3 teleost species. Fish, collected via trammel nets, gillnets and longlines in the channels and along the banks of the estuary with cooperation of SCDNR, were measured, muscle biopsied from the dorsal musculature, and then released. Quantitative metrics indicate that these predators occupy different trophic levels and use different carbon sources. Dietary niche overlap shows that some elasmobranchs have unique isotopic niche spaces indicating potential resource partitioning, while several species of teleosts and sharks had varying degrees of overlap that implies shared resources. Bayesian stable isotope mixing models revealed information about the contribution of distinct carbon sources in each predators diet.

Results may have implications for ecosystem-based management of the Cape Romain estuarine system that can be applicable to other estuaries.

0397 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, AES CARRIER AWARD

Ashley Shaw¹, Gorka Sancho¹, Julie A. Neer²

¹College of Charleston, Charleston, SC, USA, ²SEDAR, North Charleston, SC, USA

Stable isotope analysis reveals resource partitioning in the cownose ray, *Rhinoptera bonasus*

Cownose rays are considered a mesopredator, and feed mainly on invertebrates, such as molluscs. Stable isotope analysis of a predatory community in a South Carolina estuary

reveals a distinct diet from teleost and other elasmobranch predators, with no overlap in dietary niche. This data not only supports diet studies previously conducted on cownose rays, this unique dietary niche in isotopic space shows that these rays exhibit resource partitioning in this estuarine habitat. In addition, the small ranges of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values indicate diet specialization in the sampled population.

0566 HL Detectability Symposium, Brazos, Friday 12 July 2013

Colin Shea¹, Mary Freeman²

¹Tennessee Technological University, Cookeville, TN, USA, ²USGS Patuxent Wildlife Research Center, Athens, GA, USA

Dealing with incomplete detection and misidentification to aid conservation of imperiled freshwater fishes and mussels in the southeastern United States

Ecological data are frequently subject to biases associated with incomplete detection and misidentification of species during sampling. Because of these biases, rare and cryptic species pose particular challenges for even estimating number of extant populations, let alone population trajectories or causes of decline. Modeling approaches that account for incomplete detection, and in some cases misidentification, provide considerable promise in allowing for less biased estimates of current distribution and, potentially in occupancy dynamics, in response to environmental drivers. Our objective is to discuss recent applications of occupancy models to estimate current and historical distributions for several imperiled fish and mussel species of conservation concern in the southeast US. We highlight: single season, single species surveys for imperiled darters (*Percidae*); a single season, multi-species approach for darters employing species traits to estimate occurrence; and multi-species models for mussels (*Unionidae*) addressing both incomplete detection and misidentification. In some cases, historical data have proven useful in evaluating evidence of recent change in species status. Accounting for sources of sampling biases can reveal substantial uncertainty in our measures of population status for rare and imperiled species. Nonetheless, effective management requires accurate assessments of species distributions, as well as a firm understanding of the predominant factors influencing the status and dynamics of imperiled species. Developing survey and monitoring approaches that account for sampling biases thus appears essential for informed management, and may be tractable for some rare fishes and mussels of concern in the southeastern US.

0720 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Andrew Shedlock¹, Christopher Botka²

¹*College of Charleston, Charleston, SC, USA*, ²*Harvard Medical School, Boston, MA, USA*

Mobile DNA in Reptiles and the Evolution of Amniote Genome Structure

Genomic information from Reptilia, the sister group of mammals, is needed in order to accurately reconstruct ancestral genomic states and place the many publicly available amniote genome sequence assemblies into meaningful molecular evolutionary context. Results of global DNA repeat content and diversity from recently completed reptile genomes as compared to other complete genome assemblies for all major clades of amniotes will be discussed in relation to contrasting models of transposable element (TE) impacts on amniote genome structure, function and diversification. Comparative data for these initial reptile assemblies provide a first genome-wide glimpse of the evolutionary dynamics of mobile repeats that remain invisible to strictly mammalian and avian genomic investigations. Goals for integrating studies of amniote TEs with our need to build a predictive theory for the eukaryotic genome, presently still lacking in comparative biology, will be discussed in light of recent discoveries and new technological developments driving the field of evolutionary genomics.

0068 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

David Shiffman, Neil Hammerschlag

University of Miami, Miami, FL, USA

Use of Social Media to Assess the Knowledge and Attitudes of Different Stakeholder Groups Towards Shark Conservation, Including Implications for Public Support for Management Policies

Many large sharks have been experiencing varying levels of population declines at a global level, primarily due to overfishing. However, the scale, magnitude and geographic distribution of these declines across species remain uncertain. This is of particular importance given that predator declines have the potential to impact ecosystem structure and function through trophic cascades. This has raised growing concern among different stakeholder groups including scientists, wildlife managers, environmentalists and fisherman. Given the potential to influence both policy and public opinion, understanding the knowledge and attitudes of different stakeholders towards shark conservation issues have been identified as a research priority. In recent years, the rising use of social media has become among the most rapid, wide-spread and

influential ways for both individuals and organizations to communicate their ideas to a diverse global audience. Shark conservation is one of the most actively discussed ocean issues and is discussed online by many thousands of users. Here we use large-scale content and discourse analyses of social media updates (primarily Facebook and twitter) shared with the public by representatives of different stakeholder groups public to assess their knowledge and attitudes towards the two of the primary issues in shark conservation, specifically the population status and ecosystem importance of sharks. Our results demonstrate that many of the arguments being made and disseminated by non-scientists advocates and organizations do not accurately represent available data. We discuss these results in terms of potential to impact policy decisions.

0016 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos, Saturday 13 July 2013

Dustin Siegel¹, Christopher Beachy², Kenneth Cabarle³, Abbigail Nicholson¹, Michael Taylor¹

¹*Southeast Missouri State University, Cape Girardeau, MO, USA*, ²*Minot State University, Minot, ND, USA*, ³*Dakota College at Bottineau, Bottineau, ND, USA*

Notes on male *Ambystoma mavortium* life history

Based on historical literature and novel examination, we categorize male *Ambystoma mavortium* into one of four urogenital demographics: 1. larvae (collecting ducts of the pelvic kidney that empty into the Wolffian duct sequentially along the length of the Wolffian duct), 2. metamorphs (collecting ducts that are in the processes of metamorphosing to the subadult/adult morphology), 3. subadults (collecting ducts of the pelvic kidney that are identical in morphology in comparison to adults, but not functional), and 4. adults (functional collecting ducts that bend caudally, anastomose, and empty into a common collecting duct before communication with the most distal portion of the Wolffian ducts; can be aquatic or terrestrial). Current data are preliminary and only encompass examination of large subadults and aquatic adults. Aquatic adults from May are reproductive, possess large and opaque testes, and have highly secretory epithelia lining their secondary sexual structures. Subadults possess the adult urogenital morphology, but are not reproductive, have flat and translucent testes, and glandular epithelia of their secondary sexual structures are quiescent. On average subadults are identical in size when compared to aquatic adults, but have greater fat reserves. Further data are necessary to test our hypothesis that four discrete urogenital stages exist within male *Ambystoma mavortium*.

0131 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Gustavo Sierra, Ana Gatica, Juan Lopez

Universidad Autonoma de Ciudad Juarez, Juarez, Chihuahua, Mexico

Isolation of *Salmonella* and other Enterobacteria from the Box Turtle *Terrapene ornata*

Enterobacteria from the genus *Salmonella* are found in the intestinal tract of 85% of turtles. In the USA, around 74,000 of *Salmonella* infections in humans are caused by contact with these reptiles. In México, the box turtle *Terrapene ornata* is protected by Mexican law (DOF, 2010), some people have them as pets in Juarez, Chihuahua. The objective is to isolate *Salmonella* from captive box turtle *Terrapene ornata*. The samples were obtained by introducing a sterile cotton swab into the cloaca of 20 different turtles for 5 seconds and then taken to the Microbiology Academy Laboratory of the Universidad Autónoma de Ciudad Juárez, where they were subjected to the procedure established by the standardized NOM-114-SSA-1994(DOF, 2002), which includes pre-enrichment in peptone broth (BIOXON), selective enrichment in tetrathionate (BIOXON) and brilliant green broth (DIBICO), selection in solid media with bismuth sulfite (BIOXON) and EMB agar (DIBICO), and biochemical identification with a series of eight biochemical tests, with a confirmation by API120E (BioMérieux) with readings by Analytab (1989). The results showed that all samples tested positive for enterobacteria in the cloaca of the box turtle, having achieved the isolation of a total of 60 bacterial colonies from 16 different enterobacteria, including *Salmonella spp* (23.33%), followed by *Citrobacter freundii* (20%), and *Escherichia coli* (11.66%). In conclusion, this study found and isolated a considerable number of enterobacteria from the box turtle, suggesting that people in possession of these reptiles need to handle them appropriately, or better yet, avoid keeping them.

0490 Herp Conservation, Ruidoso/Pecos, Sunday 14 July 2013

Cameron Siler¹, Andres Lira-Noriega², Rafe Brown²

¹*University of South Dakota, Vermillion, SD, USA*, ²*University of Kansas, Lawrence, KS, USA*

Conservation genetics of Australasian Sailfin Lizards and evaluation of the illegal pet trade in the Philippines

Despite rampant coastal development throughout Southeast Asia and the Pacific, studies of conservation genetics and ecology of vulnerable, coastal species are rare. Large bodied vertebrates with highly specialized habitat requirements may be at particular risk of extinction due to habitat degradation and fragmentation, especially if

these habitats are patchily distributed, marginal, or otherwise geographically limited, or associated in space with high human population densities or heavy anthropogenic disturbance. In this study we (1) identify significant evolutionary units for conservation in large-bodied Sailfin Lizards (genus *Hydrosaurus*), (2) model appropriate habitat from species occurrence data, (3) evaluate the efficacy of the current protected area network of the Philippines, and (4) identify the source of hydrosaurians in the illegal pet trade. Using a multilocus molecular dataset, we employ maximum likelihood and Bayesian phylogenetic methods to estimate genealogical relationships, construct multilocus haplotype networks, identify genetic variants, and estimate phylogeographic relationships. We determine that the extent of the species' habitat coincident with protected areas is low. We clarify the current taxonomic arrangement for Sailfin lizards and find evidence for four divergent lineages. Our forensic evaluation of the illegal pet trade in the Philippines determines the existence of a genetically distinct natural population that is at risk of systematic exploitation by traders. This is the first conservation genetic study to evaluate the potential effectiveness of the protected landscape coverage in the Philippines, a Megadiverse nation and Biodiversity Hotspot.

0792 SSAR Effects of Energy Development on Herps Symposium, Galisteo/Aztec, Saturday 13 July 2013

Barry Sinervo¹, Jeffrey Lovich², Joshua Ennen³, Donald B. Miles⁴, Robert D. Cooper¹, Raymond B. Huey⁵

¹University of California, Santa Cruz, CA, USA; ²U.S. Geological Survey, Flagstaff, AZ, USA; ³University of Tennessee, TN-SCORE, USA; ⁴Ohio University, Athens, OH, USA; ⁵University of Washington, Seattle, WA, USA

The impact of solar farms and wind farms on population persistence and extinction of the desert tortoise, *Gopherus agassizii*

Solar (photovoltaic) plants are widely touted as an ecologically clean source of renewable energy, and this widespread deployment of solar arrays is projected to slow climate warming. Solar plants are most effective when sited in deserts, where incident solar radiation is high and reliable. Nevertheless, because many deserts are pristine habitats that support high biodiversity, the potential biological impact of solar installations on desert communities needs to be investigated. Obviously, the construction of massive solar arrays at industrial terawatt scales will destroy hundreds of square kilometers; but less obviously those arrays, which are dark, will change albedo, raise air temperatures, and create a heat island that extends beyond the arrays themselves. Here we show that warming added by solar panels could accelerate extinctions of several desert reptiles in the southwestern United States. Paradoxically, solar plants may reduce warming at a global scale, but still contribute to local warming and to local organismal extinction.

0186 General Ichthyology II, Ruidoso/Pecos, Friday 12 July 2013; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Randy Singer, Lawrence Page

Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

Does your flap hang low? Is it bony or a row? A revision of the genus *Acanthocobitis* (Teleostei: Nemacheilidae) with recognition of the genus *Paracanthocobitis*

Acanthocobitis McClelland 1861 is a genus of nemacheilid loaches consisting of 7 species known from eastern Pakistan to western Thailand. Recent study of the group, made possible in part by the All Cypriniformes Species Inventory, is yielding a broader understanding of diversity and relations within *Acanthocobitis*. *Acanthocobitis botia*, the name applied to most populations, is a species complex, with several forms diagnosable as new species. In addition, recognition of the genus *Paracanthocobitis* for all species except for *Acanthocobitis longipinnis*, the type species of *Acanthocobitis* and the morphologically most distinct among recognized species, will more accurately describe the diversity within this group of fishes.

0341 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel, Friday 12 July 2013

Phillip Skipwith¹, Aaron Bauer², Todd Jackman²

¹*University of California, Berkeley, Berkeley, CA, USA*, ²*Villanova University, Villanova, PA, USA*

Diversification Rates of New Caledonian Diplodactylid Geckos Inferred From Concatenated and Coalescent Divergence Time Estimates

The thirty-six diplodactylids endemic to New Caledonia form a morphologically diverse clade that contains viviparous species as well as the world's largest gecko. This group, like so many other New Caledonian taxa, has historically been thought of as ancient due to a vicariance event separating Tasmantis from eastern Gondwana in the late Cretaceous. This 'museum' model also assumes that diversification in these groups have been slow and constant rather than an initial burst followed by a plateau as ecological space is filled. To test these hypotheses, we estimated divergence dates using a multilocus dataset (5,235 bp) incorporating both mtDNA (ND2 + 5 tRNAs) and nucDNA (KIF24, KIAA1549, RAG1, MXRA5, PDC). Concatenated and multispecies coalescent methods recover mean ages for the crown New Caledonian clade in the late Oligocene and mid-Miocene respectively. Furthermore, both methods place the divergence between the New Caledonian clade and its Australian sister taxon in the mid-Eocene.

From these dates we infer that the New Caledonian clade reached the island group via long distance over-water dispersal, rejecting the traditional museum hypothesis. We failed to detect significant rate shifts of diversification within the New Caledonian clade using AIC. The γ -statistic and simulations indicate that net diversification was initially rapid and has decreased through time, thus deviating from a Yule model. While model selection using AIC selects a density-dependent model, we are reluctant to attribute this apparent decrease in diversification to density dependence in terms of ecological opportunity because a number of factors can contribute to the observed pattern.

**0596 NIA BEST STUDENT PAPER, NIA Oral Papers, Doña Ana/Cimarron,
Monday 15 July 2013**

Veronica Slobodian, Flávio Bockmann

Universidade de São Paulo, Ribeirão Preto/SP, Brazil

**Taxonomy, Systematics and Biogeography of *Brachyrhamdia* Myers, 1927
(Siluriformes: Heptapteridae) and its mimetism with other siluriforms**

Brachyrhamdia is a catfish genus of the family Heptapteridae which occurs in northern South America, throughout the Amazon (including Tocantins) and Orinoco systems, and rivers draining the Guyana region. Currently, *Brachyrhamdia* includes five valid species, although its validity has been challenged at times. This work aimed to review taxonomically the genus, test its monophyly and elucidate the phylogenetic analysis among its species on the basis of morphological data, and propose a hypothesis on its biogeographic history. We recognized all five species as valid (*B. heteropleura*, *B. imitator*, *B. marthae*, *B. meesi*, and *B. rambarrani*), and add two new species, possibly three to its composition. Our phylogenetic analysis corroborated the monophyly of the *Brachyrhamdia*. Despite *Brachyrhamdia* is here shown to have a deep position within a non-monophyletic *Pimelodella*, the lack of knowledge on relationships among most basal heptapterids lead us to keep it provisionally as a valid genus. The single shortest, fully resolved tree that we obtained has the following topology: (*B. marthae*, *B. meesi*) ((*B. heteropleura*, *Brachyrhamdia* n. sp. 'Araguaia-Tocantins') (*B. rambarrani* (*B. imitator*, *Brachyrhamdia* n. sp. 'Amanã')))). The distribution areas of species of *Brachyrhamdia* are within the Amazon lowlands, in typically lowland rivers or drainages of composite nature that probably were shield rivers in its origins. Furthermore, *Brachyrhamdia* species have possible mimetic associations with other siluriforms, especially species of *Corydoras*. Indeed, despite the lack of ecological records about shared niche, in all localities where *Brachyrhamdia* are found, they are sampled together with another catfishes (usually *Corydoras*) bearing striking coloration and body habit resemblances.

0213 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Gerald Smith¹, Thomas Dowling²

¹*University of Michigan, Ann Arbor, Michigan, USA*, ²*Arizona State University, Tempe, Arizona, USA*

Introgression in Catostomin Fishes: Evolutionary Significance and Taxonomic Problems

Introgressive hybridization is common in American catostomids, cyprinids, salmonids, centrarchids, cichlids and other groups. Renewed interest in the possibility of introgressive enhancement of rapid evolution, speciation, and species flocks prompts the need for tests of hypothesized introgression, favorable selection, and genomes adapted to mixing. Experiments, hatchery work, and comparisons of natural cyprinid and catostomid hybrids and backcrosses indicate that diploid as well as tetraploid fishes can tolerate mismatched alleles that cause reduced survivorship, yet produce viable F2s and backcrosses with morphologies that persist in populations. We document introgressive breakdown of reproductive barriers after 5-8 million years of fossil-documented lineage divergence in catostomids. Examples of hybrid species as well as context-dependent introgressive amalgamation of species and reticulate evolution are also observed. Tests of these hypotheses involve comparisons among independent gene trees, allozymes, independent and segregating morphological traits, and history from fossils. All five genera and 16 species of western catostomids show incongruent gene trees and morphological phylogenies, indicative of introgressive hybridization and polyphyly. Gene trees and morphology demonstrate different histories of genic and organismic evolution. Implications for morphological evolution are not consistent with histories inferred from molecular phylogenies. Conflicts for taxonomy are not easily resolvable: persistence of morphology despite millions of years of introgression is used to justify polyphyletic generic groups; but holding to the principle of monophyletic generic groups would not justify different genera of western catostomids.

0457 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Kevin Smith, Walter Bien

Drexel University, Philadelphia, PA, USA

Radio telemetry and the neonate ecology of the Northern Pinesnake (*Pituophis melanoleucus*)

Due to the cryptic and fossorial nature of Northern pinesnakes (*Pituophis melanoleucus*), there is a lack of data on their early life behavior and dispersal. An understanding of

first season life history traits from hatching to ingress is particularly difficult to monitor. Without field observations, it is difficult to elucidate key developmental processes, such as shedding rate, feeding rate, diet preference, habitat preference, dispersal patterns, and the spatial ecology after leaving the nest. These life history factors could have pronounced effects on land management concerning this species, State Threatened in New Jersey. Until recently, the use of radio telemetry was only applicable for adult pinesnakes. External transmitters are not appropriate for semi-fossorial constrictors as they interfere with normal snake behaviors such as prey handling and excavation. However, we surgically implanted eight *P. melanoleucus* neonates with small transmitters, less than 3% body weight, and radio-tracked them after leaving their nests to fall ingress. We monitored neonate activity daily and recorded environmental and behavioral data. Neonates preyed on small adult rodents and shed multiple times over the first season. Radio telemetry helped confirm black racers (*Coluber constrictor*) as a predator of neonate pinesnakes. Neonates traveled distances from the nest ranging from 30m to 300m. Neonates with pit-tags only were observed within 70m of the nest throughout the field season. Our data suggest that the use of radio-implanted transmitters in neonate pinesnakes does not negatively impact normal snake activity, behavior, and movement patterns and may be applicable to other cryptic species.

**0302 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

Nicole Smolensky, Luis Hurtado, Lee Fitzgerald

Texas A&M University, College Station, TX, USA

Phylogeography of African Dwarf Crocodiles (*Osteolaemus* spp.)

Many biogeographic patterns in Africa's flora and fauna have been attributed to putative dispersal barriers by mountain chains, rivers, or spatiotemporal changes in habitat. The Dahomey Gap and Cameroon Volcanic Line (CVL) are two hypothesized barriers separating Upper Guinean, Lower Guinean and Congolian lowland rainforest taxa. The dwarf crocodiles (*Osteolaemus* spp.) have recently been described as a cryptic species complex of three monophyletic clades occurring in the Upper Guinean (*O. cf. tetraspis*), Lower Guinean (*O. tetraspis*) and Congolian (*O. osborni*) rainforests, with the CVL hypothesized as a dispersal barrier between *O. cf. tetraspis* and *O. tetraspis*. I used phylogenetic analyses of two mitochondrial genes and one nuclear gene to investigate this hypothesis. I collected 65 tissue samples from populations in river basins in Cameroon, and on either side of the CVL and obtained additional sequences of each of the clades from GenBank. I did not find deep divergences between populations to the east and west of the CVL. Samples clustered with the well supported *O. tetraspis* and *O. osborni* clades. Each clade had low nucleotide and haplotype diversity. Populations of *O. tetraspis* throughout Cameroon and on both sides of the CVL were primarily represented by a single shared haplotype. My study provides the first evidence for the presence of *O. osborni* in Cameroon, an important finding considering these species are traded live in

the bush meat market, and our knowledge of their conservation status is limited. Current distributions of these species results from the interplay between contemporary and historical factors.

0700 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Mateus Costa Soares, Marcelo Rodrigues Carvalho

Universidade de São Paulo, São Paulo/SP, Brazil

Comparative myology of the mandibular and hyoid arches in elasmobranchs (Chondrichthyes) and its relevance for phylogenetic hypotheses of living species

Past studies attempting to reveal the interrelationships of Elasmobranchii have proposed two principal hypotheses. Based on morphological data, elasmobranchs are divided into two groups, Galeomorphi and Squalomorphi, the latter including the rays (Batoidea; being part of the clade Hypnosqualea with Squatina and Pristiophoriformes). However, molecular data suggest that Galeomorphi and Squalomorphi form a monophyletic clade, sister-group to Batoidea (sharks are therefore monophyletic). To elucidate this conflict, the present work examined the comparative anatomy of jaw and hyoid arch muscles of about 100 species (37 families) of sharks, rays and chimaeras. Some 35 myological characters are proposed, based on our observations and information from the literature, which shed light on different aspects of elasmobranch intrarelations. These concern, for example, the monophyly of Galeomorphi (e.g. presence of a tendon linking m. levator labii superioris to the neurocranium), the monophyly of Squalomorphi (e.g. presence of m. adductor mandibulae superficialis), relationship between Heterodontiformes and Orectolobiformes (e.g. variations in m. levator labii superioris and m. constrictor hyoideus dorsalis), the relationship between *Chlamydoselachus* and Hexanchidae, the monophyly of Squaliformes, the monophyly of Hypnosqualea (e.g. presence of m. depressor rostri and variations in m. spiracularis), and the intrarelations among potamotrygonid stingrays (variations in adductor mandibulae complex and m. spiracularis). Muscle characters have great potential to help clarify relationships among living elasmobranch groups, and mandibular and hyoid arch muscles favor the morphological hypothesis in which batoids are nested within squalomorphs.

0328 NIA Oral Papers, Doña Ana/Cimarron, Monday 15 July 2013

Timothy Sosa

University of Chicago, Chicago, IL, USA

Molecular systematics of Mesoamerican Characidae, with implications for historical biogeography

I use several loci to reconstruct patterns of ancestry in Mesoamerican representatives of the family Characidae, confirming some previous hypotheses of relationships but challenging others. I discuss the implications for the environmental history of the region and evolutionary dynamics within this clade.

0393 AES Conservation, San Miguel, Sunday 14 July 2013

Julia Spaet, Michael Berumen

King Abdullah University of Science and Technology, Thuwal, Makkah, Saudi Arabia

Long-term Market Survey of Saudi Arabian Red Sea Shark Fisheries

Shark populations worldwide are severely threatened due to overexploited and unregulated fisheries. Information on unmonitored coastal fisheries is difficult to obtain, especially in regions where historical data on shark diversity, abundance, or catch levels is sparse. Yet it is vital to develop an understanding of the historical changes determining population trends and evaluate the current status of shark populations in order to conserve these vulnerable species. Here, we document for the first time the current state of the Saudi Arabian Red Sea shark fisheries based on catch data from Jeddah fish market, one of the biggest in the Red Sea. Bi-monthly market surveys were carried out for 24 months between 2011 and 2013. Of the 30 shark species present in the Red Sea, 23 species were recorded. Notably, only four reef-associated shark species (*C. amblyrhynchos*, *C. sorrah*, *C. falciiformis* and *C. limbatus*) comprised 60% of the total catch. Of all sharks landed, 75% were below the size of sexual maturity, indicating severe growth and recruitment overfishing. In combination with simultaneously conducted fisheries independent surveys (Baited Remote Underwater Video and Longline Surveys) in Saudi Arabian waters, the current data serves as an indication of the acute depletion of sharks in Saudi Red Sea waters. Given the inherent vulnerability of sharks and the overfished states of many global stocks, there is clearly an urgent need to formulate effective conservation and management plans for these rapidly declining species in a region that has so far received very little attention.

**0570 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Stephen Spear¹, Joshua Parker², Christopher Jenkins¹, Charles Peterson³, Lisette Waits⁴

¹The Orianne Society, Clayton, GA, USA, ²Clayton State University, Morrow, GA, USA, ³Idaho State University, Pocatello, ID, USA, ⁴University of Idaho, Moscow, ID, USA

Modeling Western Rattlesnake habitat use and connectivity to inform the current and potential impacts of energy development

Oil, gas, and wind development and the infrastructure associated with these activities have the potential to alter both snake habitat and functional connectivity, yet there is a general lack of data on possible effects. In the northwestern United States, snakes often use communal hibernacula for overwintering while undertaking seasonal migrations to nearby areas for the summer. The summer habitat is often used for both foraging and mating, and as such is important for genetic connectivity among denning groups. Therefore, conservation of these north temperate snakes requires protection of focal overwintering dens, migratory movement corridors, and maintenance of intact landscapes that can be used for foraging and mating. We present data from two subspecies of the Western Rattlesnake complex (Midget Faded Rattlesnakes (*Crotalus oreganus concolor*) in Wyoming/Colorado and Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*) in Washington) that identified important areas for focal protection of snake dens and foraging areas, and has already provided managers with guidance for permitting projects. Furthermore, for Midget Faded Rattlesnakes, we found a significant negative correlation between low-use unpaved roads and genetic connectivity and use our landscape genetic model to demonstrate how the road network has fragmented the network of rattlesnake gene flow. We also focus on how recent wind power projects in Washington might influence current Northern Pacific Rattlesnake connectivity linkages. Collectively, our examples highlight the importance of considering both habitat use and connectivity when evaluating effects of energy development, as well as the urgent need for more research on the topic.

**0567 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Brenton Spies

California State University, Northridge, Northridge, CA, USA

Temperature-mediated variation in larval traits of a seasonally closed estuary specialist fish: how much does latitude matter?

Variations in the environment have been found to strongly influence the life history of many marine organisms that occur across large latitudinal gradients. Species such as the endangered tidewater goby (*Eucyclogobius newberryi*) persist in estuaries along the California coast that are highly seasonally variable. This habitat preference may predispose them to local extirpation. This study investigates variations in the early life history of *E. newberryi* in relation to temperature trends found in ten estuaries spanning approximately eight degrees of latitude. Hourly temperature recordings were taken from July-October of 2011 using ibutton thermocron data loggers. Newly settled individuals were collected in order to determine how habitat variations affect pelagic larval duration (PLD), size at settlement, and post-settlement growth rates. Estuaries inhabited by *E. newberryi* showed high variability in temperature with no latitudinal trend, likely due to factors such as estuary size, amount of freshwater input, and duration of seasonal closure. Variations in all life history traits were found between high and low temperature sites. Fish that experienced colder temperatures had a longer PLD, slower post-settlement growth rates, and were larger at settlement.

0353 Amphibian Conservation, Galisteo/Aztec, Friday 12 July 2013

Michael J. Sredl

Arizona Game and Fish Department, Phoenix, AZ, USA

Calibrating Our Progress Towards Recovery of Amphibian Populations: an Area-based Approach and Occupancy Modeling

Like many amphibian species worldwide, populations of Chiricahua leopard frogs (*Lithobates chiricahuensis*) have experienced dramatic, rangewide declines during the past three decades and were listed under the Endangered Species Act (ESA) as threatened in 2002. A species recovery plan was finalized in 2007 that included four recovery criteria that, when reached, will have: 1) established metapopulations and isolated robust populations, 2) managed necessary aquatic breeding habitats, 3) managed important dispersal corridors, and 4) reduced threats so that the Chiricahua leopard frog no longer needs the protection of the ESA. Although great progress has been made since federal listing, progress on recovery criterion 1 has been hampered by 1) the dearth of suitably

configured landscapes that could "host" candidate metapopulations and 2) the difficulty of establishing and monitoring stable and viable metapopulations given the limited human and financial resources available. I develop a conceptual area-based approach to calibrate progress toward recovery that is applicable to the Chiricahua leopard frog and other patchily-distributed amphibians. This approach utilizes occupancy modeling to gauge progress in establishing, managing, and monitoring viable metapopulations. It is easier to design and implement, makes fewer assumptions, and is less biased than the current "strict metapopulation" approach.

0254 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Katherine St. Clair¹, Roy Drinnen², Tasha Metz¹, Kimberly Reich¹, Greg Whittaker², Andre Landry¹

¹Texas A&M University at Galveston, Galveston, TX, USA, ²Moody Gardens, Galveston, TX, USA

Results of a captive feeding trial to determine turnover and discrimination of ¹³C and ¹⁵N in epidermis of cownose rays (*Rhinoptera bonasus*)

Studies documenting habitat-use patterns of cownose rays (*Rhinoptera bonasus*) along the Texas coast are limited, with much of the available data generated by federal and state fisheries monitoring or by-catch programs. Stable isotope analyses have been increasingly used to characterize foraging ecology of various species, but only recently applied to elasmobranchs. Analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ retained in epidermal tissue is a possible option in discerning seasonal movements of cownose rays between inshore and nearshore habitats along the Texas coast. However, the incorporation rate and discrimination factor for epidermal tissue of cownose rays essential to this analysis have not been documented. For this reason, a subset of wild cownose rays from the Texas coast was collected for use in a controlled feeding trial to determine both isotope turnover and discrimination values. These data are key to the interpretation of carbon and nitrogen values in tissues of cownose rays captured via entanglement netting inhabiting northwestern Gulf of Mexico waters. Overall, these feeding trials will generate information that fills a void in our understanding of cownose ray ecology in this region and potentially aid in the management of marine and estuarine resources.

**0192 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Marisa Stachowski, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Insights into *Ilyodon*: Phylogeography from South of the Border

Ilyodon (Goodeidae) is a wide-ranging species that occurs in basins of the Pacific slope of west-central Mexico. There has been significant taxonomic uncertainty in the genus despite a plethora of taxonomic, genetic, and evolutionary studies. As many as six species are currently recognized: *Ilyodon furcidens*, *I. whitei*, *I. lennoni*, *I. xantusi*, and *I. cortesae*. The widespread distribution of the genus, the disjunct status of many of the species, as well as long-standing taxonomic confusion warrant further systematic and taxonomic investigation. Therefore, we conducted a range wide phylogeographic study of *Ilyodon* and investigated the monophyly of the putative species in the genus using one mitochondrial marker (cytb) and two nuclear markers (S71 and calmodulin).

Phylogenetic analysis of all three markers recovered a clade of individuals from the Ameca-Armeria basins as monophyletic which correspond to *I. furcidens* and *I. xantusi*. The Balsas and Coahuayana basins each contain multiple species (*I. whitei*, *I. furcidens*, and *I. cortesae*), however each putative species was not found to be monophyletic. We found little support for the recognition of the other species of *Ilyodon* based on genetic divergences and phylogeographic position. BEAST analysis using fossil calibrations reveal a relatively young age of divergence between *Ilyodon* and the rest of the goodeids, which may act to explain why the morphological variation seen across populations is not concordant with the observed molecular variation. These results suggest that a taxonomic revision of the group may be warranted.

0281 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Margaret Stebbins, Lauren Carter, Jacquelyn Guzy, Kristen Cecala, Michael Dorcas

Davidson College, Davidson, North Carolina, USA

Orientation of Spotted Salamander (*Ambystoma maculatum*) Seasonal Migrations

Understanding the spatial orientation of semi-aquatic animals within terrestrial habitats surrounding wetlands is critical to determining how much and what type of habitat is necessary to sustain populations. We examined directionality of movement of spotted salamanders (*Ambystoma maculatum*) by intercepting adults during their seasonal breeding migration. We encircled a 0.5 ha wetland with a 400 m drift fence and

captured salamanders in pitfall traps spaced 10 m apart on both sides. Salamanders were individually marked using subcutaneous injections of visible implant elastomer. We captured 811 individuals (1,426 recapture events) and found that salamander entry and exit points were non-random and related to the surrounding upland terrestrial habitat. In addition, we analyzed a subset of salamanders (163 individuals) with known entry and exit locations and found that individual salamanders exited the wetland at a very similar location to which they entered the wetland. Furthermore, we observed that the side of the wetland bordering a recent clear-cut area had considerably lower numbers of salamanders entering and exiting than the rest of the wetland. We suggest that salamanders are entering and exiting from a few specific areas and found that many enter and leave from the same location, demonstrating the importance of preserving critical upland habitat, especially habitat facilitating travel routes during breeding events.

**0266 NIA BEST STUDENT PAPER, NIA Oral Papers, Doña Ana/Cimarron,
Monday 15 July 2013**

Sarah Steele¹, Hernán López-Fernández²

¹*University of Toronto, Toronto, Ontario, Canada,* ²*Royal Ontario Museum, Toronto, Ontario, Canada*

Exploring Body Size Frequency Distributions in Neotropical Fishes and Model Systems

Implications of body size on life history strategies, physiology and ecology have been a popular topic in evolutionary biology. Despite this, few studies have addressed potential causes of trends towards extreme body sizes in extant taxa. Studies addressing body size evolution in extant fishes and possible drivers of extreme body size are particularly rare. Large body size is associated with increased reproductive potential, yet body size reduction is a common phenomenon in freshwater fishes, with a higher proportion of small-bodied species occurring in the tropics. We explore body size frequency distributions (BSFDs) of major lineages within Neotropical fishes to identify general trends in body size evolution. Body size patterns within and among species-rich groups were compared to these trends and representative lineages were identified. Neotropical cichlids are both representative and allow for direct tests of evolutionary hypotheses in a phylogenetic context. BSFDs of Neotropical cichlids share many similar characteristics to Neotropical fishes as whole and therefore will be used as a model for body size evolution. The extrinsic and intrinsic drivers of body size evolution in Neotropical cichlids are currently not known, with only a few studies that have addressed broader patterns of evolution. BSFDs of major clades within Neotropical cichlids show that body size diversity and optimal body size likely differ among these clades. In addition, increased body size diversity seems to be associated with increases in diversity of ecological roles and may have been a key driver for rapid diversification in some Neotropical cichlid clades.

0200 HL Detectability Symposium, Brazos, Friday 12 July 2013

David Steen

Virginia Tech, Blacksburg, VA, USA

How Can We Use Detection Probabilities and Occupancy Modeling to Learn More About Snakes?

Snakes are secretive animals; this makes assessments of abundance difficult and reinforces the importance of considering low and/or varied detection probabilities when assessing populations. However, based on captures of terrestrial snakes in the southeastern United States, individual snakes are infrequently recaptured and species are sporadically detected even when they are always present. Thus, even after considering recent statistical advances, researchers cannot determine whether snakes are rare or actually just infrequently detected. In other words, detection probabilities and occupancy modeling techniques are not the panacea we need to inform our knowledge of snake biology, what we need are better methods of detecting these animals.

That said, detection probabilities might be increased, in a sense, by expanding the scale of research. By abandoning attempts to characterize abundances in favor of focusing on species-level detection across regions and expanding the scope of trapping such that samples are the result of years of constant sampling effort, novel findings may emerge. I discuss recent efforts to A) characterize the landscape-scale habitat preferences of terrestrial snakes throughout the southeastern United States B) conduct co-occurrence modeling of these animals. In addition to generating patterns of occupancy in relation to landscape-scale habitat features, we found that snake assemblage structure may be influenced by competition and that detection probability may be altered by the presence of snakes that are superior competitors.

0202 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

David Steen¹, Brittney Hopkins¹, James Van Dyke², William Hopkins¹

¹*Virginia Tech, Blacksburg, VA, USA*, ²*University of Sydney, Sydney, Australia*

Prevalence of Ingested Fishing Hooks Within Free-roaming Freshwater Turtles

Recreational fishing represents a potential threat to freshwater turtles because this activity is widespread globally and turtles can ingest baited hooks, an event that increases mortality rates in other vertebrates. However, hook ingestion by freshwater turtles has not yet been the subject of large-scale study. We used X-ray technology to examine over 600 free-ranging turtles of four species from five rivers in the southeastern United States and quantified the presence/absence of ingested fish hooks. For some

population segments, high proportions (up to 33%) contained fish hooks. Because freshwater turtle demography suggests that even small increases in adult mortality may lead to population declines, this work identifies a potential conflict between a common recreational activity and an imperiled and sensitive taxonomic group.

**0330 General Herpetology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD GENERAL HERPETOLOGY**

Michael Steffen, Ronald Bonett

University of Tulsa, Tulsa, OK, USA

Pheromone Evolution and Reproductive Isolation in Dusky Salamanders

Conspecific mate recognition signals can delimit species boundaries and structure communities. However, signals and mate choice are evolutionarily labile, and few studies have examined the impact of signal discordance on lineage diversification in adaptive radiations. Salamanders produce highly variable, proteinaceous courtship pheromones. Dusky salamanders of the genus *Desmognathus* are endemic to eastern North America, and display dramatic disparity in ecology, body size and life history. However, some distantly related species are highly convergent in these traits, and behavioral studies have shown varying degrees of prezygotic isolation among divergent, yet ecologically similar species. In this study, we analyze the transcripts of pheromone genes (plethodon modulating factor and sodefrin precursor factor) in *Desmognathus*. We specifically test how convergence and introgression play a role in the geographic distributions of these pheromones, and if pheromone divergence is correlated with patterns of behavioral reproductive compatibility or isolation.

0425 SSAR SEIBERT AWARD ECOLOGY I, Brazos, Thursday 11 July 2013

Sean Sterrett, John Maerz

University of Georgia, Athens, GA, USA

**Why the conservation of freshwater turtles matters: Perspectives on the
nutrient dynamics of common freshwater turtles in the Southeastern United
States**

The conservation crisis occurring in freshwater ecosystems is expected to have major consequences for ecosystem function. Nutrient cycling is an important ecosystem service in both natural and human-dominated landscapes, and vertebrates are hypothesized to play a unique role in the rates in which nutrients are cycled, stored and moved within and between ecosystems. We hypothesized that turtles, which can occur in high biomass

within freshwater ecosystems, are particularly important in the cycling of key nutrients such as phosphorus. We used ecological stoichiometry theory married with population ecology to estimate turtle contributions to nutrient cycling in freshwater habitats in the southeastern United States. From 2010-2012, we captured 612 turtles of 394 individuals representing ten species among three habitat types in Georgia, U.S.A. Four species compose 85% of all captures. Turtle shells accounted for 60-64% of dry body mass, which is several times the value of skeletons among other vertebrates, and twice that of projected estimates for turtles reported in early literature. The skeleton is rich in Calcium and Phosphorus, making turtles a particularly unique reservoir for these essential nutrients. We measured excretion rates of 90 individuals. We estimated that turtles contributed an average $39.43 \mu\text{g P} \cdot \text{h}^{-1}$ and $154.85 \mu\text{g N} \cdot \text{h}^{-1}$, which are comparable to excretion estimates of fish populations. These results provide the first data to demonstrate that turtles are influential in nutrient dynamics within freshwater, and suggest that declines in turtle populations will alter ecosystem processes.

0433 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, Doña Ana/Cimarron, Thursday 11 July 2013

Jessica Steudeman, Kenneth Andrews

East Central University, Ada, OK, USA

Strength of the Femur and Humeri of Oklahoma Turtles (Order Testudines) Indicated from Structural Analysis of the Bisected Bones

Upper long bones of turtles were examined to determine comparative strength to withstand stresses placed on the limbs by added weight of the shell (carapace and plastron) to organism mass. Femora and humeri were extracted from 59 turtles collected within Oklahoma. Extracted bones were measured for: total bone length, short diameter, long diameter, short anterior bone collar, short posterior bone collar, long ventral bone collar, and long dorsal bone collar. Measurements were used to calculate the short and long KR values, short and long K values, and the R/t value for each bone collar. KR is radius of the marrow cavity. K is ratio of outer bone collar diameter compared to inner marrow cavity diameter. R/t is ratio of total radius compared to the thickness of the bone collar. Data was used to determine variation in strength within different turtle species and other vertebrates. Differences in K and R/t values were found between terrestrial turtles and aquatic turtles as well as other vertebrates. Significant differences occurred in thickness of opposing sides of the bone collar. Differences reflect stress points on limbs as it is held in a horizontal position for walking. Dorsal and anterior aspects of the bones require more strength, and therefore have thicker bone collars, while the ventral and posterior aspects require less strength and more flexibility. Data suggests shell weight causes remodeling of bone collars to carry increased mass induced by the shell while on land.

0659 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, Doña Ana/Cimarron, Thursday 11 July 2013

Timothy Steudeman, Kenneth Andrews

East Central University, Ada, Ok, USA

A Morphometric Investigation of Possible Hybridization in Sympatric Regions between *Terrapene c. triunguis* and *Terrapene o. ornata*

The box turtles *Terrapene carolina triunguis* and *Terrapene ornata ornata* are sympatric in regions of Oklahoma. Milstead (1969) proposed a phylogeny for the Genus *Terrapene* based on 16 characters including paleontologic data and morphometrics of interplastral scute ratios. It has been proposed by multiple authors that these two species interbreed. Morphometric measurements were extracted from six hundred and ninety-five box turtles in field and museum collections to determine if interbreeding exist between these two sympatric species. The shell measurements extracted were: Length of Plastron, Humeral, Internal Seam, height of the shell, and length and widths of cervical 1, 2, 3, anterior lobe, posterior lobe, and carapace. Measurements were analyzed to determine a possible hybridization between the species *Terrapene c. triunguis* and *Terrapene o. ornata*. Baseline statistics were utilized to determine variation within these structures and T tests will be performed on the averages to determine if there are any significant differences between the average meristic values of the structures. Once these variances are determined, then Discriminant Function Analysis (DFA), Principal Components Analysis (PCA), and Cluster Analysis (CA) will be used to determine if these variations have hybrid specimens with intermediate values. Preliminary analysis suggests that cervical length would be of use in determining interbreeding. These results suggest that there is hybridization between these two species and that Cervical Length and Humeral Length measurements can be used to differentiate between them.

0578 SSAR EVOLUTION, SYSTEMATICS, AND GENETICS BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

James Stewart

Southeastern Louisiana University, Hammond, Louisiana, USA

Lineage Delimitation of Dekay's Brownsnake (*Storeria dekayi*) using Ecological Niche Modeling

Dekay's Brownsnake, *Storeria dekayi*, has a widespread distribution ranging from Quebec south to eastern Mexico with a disjunct population in Guatemala and Honduras in North America. Currently, seven subspecies are recognized in the literature. The subspecies category is problematic philosophically and operationally, and within *S.*

dekayi subspecies delineations are challenging. The use of the Ecological Species Concept to recognize unique niches as a proxy for unique lineages serves as the operational concept in association with the Evolutionary Species Concept. A unique niche should support a unique lineage that has its own independent, evolutionary trajectory. This study used Ecological Niche Modeling (ENM) to test if unique lineages associated with unique niches were discoverable within *S. dekayi*. By combining known presence data and ecological parameters, ENMs were created to test for unique niches in *Storeria dekayi*. Along with interpreting environmental variables, Environmental Niche Modeling Tools (ENMTools) were utilized to test niche identity and background. The resulting models support deviation amongst the populations' niches. I hypothesize unique lineages are present in these populations.

0335 AES Conservation, San Miguel, Sunday 14 July 2013

Joshua Stewart¹, Daniel Fernando², Calvin Beale⁴, Rebecca Pilkington-Vincett³, Brice Semmens¹

¹*Scripps Institution of Oceanography, UCSD, La Jolla, CA, USA*, ²*Linnaeus University, Kalmar, Sweden*, ³*The Manta Trust, Dorset, UK*, ⁴*Misool Eco Resort Conservation Center, West Papua, Indonesia*

Conservation implications of oceanic manta ray spatial ecology based on stable isotope analysis and satellite tagging

Oceanic manta rays, a poorly understood, charismatic marine megafauna, are under intense fishing pressure worldwide. One of several species of Mobulid rays whose gill rakers are used as a pseudo-remedy in Traditional Chinese Medicine, thousands of mantas are killed each year in developing countries such as Sri Lanka and Indonesia. Given this intense harvest and the species' low reproductive rates, manta populations are in decline, threatening economically important ecotourism programs in many developing countries. Despite their popularity with the public, mantas are one of the few remaining marine megafauna whose spatial ecology has not been closely examined. By investigating the movements and spatial dynamics of oceanic mantas, we intend to highlight subpopulations with increased susceptibility to overfishing, develop regional conservation recommendations, and identify critical habitats that can be protected from an ecosystem management perspective. Based on stable isotope analysis from widely disparate geographic regions, oceanic manta isotope signatures suggest distinct populations between regions. Similarly, preliminary evidence from satellite-tracked individuals indicates a high degree of regional fidelity on the order of months to years. However, tracking data also suggest individual animals exhibit different patterns of habitat use within regions. Our findings suggest that management actions should account for clear separation of populations among regions (and thus region-specific susceptibility to harvest), while spatially explicit conservation methods will be improved by understanding within-region behaviors and habitat use.

0435 SSAR SEIBERT AWARD CONSERVATION, Galisteo/Aztec, Friday 12 July 2013

Rochelle Stiles¹, Chris La Rue², Michael Hawkins², Michael Lannoo³

¹Indiana State University, Terre Haute, IN, USA, ²Iowa Department of Natural Resources, Spirit Lake, IA, USA, ³Terre Haute Center for Medical Education, Indiana University School of Medicine, Terre Haute, IN, USA

Amphibian Response to Restored Prairie Potholes

We surveyed 118 prairie pothole wetlands in Northwestern Iowa, created across 325 km² over the past 30 years to protect water quality in the Iowa Great Lakes, to determine the nature of the amphibian response to these new habitats. We found over 120 populations of native and introduced species, as follows: native Northern Leopard Frogs (*Lithobates pipiens*) were found in 80 (68%) restored wetlands; native Eastern Tiger Salamanders (*Ambystoma tigrinum*) were found in 41 (35%) restored wetlands; and non-native American Bullfrogs (*L. catesbeianus*) were found in 19 (16%) restored wetlands. Northern Leopard Frogs were found in wetlands with intermediate surface areas that had been more recently restored and exhibited the shortest distances to the nearest occupied wetland. Tiger Salamanders occupied wetlands with the smallest surface areas and with intermediate distances to the nearest occupied wetland. Non-native American Bullfrogs were found in the largest wetlands and had the greatest distances to the nearest occupied wetland. Northern Leopard Frog and Eastern Tiger Salamander larvae co-occurred more often than expected, while Northern Leopard Frog and American Bullfrog larvae co-occurred less often than expected. Eastern Tiger Salamander and American Bullfrog larvae were never syntopic. Based on a previous survey conducted two decades ago, it appears that introduced American Bullfrogs are displacing native Eastern Tiger Salamanders, but not Northern Leopard Frogs, in this region.

0110 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Matthew Stone¹, Melissa Bernhard², Eric Hellgren³, Matthew Lovern⁴

¹Kutztown University, Kutztown, PA, USA, ²College of Charleston, Charleston, SC, USA, ³Southern Illinois University, Carbondale, IL, USA, ⁴Oklahoma State University, Stillwater, OK, USA

Relationship Between Environment, Osmotic stress, and Urinary Corticosterone in a Wild Population of Texas Tortoises (*Gopherus berlandieri*)

Extreme environmental conditions can elicit a stress response in vertebrates. The Texas tortoise (*Gopherus berlandieri*) is native to the hot, arid regions of south Texas and Mexico

where temperature and precipitation can be highly variable. Due to expected changes in rainfall and temperature for this region as a result of global climate change, it is important to understand how environmental variables influence stress. The objective of this study was to link precipitation to concentrations of the stress hormone corticosterone in urine. Urine samples were collected from *G. berlandieri* in 2004 and 2005, two years that exhibited drastically different amounts of rainfall. We found that urinary corticosterone was not different between these two years despite tortoises having higher urine osmolality and poorer body condition during the driest of the two years. These results suggest a greater degree of osmotic stress in years and months with little rainfall, but with little concomitant impact on stress hormones. *Gopherus berlandieri* may be able to cope with short-term variation in rainfall and food availability; however, physiological responses to long-term drought remain unknown. Future research is needed to determine if more extreme and long-term drought could elicit a stress response in *G. berlandieri*.

**0688 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

James Stroud¹, Graeme Gillespie²

¹Florida International University, Miami, FL, USA, ²National Environmental Research Program, Northern Territory, Australia

Habitat niche partitioning in two tropical leaf-litter lizards (Scincidae)

Unlocking the complex relationships of factors influencing community structure remains a core topic in ecology. We present data on the habitat associations of two sympatric tropical leaf-litter lizards, *Sphenomorphus variegatus* (n=2695) and *Eutropis rudis* (n=991), from the under-studied forests of Buton Island (south east Sulawesi, Indonesia). Structural habitat variables were recorded at two spatial scales, to investigate the relationship between micro- and macro-habitat on species distribution. Although microhabitat associations were similar, species-specific responses to broader scale habitat structure were observed. *E. rudis*, a heliotherm, were strongly associated to disturbed habitat structure, indicated by high numbers of logs, and log size, as basking potential is high due to higher levels of ground sunlight due to lower understorey cover. The thermoconforming *S. variegatus* is more strongly associated with shaded forest, where the larger *E. rudis* (df=1443, p<0.0001) is limited by lack of basking sites. The importance of thermal conditions is highlighted by daily phenology, which sees activity peak during midday for *E. rudis* but maintain throughout the day by *S. variegatus*. Further research investigating the dietary analysis and thermal ecology would strengthen our overall understanding of the most important factors affecting organisation in this community.

0106 AES Ecology, Mesilla, Thursday 11 July 2013

Kristine Stump¹, Joseph Serafy², Samuel Gruber³

¹University of Miami - RSMAS, Miami, FL, USA, ²National Oceanic and Atmospheric Administration - NMFS/SEFSC, Miami, FL, USA, ³Bimini Biological Field Station, Bimini, Bahamas

Effects of Habitat Loss in a Shark Nursery: Community Characterization Before and After a Disturbance

The lemon shark, *Negaprion brevirostris*, is a large coastal species that uses nursery habitats throughout its range. In Bimini, Bahamas, mangrove-fringed shorelines serve as nursery grounds for hundreds of juvenile *N. brevirostris*, providing both protection from predation and ample foraging. Recently, a significant portion of nursery habitat was destroyed during construction of a resort. Clear-cutting of mangrove forests and filling of wetlands affect not only nursery-bound neonate and juvenile *N. brevirostris*, but also the resources upon which they rely. To describe community diversity and structure, near-shore seining was conducted between 2009 and 2011 to quantify prey communities in both the disturbed and a nearby intact control nursery. These data were compared to data collected prior to habitat degradation, from 2000 to 2003, using identical methods, in both nurseries. Analysis-of-Similarity (ANOSIM) results showed no significant differences in abundance, biomass or occurrence of taxa in the control nursery ($p > 0.05$), while significant differences were found for all three in the disturbed nursery ($p < 0.002$). Species richness decreased significantly in the disturbed nursery (ANOVA, $p < 0.05$), while no such change was seen in the control. The declines found in mean abundance of most taxa in the disturbed nursery, including those important in *N. brevirostris* diet, can have effects on the growth, survival, habitat use and home range of the nursery-bound sharks in this insular system.

0117 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Daniel P. Sturla, Daniel J. Leavitt

Arizona Game and Fish Department, Phoenix, Arizona, USA

Habitat Partitioning between the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) and Sonoran Desert Horned Lizard (*P. goodeii*) in Southwestern Arizona

Understanding the ecological niche is fundamental to enhancing our ability to conserve biological diversity. Locations where closely-related species overlap in geography offer an opportunity to evaluate niche partitioning. Here, we analyzed physical covariates of the distribution of the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) and Sonoran

Horned Lizard (*P. goodii*) on the Marine Corp Air Station in Yuma, Arizona. To understand how lizards partition habitat we asked which physiographic variables contribute to differences in the landscapes inhabited by the two species. We conducted occupancy surveys between May and September 2011, and 2012. During these surveys we collected physical data at 568 sites where horned lizards were detected. Post-survey, remotely sensed data that describe terrain and vegetation were combined with field data to enhance the suit of variables to be used. We created a regression formula using the detection results along with their associated physiographic variables to identify and predict habitat usage between the two species. Habitat quantification is critical for the monitoring of Flat-tailed Horned Lizard, a species of conservation concern especially in areas that continue to be developed. This technique of monitoring will complement current monitoring protocols and offer an evaluation of management action.

0621 AES Reproduction, Mesilla, Sunday 14 July 2013

James Sulikowski¹, Ryan Knotek¹, Cassidy Peterson¹, William Driggers², Eric Hoffmayer², Walter Buble³, Paul Tsang⁴

¹University of New England, Biddeford, ME, USA, ²National Marine Fisheries Service, Pascagoula, MS, USA, ³Texas Parks and Wildlife Department Coastal Fisheries Division, Port O'Connor, TX, USA, ⁴University of New Hampshire, Durham, NH, USA

Observations of the Reproductive Biology of Spiny Dogfish, *Squalus acanthias*, along the United States East Coast; is this species more resilient than once thought?

The spiny dogfish, *Squalus acanthias*, is a k-selected species with a long gestation period, low fecundity, and late maturation. Increased fishing pressure from 1987 to 1996 along the U.S. east coast resulted in the stock collapsing below biomass threshold levels. Despite the implementation of a strict management plan in early 2000, the aforementioned life history characteristics of this shark suggested that the population was incapable of rebounding until 2020. However, between 2005 and 2008 a four-fold increase in the biomass of spiny dogfish was observed, an anomaly that is biologically unrealistic for this species. One possible explanation for the biomass increase may be related to the reproductive biology of this species. Although previous research has suggested a 24-month gestation period along the U.S. eastern seaboard, past studies have been geographically isolated, are antiquated, and have not analyzed the reproductive cycle over the purported 24-month gestation period. To better understand how the reproductive biology may be contributing to the observed population increases, monthly field collections of female dogfish from distinct regions along the U.S. east coast were coupled with bimonthly ultrasound images from captive individuals in order to monitor the length and determine distinct stages of spiny dogfish gestation. Preliminary data suggests that regional variability in reproductive events (i.e. parturition), as well as an overall shorter gestation period may exist for this species along the U.S. east coast.

0725 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Brian Sullivan¹, Matthew Kwiatkowski², Keith Sullivan¹

¹Arizona State University, Phoenix, AZ, USA, ²Stephen F. Austin State University, Nacogdoches, TX, USA

Sex Related Variation in Over-wintering Behavior of *Gopherus morafkai* in Central Arizona

We used radio-telemetry to assess refuge use and associated winter activity for a population of *Gopherus morafkai* in the north-central Sonoran Desert, Arizona. We observed 32 (13 males and 19 females) tortoises at over-wintering refuges from early December through mid-February; 71% used the same refuge in successive years. Most refuges were tunnels and caves in caliche formations, from 0.75 to 4.0 m deep (12 males, 10 females); 10 were superficial (exposed) refuges, either wood rat nests or pallets under shrubs (1 male, 9 females). Hence, females were significantly more likely to occupy superficial refuges than males ($P = 0.024$). For a reduced subset of intensively monitored subjects ($N = 23$), on a given morning from 1 December through 15 February, 10% were observed basking outside of their refuges at air temperatures of 8-22°C. Basking individuals were typically females ($N = 9$ of 14) and rarely males ($N = 1$ of 9); thus, females were significantly more likely to bask than males ($P = 0.029$). Seven individuals were observed with green beaks indicative of recent feeding (6 females, 1 male). All individuals ($N = 36$) under observation emerged from their over-wintering refuge to drink standing water in washes during the first heavy winter rain, a mid-December storm event, at temperatures of ~ 5°C. These observations stand in stark contrast to the widely accepted view that desert tortoises are inactive from November through March in the Southwest.

0343 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

John P. Sullivan, John P. Friel

Cornell University Museum of Vertebrates, Ithaca, New York, USA

Africhthy.org: A Virtual Research Environment and Web Portal for African Fishes

Africhthy.org is an online information management system and social networking site for everyone interested in the ichthyology of Africa. We created Africhthy.org to facilitate efficient information-sharing and collaboration among systematists,

conservationists, fisheries managers, aquaculturists, aquarists, and university students & faculty who work with African fishes, wherever they are based. Africhthy.org makes available an up-to-date taxonomy of African fishes, identification keys, species descriptions and images, an archive for the voluminous “gray literature” on African fishes, discussion forums, an announcement bulletin board, and a multi-authored blog. New publications on African fishes are added and featured on the site regularly. Species pages on Africhthy.org aggregate data and media from the Encyclopedia of Life, IUCN and GBIF, sequence data from NCBI, and literature citations from the Biodiversity Heritage Library. All content is tagged with taxon and watershed IDs from controlled, updatable vocabularies. A new publication module allows for direct preparation and submission of manuscripts to the Pensoft journal ZooKeys. Proposed enhancements will facilitate crowd-sourcing identification of fishes from uploaded images. Since its inception in January 2012, more than 1400 references have been added and more than 120 individuals have registered on the site. Africhthy.org uses the Drupal-based Scratchpads platform developed at the Natural History Museum, London and is one of nearly 600 Scratchpad sites hosted at the NHM. Scratchpads are available to any scientist who completes an online registration form at <http://scratchpads.eu> and are a product of the Virtual Biodiversity Research and Access Network for Taxonomy (ViBRANT) project, funded by the European Union FP7.

0081 AES Stingray Symposium, Mesilla, Friday 12 July 2013

John (Jack) Szczepanski

University of Rhode Island, Kingston, RI, USA

Feeding ecology of the bullnose ray, *Myliobatis freminvillii*, in Delaware Bay

Feeding habits of many batoid elasmobranchs have been recorded, but diets, prey selection, and resource partitioning within specific populations are not fully understood. Few descriptions exist of the diet of a species throughout its entire life history. Through gut content analysis, my research examined the feeding habits of the bullnose ray, *Myliobatis freminvillii*, to understand the diet and trophic role of this species in the estuarine ecosystem at various life stages. I was able to collect a higher abundance of neonate and juvenile rays than expected allowing for a more comprehensive diet characterization than in past studies. 160 specimens (78 male and 82 female) were collected over two years; gastropods, crustaceans, and bivalves were the most abundant prey. *Pagurus longicarpis* was the most important prey item in all indices along with *Euspira heros*, *Busycon* sp. and *Ilyanassa trivittata*. There were small but significant ontogenetic differences in prey weight in which consumption shifted from pagurid crustaceans to bivalves. No significant sexual or temporal differences in diet were exhibited. Significant differences in diet among collection sites indicated potential prey selection by availability. Increasing proportional abundance of smaller size classes through the summer months provides some evidence indicating that Delaware Bay may serve as a nursery area for the bullnose ray. The data shown can provide new

information for future efforts in conservation, ecosystem-based fisheries management and modeling. Preliminary diet characterizations on other sympatric species and trophic ecology comparison between different batoid elasmobranch communities along the Western Atlantic Coast are also discussed briefly.

**0048 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Milton Tan, Jonathan Armbruster

Auburn University, Auburn, AL, USA

What is Miniaturization?: Lack of Miniaturization in the Evolution of Body Size in a Group Including Some of the Smallest Fishes in the World (Danioninae: Cyprinidae)

Miniaturization has occurred numerous times in vertebrate evolution, but there are multiple definitions in the literature for what defines a miniature vertebrate and the process of miniaturization. Danioninae has been previously recognized for its diversity of miniature fishes, including approximately 20-30 species considered miniature and most of the diversity of miniature fishes in the Cyprinidae. Previous work studying body size evolution in the Danioninae coded body size as a binary character (miniature vs. non-miniature) and found multiple transitions to a miniature state; however, a discrete framework potentially biases the interpretation of the evolution of body size. Using phylogenetic comparative methods, we study the evolution of body size as a continuous character in the Danioninae and test whether miniaturization occurs based on two alternative definitions for miniaturization from the literature: 1) a trend in decreasing body size over evolutionary time (the opposite of Cope's rule), or 2) an extreme decrease in body size. A molecular phylogeny was inferred from previously published sequences, and body size data was collected from FishBase and the primary literature. We do not find strong evidence that numerous miniaturization events occur in the Danioninae under these definitions, despite being a clade that includes many fishes considered miniature by the traditional definition. While the traditional definition of miniature fishes will remain useful, we argue that using this definition in an evolutionary context provides a biased and incomplete picture of body size evolution.

0333 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Kevin Tang¹, Peterson Cullimore¹, H.J. Walker²

¹*University of Michigan-Flint, Flint, Michigan, USA*, ²*Scripps Institution of Oceanography, La Jolla, California, USA*

Phylogenetic relationships of the surfperches (Teleostei: Embiotocidae)

Surfperches (family Embiotocidae) form a unique group of fishes that are distributed on both sides of the Pacific Ocean. The family currently includes 13 genera with 23 recognized species, with the bulk of the species found off the west coast of the United States. Embiotocids are biologically interesting because all species display viviparity, a trait not observed in any of their presumed close relatives and found in very few marine bony fishes overall. Sequence data from mitochondrial (12S, 16S, ATPase 8/6, cytochrome *b*, cytochrome *c* oxidase I) and nuclear genes (histone 3, recombination activating gene 1, and *tmo-4c4*) were obtained from all 13 genera (*Amphistichus*, *Brachyistius*, *Cymatogaster*, *Ditrema*, *Embiotoca*, *Hyperprosopon*, *Hypsurus*, *Hysterothorax*, *Micrometrus*, *Neoditrema*, *Phanerodon*, *Rhacochilus*, and *Zalembeus*) and 22 of the 23 species. Species from a number of other percomorph families were also examined to investigate the higher level relationships of Embiotocidae. A phylogeny of surfperch relationships will be presented and the monophyly of the family and its genera will be discussed.

0026 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Christopher Taylor¹, Benjamin Kennedy¹, Sarah West²

¹*Abernathy Fish Technology Center, U.S. Fish and Wildlife Service, Longview, WA, USA*, ²*Biology Department, Whitman College, Walla Walla, WA, USA*

Long-Term Effects of an Integrated Steelhead Supplementation Program

Integrated supplementation programs for salmonids manage hatchery and wild fish as one gene pool, and attempt to correct for many of the potential problems associated with traditional hatchery practices. Obviously, the reproductive success of hatchery-origin fish in the wild is critical for increasing the size of the natural population. While there is some evidence that these programs can be effective at boosting endangered populations, they are not without genetic and/or ecological consequences, and there are currently no long-term natural population studies to evaluate the efficacy of these programs. Abernathy Fish Technology Center has been running a long-term integrated hatchery program for Steelhead on Abernathy Creek (a tributary to the Columbia River estuary) since 1999. Adult returns and natural Steelhead production through 2012 indicate mixed results. Adult returns increased considerably through 2011 with corresponding

increases in natural production. However, adult returns declined precipitously in 2012 and Steelhead redd counts have been on the decline since peaking in 2009. The 2012 decline in Abernathy Creek adult returns was mirrored by an increase in out of basin stray adult fish. Although the impact of ocean conditions on adult returns and instream productivity represent a largely unknown source of variability in our results, the general trend of increased fry and smolt densities across years is promising.

0355 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Christine B. Testerman, Mahmood S. Shivji

Save Our Seas Shark Center USA, Nova Southeastern University, Dania Beach, FL, USA

Comparative Patterns of Global Population Genetic Structure in Four Fisheries Exploited Sharks of Conservation Concern

The great hammerhead (*Sphyrna mokarran*), smooth hammerhead (*S. zygaena*), porbeagle (*Lamna nasus*), and bull shark (*Carcharhinus leucas*) are all commercially exploited. The hammerheads and porbeagles recently received heightened conservation status via recommended CITES Appendix II listings. We evaluated the genetic population structure of these species using globally distributed sample sets (*S. mokarran* n=312, *S. zygaena* n=332, *L. nasus* n=224 and *C. leucas* n=490) and nuclear markers and/or mitochondrial control region (mtCR) sequences. All four species showed statistically significant genetic partitioning on large scales, i.e., between hemispheres (*L. nasus* mtCR $f_{ST} = 0.8273$) or oceanic basins (*S. mokarran* mtCR $f_{ST} = 0.8745$, nuclear $F_{ST} = 0.1113$; *S. zygaena* mtCR $f_{ST} = 0.8159$, nuclear $F_{ST} = 0.0495$; *C. leucas* nuclear $F_{ST} = 0.1564$). Furthermore, *S. zygaena* mtCR sequences indicated statistically significant matrilineal genetic structuring within oceanic basins, but no intra-basin structure was detected with microsatellites. *S. mokarran* showed shallow but statistically significant genetic structure within oceanic basins with both nuclear and mitochondrial data, albeit with some differences between the two marker types in fine scale patterns involving northern Indian Ocean samples. A microsatellite assessment of *C. leucas* demonstrated no population structuring within the Atlantic or Indo-Pacific, with the exception that samples from Fiji were differentiated from the remaining Indo-Pacific Ocean locations. In contrast, the *L. nasus* mtCR and nuclear ITS2 sequences revealed strong northern vs. southern hemispheric population differentiation, but no differentiation within these hemispheres. These geographic patterns of genetic structure will inform stock delineation and other conservation and management efforts.

0765 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Kevin Tewell, Jarrett Johnson

Western Kentucky University, Bowling Green, KY, USA

Subpopulation clustering and landscape genetics of pond-breeding salamanders (*Ambystoma opacum*) in continuously forested habitat

Landscape features may influence the patterns of migration and dispersal of amphibian species and create genetic structure. A primary goal of landscape genetics is to analyze these influences in order to make more informed management decisions. We sampled larvae from 50 breeding ponds within the boundaries of Mammoth Cave National Park and genotyped 12 individuals per pond at 10 microsatellite loci to estimate gene flow between ponds. We used GIS layers of habitat types to conduct a least-cost path analysis and determine the relative cost of movement through each habitat type. We were interested in answering two questions: does structure exist in this continuous landscape, and does a single pond equal a mating population? Preliminary data indicate that structure does exist at the park. Our results show that a landscape genetics approach is an appropriate mechanism for determining population structure and the size and locations of randomly mating populations.

0126 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Meagan Thomas, Stephen Mullin

Eastern Illinois University, Charleston, Illinois, USA

Measuring Niche Overlap in a Community of Invertebrate Eating Snakes

Competition for resources exerts significant influence in the structure of biological communities, particularly when species having similar habitat requirements are involved. Despite their widespread abundance and role as successful predators, there is a paucity of information about niche partitioning among snake species. The dietary ecology of invertebrate specialists, in particular, is difficult to study because of the relatively rapid digestion of prey. Using stable isotope analysis, we quantified the dietary niche overlap between five different species of invertebrate eating snakes (genera: *Coluber*, *Diadophis*, *Opheodrys*, and *Storeria*). We collected blood, scale, and tail tissue from wild-caught snakes, as well as a range of whole prey specimens to assess niche partitioning between species across a broad temporal scale. All samples were freeze-dried, homogenized, and analyzed using mass spectroscopy. We used a 2-way ANOVA to assess whether or not food-resource partitioning was present in this

community, and determine whether or not there were any interactions between species and the rate of resource uptake in tissues. We discuss our findings as they pertain to the co-existence of these snakes in a single habitat. Similar analyses can reveal fine-scale shifts in diet that have the potential to alter the dynamics of the trophic web within a given community.

**0401 NIA BEST STUDENT POSTER, Poster Session II, NW Exhibit Hall,
Saturday 13 July 2013**

Andréa Thomaz¹, Dahiana Arcila-Mesa², Luiz R. Malabarba³, Guillermo Orti²

¹University of Michigan, Ann Arbor, MI, USA, ²The George Washington University, Washington, DC, USA, ³Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil

Molecular Phylogeny of the Subfamily Stevardiinae Gill, 1858 (Characiformes: Characidae) – Major Clades and the Evolution of Reproductive Traits

Stevardiinae is a diverse and widely distributed monophyletic clade of tetras (Characidae) from South and Central America. This group was first proposed as a monophyletic group named “Clade A” (*sensu* Malabarba & Weitzman), and recently received the status of subfamily in a comprehensive characid phylogeny (*sensu* Miranda). Today, this subfamily includes 46 genera and around 300 valid species, with many species presenting sexual dimorphism, with hypertrophied glandular tissues and modifications of fin rays and scales on males, putatively related to the inseminating reproductive behavior. Hitherto, just phylogenies with few representatives of this subfamily were proposed, lacking hypotheses that embrace the subfamily as a whole. We present a molecular phylogeny with the largest number of stevardiine species analyzed so far, testing its monophyly and internal relationships. Our study analyzed 356 samples from 158 species/morphospecies distributed in 33 genera putatively included in this group and 17 outgroup characid taxa. The phylogeny was inferred with seven genes (mtDNA: 12S, 16S and COI; nuclear: Rag1, Rag2, myh6 and PTR). The results support the subfamily as monophyletic with seven main clades: *Markiana* + *Bryconamericus scleroparius* group as the sister group for the rest; Xenurobryconini (without *Argopleura*); Glandulocaudini + Corynopomini; *Acrobrycon* + *Hemibrycon*; *Carlasyanax* + *Creagrutus* + *Monotocheirodon*; Amazon *Bryconamericus* + *Knodus*; and southern South America *Bryconamericus*. Inseminating species are present in several clades within this subfamily. The previously proposed tribes Xenurobryconini, Diapomini, Hysterotini and Stevardiini were found polyphyletic. This phylogeny is the first to demonstrate a detailed hypothesis of the internal relationships for this subfamily.

**0531 General Ichthyology, Ruidoso/Pecos, Thursday 11 July 2013; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Andréa Thomaz¹, Luiz R. Malabarba², L. Lacey Knowles¹

¹University of Michigan, Ann Arbor, MI, USA, ²Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil

Testing the combined effect of sea-level changes and habitat stability on genetic differentiation in a freshwater Neotropical fish

Although a species' vagility mediates effective dispersal, habitat and climate extrinsically regulate a species' dispersal opportunities. Freshwater fish distributions are expected to reflect the topographic events of a region because they are strictly dependent on historical river connections for dispersal. Also, fish distributions were affected by glacial cycles during the Pleistocene that physically changed the habitat. The rivers that drain the southeastern coast of Brazil are ideal for estimating and contrasting dispersal routes because they experienced consecutive fluctuations in river networks due to sea-level changes during glacial periods. Also, this region encompasses the Atlantic Rainforest, which was reduced to small refugial areas during the Last Glacial Maximum (LGM). This study tests the impact of two scenarios [(1) palaeodrainages and (2) forest refugia during LGM] on the population genetic structure of a forest dependent freshwater fish (*Hollandichthys multifasciatus*: Teleostei: Characidae). Explicit predictions for both scenarios were made using GIS tools and habitat envelopes for the forest and were contrasted with patterns of genetic variation among populations. Preliminary results based on AMOVA for mtDNA demonstrate that palaeodrainages explain 68% of the genetic divergence in *H. multifasciatus*. When testing palaeodrainages in forest refugia vs. non-refugia areas, palaeodrainages explain 57% of the genetic differentiation among populations in refugia, while they are not a significant factor for non-refugial areas. Further analyses will be developed with RADSeq using model-based inferences (i.e. ABC). These preliminary results demonstrate the importance of considering stability of habitat affiliations relative to biogeographic barriers as a potential influence on fish dispersal capability.

0149 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Kenneth Thompson¹, Clark Hubbs²

¹Lock Haven University of Pennsylvania, Lock Haven, PA, USA, ²The University of Texas, Austin, TX, USA

Artificially Produced Intergeneric Hybrids Among Eight Genera of Neotropical Cichlidae

Hybrids were artificially produced by stripping and mixing gametes from eight species of Neotropical Cichlidae. Female *Herichthys cyanoguttatus* were crossed with conspecific males and males of seven other genera (*Rocio*, *Cichlasoma*, *Amphilophus*, *Caquetaia*, *Geophagus*, *Archocentrus* and *Cryptoheros*). All crosses produced viable hybrids. Hybrid viability was compared with that of control crosses as a preliminary indication of evolutionary distance. Hybrid viability was calculated as the ratio of heterospecific / homospecific survival. Viability calculated at hatching ranged from 8.00 - 70.3% while viability of controls was 42.3%. Viability calculated at 25 days of age ranged from 1.1 - 24.6% for hybrids compared to 33.3% for controls. Meristic data confirm that hybrids are physically intermediate between the parental species. Color patterns for F₁ hybrids as determined by analysis of color photos of living specimens were found to be intermediate as well. C-metaphase karyotypes from gill epithelium were produced for both hybrids and parental species. These data indicate the intermediate nature of the karyotypes. The hybrid karyotypes were also used to compare chromosome size between the various species included in this study.

0299 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Linda Thompson, Carl Anthony, Ralph Saporito

John Carroll University, University Heights, OH, USA

Using geographic variation in morph frequency to test apostatic selection for color in red-backed salamanders

Negative frequency-dependent (apostatic) selection by predators results from higher than expected predation rates on common prey types. This provides a survival advantage to rare forms and is one way in which polymorphisms may be maintained in natural populations. At least eight species within the salamander family Plethodontidae are polymorphic for presence or absence of a dorsal stripe and populations vary in their degree of polymorphism. For example, on the southern shore of Lake Erie (Ohio, USA), populations of Eastern Red-backed Salamanders (*Plethodon cinereus*) grade from those made up of all striped individuals in the east to populations dominated by unstriped individuals to the west. We used this natural geographic variation in morph frequencies

to pose hypotheses about predation rates on the two phenotypes. We predicted that in populations made up of only striped individuals, the unstriped phenotype would exhibit rare form advantage, but that in mixed populations, or populations dominated by unstriped individuals, this advantage would disappear. To test these predictions, we placed equal numbers of striped and unstriped clay model replicas (n=1800) across three population types (monomorphic striped, mixed, unstriped dominant) and scored predation attempts by birds and mammals. The position of bite marks on the models suggested that predators were treating the model salamanders as prey items. However, we did not detect any statistically significant differences in predation rate across population types, suggesting that frequency dependent selection may not be operating to maintain color polymorphism in this system.

0250 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Ryan Thoni, Richard L. Mayden

Saint Louis University, Saint Louis, MO, USA

Morphological Variation of the “*Catostomus plebeius*” Complex from the Rivers of the Sierra Madre Occidental, Mexico (Cypriniformes, Catostomidae)

The Rio Grande Sucker, *Catostomus plebeius*, is known to occur from the Upper Rio Grande drainage in Colorado and New Mexico, south through endorheic basins and headwaters of Pacific Slope drainages to Durango and Zacatecas, Mexico. This species has received some attention for morphological and molecular variation from various researchers in previous years. Populations in Mexico, however, have simply been without investigation, largely because of the difficult terrain of the Sierra Madre Occidental and the dangers associated with conducting fieldwork in these rivers and canyons. After 20 years of sampling in these rivers of Mexico we have amassed a significant number of samples from most of the known drainages for study. Here we examine both meristic and morphometric variation of this species complex. Coloration and other features were also evaluated. All of these character-based features and a summary of molecular studies are used to assess diversity in this species complex.

0301 Fish Systematics I, Galisteo/Aztec, Thursday 11 July 2013

Michelle Tipton, Barry Chernoff

Wesleyan University, Middletown, CT, USA

How Many Species of Blacknose Dace Are There?

Recognition of species within the Blacknose Dace Complex has been controversial. There have been 13 nominal species proposed for fishes in this complex. Morphological

analyses have been ambiguous and field identification is complicated by the lack of consistently diagnostic characteristics. This has led to conflicting statements of species recognition and their geographic ranges. Since the 1940's, all authors have recognized *Rhinichthys atratulus* as valid and some have also recognized *R. obtusus* as valid. Genetic analyses of nine microsatellite loci and two mitochondrial genes from Blacknose Dace across the eastern half of North America revealed two monophyletic groups, corresponding to *R. atratulus* and *R. obtusus* with approximately 10% sequence divergence between them (Tipton & Chernoff 2013). *R. atratulus* is distributed in Atlantic and southeastern Great Lakes drainages, while a larger and more genetically and geographically diverse clade of *R. obtusus* inhabits St. Lawrence, Great Lakes, Mississippi and Gulf Coast drainages. Further analyses reveal that the genetic variation within the *R. obtusus* clade is approximately five times higher than within the *R. atratulus* clade. Phylogenetic analyses within *R. obtusus* demonstrate clear distinctions among subclades that are geographically coherent. These subclades have diverged genetically by approximately 5%. Based upon previous and current genetic analyses, we recognize the following four species within the Blacknose Dace Complex: *Rhinichthys atratulus* (Hermann), Eastern Blacknose Dace; *R. obtusus* Agassiz, Southern Blacknose Dace; *R. meleagris* Agassiz, Western Blacknose Dace; and *R. productus* (Storer), Central Blacknose Dace.

**0638 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, San Miguel,
Friday 12 July 2013**

James Titus-McQuillan, Aaron Bauer, Todd Jackman

Villanova University, Villanova, PA, USA

**Phylogenetic Relationships Among African Shovel-nose Snakes (Serpentes:
Lamprophiidae)**

The lamprophiid genus *Prosymna* comprises 16 species of small snakes ranging from Senegal to Kenya and Somalia and south to South Africa that are characterized by a modified rostral scale giving them a shovel-nosed appearance. They prey on small squamates and several species are believed to be specialist feeders on hard-shelled gecko eggs. Preliminary data on the mechanism of egg-eating suggests that eggs may be broken by a modified maxilla and their contents extruded by muscular-contraction of the forebody. Higher order affinities of *Prosymna* are controversial and they have been variously placed in the Elapidae, Colubridae, or Lamprophiidae, or have been accorded familial rank as the sole member of the Prosymnidae. To date there has been no explicit phylogeny for the genus and sequence data are available for only five species. We investigated relationships among 10 species in the genus using both mitochondrial (Cyt B, ND2, and 16s) and nuclear markers (RAG1, C-MOS, MXAR5, and ENC1). Data were analyzed under maximum likelihood, maximum parsimony, and Bayesian Inference. The northern Namibian/Angolan *P. visseri* is sister to all other congeners. West African species (*P. meleagris* and *P. greigerti*) are sister taxa to one another and are nested within

a larger clade including *P. ambigua*, *P. janii*, and *P. stuhlmannii*, which is, in turn, sister to a southern clade comprising *P. bivittata*, *P. lineata*, *P. frontalis*, and *P. sundevallii* is sister to this. This preliminary phylogeny can serve as the basis for an explicit assessment of the evolution of egg-eating within *Prosymna*.

0608 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Glenys Tordecilla-Petro¹, Fredys F. Segura-Guevara², Charles W. Olaya-Nieto²

¹Institución Educativa Román Chica Olaya, Alcaldía Municipal de Lorica, Córdoba, Colombia, ²Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas, Universidad de Córdoba, Lorica, Córdoba, Colombia

Evaluation of the Growth Basic Parameters of Moncholo (*Hoplias malabaricus*) for Several Annual Cycles in the Ciénaga Grande de Lorica, Sinu River System, Colombia

In order to evaluate the growth basic parameters of Moncholo (*Hoplias malabaricus*) for several annual cycles in the Ciénaga Grande de Lorica, 3215 individuals were collected between Enero 2000 and July 2007. The sizes ranged between 17.9 and 46.2 cm in total length (TL) and the total weight (TW) between 55.0 and 1304.0 gram (g). The length-weight relationship and the condition factor for both sexes were estimated with the equation $TW = a TL^b$ and $CF = TW/TL^b$, respectively. The equation estimate was $TW = 0.009 (\pm 0.04) TL^{3.04 (\pm 0.03)}$, $r = 0.97$, $n = 3215$, with positive allometric growth coefficient and high correlation coefficient. The growth coefficient ranged from 2.96 (2000 year) and 3.04 (2003 year), without significant statistical differences, and the condition factor ranged from 0.010 (2003 and 2007 years) and 0.013 (2000 year), without significant statistical differences too; and direct correlation between the condition factor, levels of the Ciénaga Grande de Lorica and the spawning season of the species was not found. Considering the information analyzed, it is inferred that growth in length and weight of Moncholo has adapted to the new hydrological conditions of Ciénaga Grande de Lorica, because significant statistical differences between the years studied were not observed.

0221 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Stephanie Tougas, Rose Carlson

Fordham University, Bronx, NY, USA

Drivers of darter fish (Percidae) community composition in Tennessee, USA.

Darters (Percidae) are benthic dwelling fish that inhabit small streams and are often used as bioindicator species in assessments of stream quality. Darters have small home

ranges and specialized habitat requirements such as clean substrate and high flow. Darters are also sensitive to many factors associated with degraded aquatic habitats, particularly urban environments, such as high turbidity and temperature. Existing studies have analyzed urban-associated species composition changes at the fish community level, but few examine effects within one fish family. Identifying key anthropogenic stresses on composition changes within the darter family will shed light on how sensitive fish species are expected to respond to an increase in these stresses in an urbanizing landscape. My study analyzes drivers of darter composition of creeks and small rivers across ten sites in Tennessee, USA. I identified 22 darter species, with richness ranging from one to nine species. A multiple linear regression with richness as the response variable and dissolved oxygen, turbidity, water temperature and pH as explanatory variables revealed that the best predictor of richness was a model including both turbidity and water temperature. In addition, I am using GIS to analyze impacts of road and population density on darter composition and richness. These findings will help focus fish conservation efforts to avoid extirpation of sensitive species such as darters.

0017 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Stanley Trauth¹, James Walker², James Cordes³

¹Arkansas State University, State University, AR, USA, ²University of Arkansas, Fayetteville, AR, USA, ³Louisiana State University - Eunice, Eunice, LA, USA

Morphology of the Urogenital Papilla in Lizards with Comments on Its Structure in Hybrid Gynandromorphs of the Genus *Aspidoscelis*

We examined the urogenital papilla (UGP) of members of six families of saurians (Anguillidae, Crotophytidae, Phrynosomatidae, Polychridae, Scincidae, and Teiidae) using macrophotography as well as light and scanning electron microscopy. The UGP is either a single, medial structure or are paired, bilateral papillae. A UGP projects ventrally from the dorsal wall of the cloacal chamber and is similar in structure and complexity to that found in most snake species studied thus far. Papillary prominences are basally supported by folds, mounds, or ridges of tissue, which lie along the anteroposterior axis of the body. Two urogenital orifices are present, and they can either be widely or narrowly separated. Internally, paired and highly-folded ampullae urogenital papillae are present. Individual UGP can be described as simple mounds (e.g., in *Sceloporus consobrinus*), conical towers (in *Crotaphytus collaris*, *Anolis carolinensis*, and *Scincella lateralis*), and elongated folds (in *Ophisaurus attentuatus* and *Plestiodon laticeps*). The UGP varies in basic design in the genus *Aspidoscelis* with *A. sexlineata* exhibiting several distinctive papillary morphologies. Other species in this genus, such as *A. gularis*, *A. marmorata*, and *A. septemvittata* exhibit grooved, papillary mounds with fleshy-lipped orifices. Hybrids and hybrid gynandromorphs of diploid, hybrid-derived *A. laredoensis* x *A. gularis* have robust UGP morphologies, remarkably different from the micro-anatomies of diploid members of the genus.

0347 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Joel Trexler, Chris Catano

Florida International University, North Miami, FL, USA

Emergent Effects of Disturbance Frequency and Return Time on a Wetland Metacommunity

Hydrological fluctuation and recurrent drying that characterize wetlands limit fishes living there to species with life history adaptations permitting survival of disturbance or dispersal to and from aquatic refuges. We tested the hypothesis that drought acts as an environmental filter to alter fish community composition and that recurrent drought leads to changes beyond the immediate effect of a single drought event. We predict that water removal leading to diminished time between droughts and increased severity of drought drives change in community composition by favoring species with rapid recovery. The Everglades is a large wetland that has experienced an increased frequency of drying in the past 10 years. After accounting for direct effects of drying on fish biomass, we observed decreasing biomass of fishes between 1996 and 2012 at 11 of 21 study sites and increase in only one, and seven of the decreasing sites were in areas also experiencing increasing frequency of drying events. We evaluated fish movement, speed and directionality in the Everglades by use of sampling with drift fences and ranked species based on these traits. Community composition changed by increase of species demonstrating rapid movement and directedness (eastern mosquitofish and flagfish) and decrease of species demonstrating slower movement and less directedness (bluefin killifish, least killifish, and sailfin mollies).

0406 AES Reproduction, Mesilla, Sunday 14 July 2013

Cindy Tribuzio¹, Calvin Blood², Beth Matta², Chris Gburski², Wally Buble³, Gordon Kruse⁴

¹Auke Bay Laboratories, Juneau, AK, USA, ²Alaska Fisheries Science Center, Seattle, WA, USA, ³Texas Parks and Wildlife, Lavaca, TX, USA, ⁴University of Alaska Fairbanks, Fairbanks, AK, USA

The Spiny Issue of Ageing Spiny Dogfish: Historical Dogma vs. New Methods

The dogma of using the dorsal fin spine to age spiny dogfish (*Squalus suckleyi*) has been in existence for over 30 years. With these well established methods, the species has a rather long history of published literature on age and growth. However, a problem with this method is that the dorsal fin spine, which protrudes from the body into the

environment, is sometimes broken and often worn, thus creating lost or difficult-to-read annuli. Recent research on an Atlantic congener (*Squalus acanthias*) found that a technique using histological staining of vertebrae thin sections made it possible to count annuli, thus eliminating the sources of uncertainty associated with worn spines. However, this vertebral method has yet to be tested in the much longer lived North Pacific spiny dogfish. Our study examines both age structures and compares inter- and intra-reader as well as inter-lab variability in reading annuli to determine which method produces the most precise ages for the North Pacific spiny dogfish. Results suggest a substantial decrease in intra- and inter-reader variability when the vertebrae method is compared to the dorsal fin spine method. Preliminary analyses also show that there are multiple sources of measurement error when using the spine method, sources that do not exist with the vertebrae method, and that inter-reader variance increases substantially more with increasing age with the spine method than with the vertebrae method.

0471 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Bradley Truett, Steven Poe

University of New Mexico, Albuquerque, NM, USA

Revisiting the Aquatic Anole Ecomorph

We use both nuclear and mitochondrial genes (NDAH2, CO1, and ECEL1) to build a phylogeny and identify evolutionary relationships between aquatic anoles (*Anolis barkeri*, *A. robinsoni*, *A. riparius*, *A. aquaticus*, *A. lionotus*, *A. poecilopus*, *A. vermicularis*, *A. eugenegrahami*, and *A. maculagula*) and a potential new aquatic anole species from Monte Verde Costa Rica. Aquatic lifestyle among anoles appears to have multiple origins, with no phylogenetic basis of adaptation to aquatic conditions. I measured 24 morphological characters to evaluate aquatic ecomorphology. Using these measurements, the ancestral traits of non-aquatic sister species were predicted in order to identify potential intermediate aquatic traits.

0436 ASIH Fish Out of Water Symposium, Brazos, Saturday 13 July 2013

Thomas Turner¹, Trevor Krabbenhoft²

¹*University of New Mexico, Albuquerque, New Mexico, USA*, ²*Texas A&M University, College Station, Texas, USA*

Comparative Genomics of Fishes in a Drying River: Are Stress and Immune Responses Similar Across Species?

Regional climate models predict extensive drying in rivers of the southwestern US over the coming decades. Fishes will likely be challenged with increasingly harsh physiological conditions and parasite loads that accompany a warming and drying climate. We present a comparative transcriptomic study aimed at understanding similarities and differences in immune- and stress-related gene expression patterns in cyprinid fishes collected from a drying river reach in the Rio Grande. The study species, Red Shiner, Flathead Chub, and Common Carp, were presumably exposed to similar pathogens, thermal, and oxygen stress. RNA-seq was conducted for each species in the Illumina platform. Library construction and sequencing was specifically designed to detect tissue-specific expression patterns among organs (skin, gut, gill, kidney & spleen) that mount different kinds of immunological response to pathogens. Reference transcriptomes were assembled and annotated for each species, and gene ontology terms were used to search for transcripts associated with immune and stress response. Once identified, we tested for similarities and differences of transcript expression and nucleotide sequence differences across genes, tissue types, individuals, and species. Our study highlights the potential of comparative genomics of non-model organisms as a research tool to help link performance, physiological ecology, and conservation biology. However, it is only a tool, and does not substitute for good questions that are motivated by natural history, organismal biology, and pressing environmental concerns.

0252 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

Nicole Valenzuela, Srihari Radhakrishnan, Robert Literman

Iowa State University, Ames, IA, USA

How The Turtle Gets Its Sex: Comparative Transcriptomics of TSD and GSD Turtle Embryos During Sexual Development

Vertebrates sex determination ranges from systems controlled by an individual's genotype (GSD) to systems controlled by the temperature experienced during embryogenesis (TSD). Here, we present the results of a comparative transcriptomic approach to decipher the composition of the gene network controlling turtle sexual development and how it differs between TSD and GSD taxa. Our goal is to test the

hypothesis that TSD and GSD networks are essentially the same, but that qualitative and/or quantitative differences in expression of key elements results in sex determination by temperature rather than by genotypic constitution. Our dataset includes gonadal transcriptomic time series (Illumina RNA-seq) encompassing embryonic stages prior to, at the onset and during the thermosensitive period, of *Chrysemys picta* (TSD), *Podocnemis expansa* (TSD) and *Apalone spinifera* (GSD) turtles incubated at male- and female- producing temperature (high/low for GSD). We contrast the results of two bioinformatics approaches, one utilizing the newly assembled *C. picta* genome to perform a genome-guided assembly of the transcriptomes, plus a de novo assembly to account for the evolutionary divergence among taxa. We identify differentially regulated genes between male- and female- producing temperatures across developmental stages, revealing a level of conservation in the composition of the genetic machinery underlying vertebrate gonadogenesis, at the same time that they uncover novel elements, including new candidate genes that participate in gonadogenesis and candidate thermosensitive TSD genes. Thus, our results shed light on the genetic basis of a complex system (sexual phenotype), its environmental susceptibility (TSD v GSD), and evolutionary potential (divergence among species).

0708 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Sara Valenzuela¹, Gamaliel Castañeda¹, Tamara Rioja², Arturo Carrillo²

¹Universidad Juárez del Estado de Durango, Durango, Mexico; ²Universidad de Ciencias y Artes de Chiapas, Chiapas, Mexico

Thermal ecology of the spiny tailed lizard *Ctenosaura oaxacana*

The priority of the ectothermic animals is to stay cold on warm habitats. This reason put them on high risk specially when the environment has a high human pressure reducing thermal quality of the habitat. Actually there are some protocols to understand lizard's thermal behavior. This study evaluates the thermal ecology of *Ctenosaura oaxacana* in four vegetation types within the locality of Montecillo Santa Cruz, Oaxaca. Sampling was carried out on two seasons: dry and wet. Thermal preference (Tsel) was recorder inside an artificial thermal gradient, body temperatures were recorder on field with an electronic thermometer (Ibutton®) attached to the body of the iguanas and environmental temperatures was calculated using data loggers deployed on every general microhabitat available on each vegetation type. Thermal quality, precision and effectiveness on thermoregulation were evaluated considering Hertz et al. protocol. The environmental and body temperatures were closer to the Tset obtained during the dry session. Secondary vegetation showed the higher thermal quality of the habitat on both seasons, which probably promoted a higher precision for thermoregulation on *C. oaxacana*. During dry season, thermoregulation effectiveness was better on the secondary vegetation meanwhile during wet session was on the grassland vegetation. Despite general results, spiny tailed iguana thermoregulates actively with variations among seasons and vegetation types. This suggests that the species could tolerate some

changes on the environment but can also be vulnerable if thermal thresholds are affected dramatically.

0064 Herp Development & Reproduction, Ruidoso/Pecos, Sunday 14 July 2013

James Van Dyke, Oliver Griffith, Michael Thompson

University of Sydney, Sydney, NSW, Australia

Conditions Favoring the Evolution of Placental Provisioning in a Viviparous Skink: Hungry Moms and Infanticidal Cannibalism.

Placentotrophy, the nourishment of offspring via a placenta, has evolved repeatedly in vertebrates, including five times in squamates. Theory has predicted that the evolution of placentotrophy requires that food resources be abundant and stable throughout gestation. If food availability is not consistently abundant enough to permit successful reproduction, theory predicts that placentotrophic females should be pre-adapted to recoup nutrition invested in reproduction. We tested these hypotheses in the placentotrophic skink, *Pseudemoia entrecasteauxii*. We fed females one of four diets (high constant, high stochastic, low constant, and low stochastic) during gestation, and tested the effects of both food amount and stochasticity of food availability on maternal body condition and reproductive variables. Low food availability significantly reduced maternal body condition, developmental success, and offspring size. Females on low food diets were significantly more likely to cannibalize both undeveloped eggs and developed offspring. Stochasticity of food availability did not significantly affect any maternal or offspring characteristic. Taken together, our results support the hypotheses that placentotrophy is most likely to be a successful strategy of offspring provisioning when food resources are abundant, and that cannibalism allows females to recoup nutrition provisioned to offspring if food resources are too low to permit successful reproduction. However, our results did not support the hypothesis that stability of food availability was necessary for the evolution of placentotrophy. Forthcoming analyses will examine the effects of diet manipulations on nutritional contents of mothers and offspring, and will determine whether placental nutrients are allocated from income or capital sources.

0258 Amphibian Conservation, Galisteo/Aztec, Friday 12 July 2013

Robin Van Meter, Donna Glinski, Matthew Henderson, Thomas Purucker

US Environmental Protection Agency, Athens, GA, USA

Pesticide Uptake Across Amphibian Dermis after Simulating an Aerial Overspray

Accumulation of pesticides through dermal contact in terrestrial amphibians is a primary route of exposure in agricultural landscapes and may be a contributing factor in widespread amphibian declines. To demonstrate the transfer of pesticides across the amphibian dermis at permitted label application rates, our study was designed to measure pesticide body burdens after two simulated aerial overspray exposure scenarios. We compared direct exposures, where amphibians were present when spraying occurred, to indirect exposures, where amphibians were exposed to soils after aerial pesticide application. During summer 2012, we reared green and barking treefrogs (*Hyla cinerea* and *Hyla gratiosa*, respectively) through 60-90 days post-metamorphosis at the US EPA in Athens, GA. We tested exposure to 5 pesticide active ingredients (imidacloprid, atrazine, triadimefon, fipronil or pendimethalin, including known metabolites) in glass aquariums lined with soil for 8 hours. We quantified total pesticide body burden and soil concentrations using LC-MS. All individuals in both treatments had measurable body burdens at the end of the study. However, body burdens and bioconcentration factors were significantly greater in the simulated overspray treatment relative to the soil spray treatment for both species and across all pesticides tested. Our study demonstrates the potential for dermal routes of pesticide exposure among terrestrial amphibians present in agricultural fields during or immediately after aerial application of pesticides, and significantly higher body burdens for direct versus indirect exposure scenarios.

0729 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

John Vanek¹, Dennis Wasko²

¹*Hofstra University, Hempstead, NY, USA*, ²*University of Hartford, West Hartford, CT, USA*

Spatial Ecology of Eastern Hognose Snakes at the Northeastern Extent of their Range

Eastern Hognose Snakes (*Heterodon platirhinos*) are thought to be declining in many areas, and are considered a "Species of Special Concern" in New York and a "Species of

Regional Concern" in the northeast. We studied the spatial ecology of Eastern Hognose Snakes in Saratoga County, NY, at the northern extent of their range in the northeast. We located snakes (n=12) during random encounter surveys and radio-tracked (n=6) those found before August and that were >100g. At each re-location we recorded GPS location, habitat data and behavioral observations. Home range size was determined using both minimum convex polygon (mean= 29.5 ha, range= 1.4 - 66.8 ha) and 95 percent kernel density estimators (mean= 49.3 ha, range= 3.1 - 155.0 ha). The majority of re-locations occurred in forested areas, but compositional analysis revealed that radio-tracked snakes had a strong preference for open areas, similar to studies in other parts of the species' range. Open habitat was used heavily after spring emergence and during the nesting season. We found no evidence of communal hibernation or communal nesting at this site. We recommend that conservation action for Eastern Hognose Snakes in the region should focus on preservation of open habitat, particularly during the spring and early summer.

0361 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

João Paulo Vasconcelos, Guilherme F. Gondolo

Laboratório de Ictiologia - Campus Heróis do Jenipapo - Universidade Estadual do Piauí, Campo Maior/PI, Brazil

Extended Distribution of *Phrynops geoffroanus* Schweigger, 1812 (Testudines: Chelidae) for Parnaíba River Basin, State of Piauí, Northeastern Brazil

The genus *Phrynops* has 11 species and numerous subspecies distributed throughout Neotropical Region. Records of the occurrence of this genus are found for most of the main river basins in Brazil. This paper reports the expansion of the distribution of *Phrynops geoffroanus*. Two specimens of this species were captured as bycatch in longline operations deployed in the Poti River (5°11'28.62"S-41°42'39.00"W) State of Piauí, northeastern Brazil. The specimens are distinguished from other species of the genus by the flat, oval carapace, often wider in the posterior region, with brown or black coloration. The plastron is cream-colored (sometimes reddish) and marked by numerous black spots, which may disappear on adults. The head has a black stripe extending from the nostrils to the base of the neck, separating a grayish-black dorsal region from a cream-colored ventral region, marked by several black stripes and spots; a black horseshoe-shaped mark on the gular region and long barbels. This is the first record of *P. geoffroanus*, for the Parnaíba River Basin. The distribution of the species was previously only known for others rivers basins. This record underscores the lack of studies carried out in the region, where one of the greatest difficulties is the little incentive for scientific research. The present study contributes to a better understanding of the biogeography of the genus. It should be stressed that the record of this species appears at a time in which conservation actions are being proposed for the construction of a dam that is currently in the planning stage.

0359 AES Behavior, San Miguel, Sunday 14 July 2013

Jeremy Vaudo¹, Bradley Wetherbee², Anthony Wood³, Lucy Howey-Jordan¹,
Mahmood Shivji¹

¹Guy Harvey Research Institute, Oceanographic Center, Nova Southeastern University,
Dania Beach, FL, USA, ²University of Rhode Island, Kingstown, RI, USA, ³NOAA,
NMFS, NEFSC, Woods Hole, MA, USA

Movements of mako sharks (*Isurus oxyrinchus*) tagged in the western North Atlantic Ocean

The mako shark (*Isurus oxyrinchus*) is a wide ranging species found in temperate and tropical waters worldwide. Although mako sharks are regularly encountered on the east coast of the United States, knowledge of their movements in this region is primarily based on catch records and tag returns. To investigate the movements of mako sharks tagged in the western North Atlantic Ocean, six individuals (130 - 244 cm FL) were tagged with pop-up satellite archival tags off the coast of Rhode Island during summers between 2004 and 2008. All six tags reported, providing depth and temperature data from a span of 412 days (range: 12 - 183 days). The two sharks tracked for over 100 days traveled south during autumn with one shark reaching South Carolina (displacement: ~1100 km over 183 days) and the other reaching the Bahamas (displacement: ~2000 km over 122 days). Mako shark vertical habitat use appears to be constrained by the thermocline. Sharks typically remained in the mixed layer, but spent more time below the thermocline during the daytime, with two sharks diving deeper than 500 m (maximum depth: 866 m). Mako sharks encountered a wide range of temperatures. The minimum and maximum temperatures experienced were 5.2 and 27.1°C, respectively. Sharks also tended to make deeper dives in warmer water masses, although minimum temperatures experienced were similar regardless of water mass, suggesting temperature may limit dive depths.

0203 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Álvaro A. Velásquez¹, Astrid Muñoz-Ortiz¹, Carlos E. Guarnizo², Andrew J. Crawford¹

¹Universidad de los Andes, Bogotá, DC., Colombia, ²Universidade de Brasilia, Brasilia, DF, Brazil

The role of orogeny and paleoclimate change in driving allopatry in the Colombian Andes frog *Rheobates palmatus*.

Geographic features and past climate events have been suggested as obstacles that limit dispersal, promote vicariance and divergence, and lead to allopatric speciation. We used the mid-elevation Andean frog *Rheobates palmatus* (Anura: Aromobatidae) to evaluate the role of high elevations (the Colombian Northern Andes highest peaks) and low elevations (the Magdalena river Valley) in creating barriers to dispersal and promoting vicariance. We used mitochondrial and nuclear DNA sequences to infer phylogenetic relationships and divergence times to test the role of climatic variables in determining the presence of geographic boundaries of the species. We found that the phylogeny of *Rheobates* is largely predicted by geography. Environmental niche tests indicated that the Magdalena Valley and the high peaks of the Eastern Cordillera are significant environmental barriers to *R. palmatus* populations. Therefore, geological as well as climatic barriers have played an important role in the diversification of *Rheobates*. Our data suggest that these frogs started to diverge during the early Miocene, which coincides with the uplift of Colombia's Eastern Cordillera. We found no evidence of recent contact across the Magdalena Valley, suggesting that Pleistocene climate fluctuations did not promote lowland crossings via downward shifts in distributions. Thus, our study offers broad support for the classic mountain orogeny model of vicariant divergence, and also suggests that lowland habitat heterogeneity may have played a long-term role in promoting vicariance as well.

0237 SSAR SEIBERT AWARD CONSERVATION, Galisteo/Aztec, Friday 12 July 2013

Philip N. Vogrinc, John D. Willson

Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas, USA

Variation in Effectiveness Among Commonly-Used Sampling Techniques Influences Accurate Assessment of Community Composition and Abundance of Semi-aquatic Snakes

Measures of community composition and abundance are important for species inventories, monitoring, and informed management decisions. The desire to maximize

capture rates of particular target species often results in the use of a single sampling technique or many dissimilar techniques, often without consideration of potential methodological biases. We sampled an aquatic snake community in South Carolina using three popular capture techniques (nocturnal visual encounter surveys, minnow traps, and aquatic coverboards) to highlight biases and variation in trap effectiveness among species (*Agkistrodon piscivorus*, *Seminatrix pygaea* and *Nerodia fasciata*). Aquatic coverboards were most effective for capturing *S. pygaea* (59.8% of captures, n=58), but were less effective for *N. fasciata* (32% of captures, n=31) and ineffective for *A. piscivorus* (8.2% of captures, n=8). Visual encounter surveys were highly effective for *A. piscivorus* (92.9% of captures, n=91) but not *N. fasciata* (6.1% of captures, n=6) and *S. pygaea* (1.0% of captures, n=1). Minnow traps were the most effective technique for *N. fasciata* (71.6 % of captures, n=754) followed by *S. pygaea* (26.9% of captures, n=283) and *A. piscivorus* (1.5% of captures, n=16). Seasonal variation in capture rates and size biases were also apparent, especially for aquatic coverboards, which were most effective in March-April and were biased towards juvenile snakes. Our results demonstrate the possibility for an abundant species to go undetected or underrepresented due to sampling bias. However, with careful consideration of biases of various capture techniques and species ecologies, accurate assessment of community composition and relative abundance can be attained.

0416 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

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Postnatal Parental Care in the Giant Amazon River Turtle *Podocnemis expansa* in Brazil

For centuries turtles have been described as deaf mutes who abandon their eggs on beaches never to be seen or heard from again; our studies on the ecology and behavior of *Podocnemis expansa* in the Trombetas Biological Reserve, Para, Brazil since 1989 show this to be an urban legend. We have been recording turtle vocalizations under natural and controlled conditions in air, underwater, underground, and in the egg. We followed turtles with VHF, satellite, and sonic transmitters to determine their movement patterns. Turtles are vocalizing at all stages of their life cycle, even in the egg. Why this was not perceived before is that the sounds, besides being at the lower end of the frequency audible to humans, are very short- often fractions of a second, and low volume. This year 18 hatchlings equipped with 0.8g sonic transmitters, were tracked with mobile and fixed receivers for 76 days. Hatchlings were migrating with adult females in the deep water in the river channel, two traveled downstream with females 62 km in 16 days, at depths of 25 m. Now that we know the complex social behavior of *P. expansa*, it is necessary to modify the programs of conservation management of this species such that

hatchlings are released immediately after emerging on the beach, and not maintained in captivity for any length of time or released in other areas away from the nesting beach. Hatchlings vocalize in the nest and as they enter the water, females respond, and they migrate together.

0161 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Peter Wainwright, Thomas Claverie

University of California, Davis, CA, USA

Major Patterns of Body Shape Evolution in Acanthomorph Fishes

Acanthomorph fishes make up over half of teleosts and about one quarter of all vertebrate species, and thus represent a major vertebrate radiation. We attempted to identify major patterns and repeating themes in body shape evolution of acanthomorphs using Jack Randall's publicly available lateral-view photographs of Indo-Pacific fishes. We digitized 20 landmarks from the head and body in one adult image for 3,000 species representing over 60 acanthomorph families. We summarized variation by conducting a principal components analysis on the landmark data. Evaluation of the 60 best-represented families revealed about an order of magnitude range in disparity between the most diverse groups (Tetraodontidae, Antennariidae and Synangiidae) and the least diverse (Belontiidae, Cheilodactylidae and Sphyraenidae). The major axis of body shape variation in acanthomorphs can be described as an axis of body elongation, with long, slender fish being contrasted with deep-bodied forms. Remarkably, body elongation is also the major axis of shape variation in about two thirds of all families. However, the underlying anatomical basis of elongation varies considerably indicating that while body elongation is a repeating theme in fish evolution, it is accomplished in many ways, possibly reflecting the ecological diversity of drivers and the versatility of acanthomorph developmental programs. Supported by NSF grants DEB 1061981 and IOS 0924489.

0550 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Jayne Waldron

Marshall University, Huntington, WV, USA

Effects of Translocation on Eastern Diamondback Rattlesnake Spatial Ecology

The eastern diamondback rattlesnake (*Crotalus adamanteus*; EDB) is being reviewed for federal protection under the Endangered Species Act, and thus it is important to evaluate management strategies that will benefit the species' conservation. We conducted a translocation study that incorporated multi-year radio telemetry data from resident EDBs along with movement data and body conditions of pre- and post-

translocated EDBs. We used home-range size and spatial home range overlap among different years as a measure of inter-annual home-range fidelity to examine translocation effects on the spatial ecology of the species. We used a body condition index to monitor the health of translocated snakes over the course of the study and to examine potential correlations between home-range size, initial body size, and body condition. Home ranges of translocated snakes varied across years, but appeared to stabilize following the initial translocation year. We failed to detect a difference in inter-annual home-range fidelity among resident and post-translocated snakes, based on home range overlap. Body mass and body condition were not affected by translocation. Change in body condition was not correlated with post-translocation home-range size or initial SVL; however, initial SVL was positively correlated with post-translocation home-range size. The results of this study indicate that EDB translocation has the potential for use as a conservation management strategy. However, we suspect the success of the project reflected quality habitats associated with the release location.

0181 SSAR CONSERVATION & MANAGEMENT BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Dane C. Ward, Walter F. Bien

Drexel University, Philadelphia, PA, USA

The effect of roads on the movement of the Northern Pine Snake

Paved and unpaved roads can act as barriers to ecosystem connectivity linkages. Increased road density contributes to habitat fragmentation, wildlife mortality, loss of genetic corridors, and decreased reproductive success. Roads represent a major threat to slow moving herpetofauna that are extremely vulnerable to vehicular road injuries and death. Of 536 reported occurrences for northern pine snakes (*Pituophis melanoleucus*) in the New Jersey biotics database 120, or 23%, were dead on road (NJDEP, 2009). We examined the mean rate of movement of the northern pine snake across three different substrates: sand, asphalt, and concrete. We tested twelve snakes (n=12) in spring, summer, and fall 2012 at the Warren Grove Gunnery Range (WGR), Burlington County New Jersey. Snakes had the fastest rate of movement across sand ($\bar{x}=0.11\text{m/s}$) compared to paved substrates: asphalt (0.09m/s) and concrete (0.06m/s). These data suggest that coarser substrates facilitate increased mobility of snakes. In addition, we examined whether snakes would move through under-road-culverts. We installed nine 12-inch diameter culverts under a new military runway at WGR to monitor wildlife movements. We documented 364 'visits' at the mouth of the culverts and 54 'usage' events (14.8% culvert usage by visiting fauna, including snakes). These data support that culverts are a viable option for mitigating road impacts to wildlife. To better understand the impact of roads on genetic exchange of pine snakes a landscape genetic study is warranted.

0179 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Dane C. Ward, Ronald M. Smith, James R. Spotila, Walter F. Bien

Drexel University, Philadelphia, PA, USA

Population Estimate of the Northern Pine Snake in the New Jersey Pinelands

Understanding population trends is paramount for successful management and long-term conservation of a rare species. The northern pine snake, *Pituophis melanoleucus*, is a state-threatened species that is declining in New Jersey. Because of its cryptic and semi-fossorial nature, quantitative population data are lacking. The northern pinesnake remains vulnerable as a result of habitat loss, habitat fragmentation, and isolation. We developed a "population model" that estimated the density of pine snakes within preferred northern pine snake habitat (pine-oak forest). We estimated that 229 adult snakes (one individual per 16.9ha) occurred in the local population at the Warren Grove Range (WGR) in Burlington County, New Jersey. We used these data to estimate the current, historical, and annual rate of decline of the northern pine snake in New Jersey. We estimated that the northern pine snake declined from an average of 16,476 snakes in 1986 to 15,188 snakes in 2007, a decline of 61 snakes per year. We plan to calibrate the "population model" at both the local (WGR) and landscape (Pinelands) scale for better resolution and precision of population estimates. Knowing population size and demographic trends will be essential for the long-term conservation of this enigmatic threatened species.

0762 Herp Genetics & Ecology, San Miguel, Saturday 13 July 2013

Rocky Ward¹, Joel Babitzke¹, Flavius Killebrew²

¹West Texas A&M University, Canyon, Texas, USA, ²Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA

Landscape genetics of Cagle's map turtle (*Graptemys caglei*) in the Guadalupe and San Marcos Rivers of Texas.

We investigated genetic variability in 101 individuals of the Cagle's map turtle (*Graptemys caglei*) collected from across most of its extant distribution in the Guadalupe River and from a site on the San Marcos River of Texas. Analyses of allelic variation in microsatellite loci indicated individuals from the San Marcos River were genetically similar to conspecifics from the middle Guadalupe River. Turtles from the upper Guadalupe River, on the other hand, were genetically divergent from middle Guadalupe River individuals. Isolation by distance appears to play a major role in genetic structuring within the Guadalupe River. Anthropogenic features (e.g., dams and

reservoirs), while they may be expected to restrict gene flow, appear to have had little impact on genetic structure.

0227 Reptile Ecology, Mesilla, Monday 15 July 2013

Robin Warne¹, Casey Gilman³, Blair Wolf²

¹*Southern Illinois University, Carbondale, IL, USA*, ²*University of New Mexico, Albuquerque, NM, USA*, ³*University of Massachusetts, Amherst, MA, USA*

Ecological variation and resource allocation to life history processes in lizards

The use of stored resources to fuel reproduction, growth and maintenance to balance variation in nutrient availability is common to many organisms. The degree to which organisms rely upon stored resources in response to varied nutrients, however, is not well quantified. Through stable isotope methods we quantified the use of stored versus incoming nutrients to fuel growth, egg and fat body development in lizards under differing nutrient regimes. We found that the degree of capital breeding is a function of an individual's body condition. Furthermore, given sufficient income lizards in poor condition can allocate simultaneously to storage, growth, and reproduction, which allowed them to catch up to better conditioned animals. In a parallel, inter-specific survey of wild lizards we found that the degree of capital breeding varied widely across a diverse community. These findings demonstrate that capital breeding in lizards is not simply a one-way flow of endogenous stores to eggs, but is a function of the condition state of individuals and the availability of nutrients during both breeding and non-breeding seasons. Here we explore the implications of these findings for our understanding of capital breeding in lizards and the utility and value of the capital-income concept in general.

0224 Herp Ecology, Galisteo/Aztec, Sunday 14 July 2013

Robin Warne, Lucas Kirschman, Alessandra Araujo

Southern Illinois University, Carbondale, IL, USA

Stress effects on susceptibility and transmission of *Ranaviruses* in amphibians

Individual variation in exposure, susceptibility and recovery to infection are fundamental drivers of disease dynamics in structured populations. Yet, how varying stressors interact with individual differences in physiological and behavioral traits to influence disease dynamics at the population level are not well understood. In addition, while environmentally induced stress is thought to be a key driver of disease outbreaks in wildlife populations, the mechanistic links between differing stressors, immune function and epidemic outbreaks are not well tested. Our work examines how chronic

environmental stressors, that include pollutants and population structure, interact with individual traits (e.g. growth, behavior and glucocorticoid hormone expression) to influence *Ranavirus* susceptibility and transmission dynamics. Here we use a *Ranavirus* and wood frog (*Lithobates sylvaticus*) study system and experimental manipulation of physiological stress to explore how individual responses to stressors and population structure influence disease outbreaks. This system is well suited for such research because wood frog larvae naturally form size structured populations in which growth, development, stress physiology and possibly immune function vary consistently with size and developmental stage. Through these efforts our research provides insight into the potential effects of environmental stress on disease outbreaks in amphibians, as well as a broader understanding of how individual traits may influence the epidemiology of contact dependent diseases in heterogeneous populations.

0744 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Melvin Warren¹, Brooks Burr²

¹*Southern Research Station, USDA Forest Service, Oxford, MS, USA*, ²*Southern Illinois University, Carbondale, IL, USA*

North American Freshwater Fishes Book Project: Update with a Preview of Photographs and Illustrations

Over the past several years, we have engaged 81 ichthyologists and fisheries biologists to produce a multi-volume work entitled "North American Freshwater Fishes: Natural History, Ecology, and Conservation" (see our poster for contributors and other details). As of this spring, Volume 1 (of 3 proposed) is in press (Lampreys-Suckers). In general, each chapter covers a North American family of freshwater fishes with emphasis at the genus level on synthesizing as much as possible in several major topical areas: diversity and distribution, phylogenetic relationships, fossil record, morphology, genetics, behavior, reproduction, ecology, conservation, and commercial importance. Other non-taxonomic chapters cover evolution and ecology of fish assemblages, reproductive behavior, non-native fishes, North American fishes as models for scientific study, and conservation overviews. As editors of this work, a challenging and primary task is to insure the chapters are well illustrated especially with good color photographs and illustrations. To that end, we are working with a plethora of talented amateur and professional photographers and illustrators as well as colleagues to compile quality photos and illustrations. Our goal in this presentation is to introduce you to the book by sharing a sample of the photographs and illustrations we are using to depict fishes in natural colors and habitats and to illustrate various aspects of their biology.

0742 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Melvin Warren¹, Brooks Burr²

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Update on “North American Freshwater Fishes: Natural History, Ecology, and Conservation”

Over 1,200 native freshwater fish species occur on the North American continent, composing the largest temperate, freshwater fish fauna on Earth. The importance of freshwater fishes in North American ecosystem function, their direct value economically and as providers of ecological services, and the increasing need to conserve this fauna cannot be over emphasized. In the last 30 years, major scientific advances have been made for these fishes across disciplines of systematics, genetics, physiology, behavior, ecology, and conservation. These advances, however, are marked by increased specialization and resulting fragmentation of knowledge about the diverse North American fish fauna. Our book will be the first-ever published, fully-illustrated multi-volume work synthesizing the diversity, natural history, ecology, and biology of 52 families of North American freshwater fishes (including several marine families with species occurring in fresh water). The coverage includes all of Canada, the coterminous United States, and Mexico (south to about the Isthmus of Tehuantepec). Chapter authors are synthesizing information on a set of standard topic areas for each family (see outline). Our emphasis is on near-comprehensive synthesis of existing information on freshwater fishes in North America. The book also covers non-taxonomic topics including evolution and ecology of fish assemblages, mating behavior, foreign fishes, fishes as models for scientific studies, and conservation overviews. Currently, 81 contributors are engaged in the book. Volume 1 is in press at Johns Hopkins University Press as of April 2013 for release in early 2014. Volume 2 and Volume 3 will follow at roughly one-year intervals.

0474 General Herpetology, San Miguel, Monday 15 July 2013

James Watling¹, Lorenzo Braga²

¹*University of Florida, Ft Lauderdale, FL, USA*, ²*Museo de Historia Natural Noel Kempff Mercado, Santa Cruz, Bolivia*

Interspecific Variation in Desiccation Resistance Explains Amphibian Distributions on Forest Islands in Bolivia

Although vulnerability to evaporative water loss is a key characteristic of amphibians, associations between desiccation resistance and landscape scale distributions of

amphibians are poorly understood. Available evidence suggests that evaporative water loss in amphibians is greater in open habitats compared with more forested habitats, so it may be expected that species that are less resistant to desiccation would have more restricted distributions in fragmented landscapes than more resistant species. We tested this idea using field-based desiccation trials to measure interspecific variation in evaporative water loss for several sympatric species of anurans occurring in a naturally-fragmented landscape in northeastern Bolivia. We found that more desiccation prone species had restricted distributions compared with more widely-ranging desiccation resistant species. Our work suggests that a key physiological trait influences landscape-scale distribution patterns of amphibians, with important consequences for understanding how a variety of global change stressors (i.e., habitat loss, fragmentation, and climate change) affect the distribution and abundance of amphibians.

0784 Herp Behavior/Amphibian Conservation, Galisteo/Aztec, Sunday 14 July 2013

Robert Weaver

Central Washington University, Ellensburg, WA, USA

Ecological Significance of Variation in Body Size in Populations of the Desert Nightsnake (*Hypsiglena chlorophaea*)

The ecogeographical principle known as Bergmann's rule states that vertebrates reach larger body sizes in colder climates. Indeed, this is true for many species of mammals, turtles, and birds. The reverse is true for other vertebrates, such as amphibians and squamate reptiles. Such reptiles (e.g. varanids or lizards) reach larger body sizes in warmer climates. For my talk I will discuss the significance of differences in body size between populations of a temperate North American diposid species of snake, the Desert Nightsnake (*Hypsiglena chlorophaea*). This species is typically associated with warm, dry, and rocky habitats in the southwest United States. *Hypsiglena chlorophaea* is a nocturnal, active (and sit and wait) forager that feeds on a variety of vertebrate prey. Based upon data collected from over 1200 specimens, adults and hatchling *H. chlorophaea* have a larger average body size in the northern (= colder) portions of its distribution (Washington State, Oregon, Idaho, northern Nevada and California, and British Columbia). Dietary data indicates the larger body size reached by these populations of *H. chlorophaea*, allows adults to consume relatively large prey items such as juvenile *Crotalus oreganus*, *Pituophis catenifer*, adult *Elgaria multicarinata*, and mammals. Additionally, a larger body size may increase the thermal inertia of an individual snake. This in turn, may allow snakes to remain active during the colder spring and summer nights typical in the northern half of this species range.

0244 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Robert Weaver¹, William Clark², Daniel McEwen³

¹Central Washington University, Ellensburg, WA, USA, ²Western Wyoming Community College, Rock Springs, WY, USA, ³University of Minnesota Moorhead, Moorhead, MN, USA

Diet and Foraging Ecology of the Racer (*Coluber constrictor*) from Central Washington State

The Racer (*Coluber constrictor*) is found throughout much of the United States, southern Canada and south into Central America. This species is found in a variety of habitat types, and is largely considered a generalist predator on invertebrates and vertebrates. Here we present data on the diet and foraging ecology of *C. constrictor* from 2 sites within the shrub-steppe of central Washington State. We searched for snakes by hand from March-October during 2007-09. We recorded the sex, snout-vent length and mass of each snake, as well as cloacal and air temperature. Snakes were gently palpated for recently ingested meals and for fecal matter. Prey items and fecal matter were identified to the lowest possible taxonomic level, preserved and stored in ethanol. We used Generalized Linear Models (GLM) to determine what biologically relevant interactions might occur between any of our explanatory variables and the most parsimonious model was selected using Akaike Information Criteria (AIC_c). Information from these hierarchical models were used to create conditional logistic regression models to determine what influences diet choices for snakes. There were a total of 69.7% of snakes that had prey within their stomachs. Invertebrates were the preferred prey item (62.0%), primarily of the order Orthoptera (92% of identified invertebrates). Larger snakes were most probable to have vertebrate prey. Individual snakes with higher cloacal temperatures were most likely to have consumed Gartersnakes (*Thamnophis* spp) as vertebrate prey, and the primary lizard foraged for were Western Skinks (*Plestiodon skiltonianus*).

0122 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Jacqueline F. Webb

University of Rhode Island, Kingston, RI, USA

The Mechanosensory Lateral Line System of Fishes: What We Still Don't Know After 150+ Years.

The mechanosensory lateral line system (LL), identified as a sensory system by Leydig in 1850, has been a subject of study by ichthyologists and morphologists, as well as by physiologists and neuroethologists who have studied the LL in a limited range of

species. The LL is an important source of characters for systematics, and an understanding of LL structure is a necessary (but often overlooked) pre-requisite for meaningful analyses of LL function. We now understand how neuromasts function (physiology, biomechanics), but neuromast morphological diversity has not been assessed sufficiently. The relationship between neuromast and canal morphology, and structure-function relationships among species have been demonstrated in only a few cases. The study of the comparative morphology of the LL system among closely related, but ecologically distinct taxa should be the basis for the comparative analysis of LL function, but such studies are rare. A great deal is now known about early neuromast development, but the relationship of neuromast distributions to subsequent LL canal development, and the way in which they are integrated into dermatocranial bones are not yet understood. The study of LL morphology and development in chondrichthyan and osteichthyan fishes has revealed fundamental and surprising differences that originated at the base of the gnathostome tree. Thus, the study of LL morphology remains a rich arena for novel and valuable descriptive work that can serve as a foundation for novel phylogenetic studies, analyses of evolutionary developmental biology, and experimental studies of LL-mediated behavior and sensory ecology and evolution of fishes.

0468 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Sarah J. Webb¹, Sandy Wiggins Bauman¹, Gregory Zychowski¹, Benjamin M. Higgins², Joseph P. Flanagan³, Céline A.J. Godard-Codding¹

¹Texas Tech University, The Institute of Environmental and Human Health (TIEHH), Lubbock, Texas, USA, ²NOAA/NMFS, Galveston, Texas, USA, ³Veterinary Services, Houston Zoo, Houston, Texas, USA

Toxicological testing in Loggerhead Sea Turtle (*Caretta caretta*) primary skin cell cultures

All seven species of marine turtle are currently listed as either threatened or endangered under IUCN listings. Because of their long life span and global range, they have the potential for long term exposure to marine contaminants. It is challenging to conduct toxicological investigations in these animals due to their threatened status. Cell culture work has potential to describe exposure-effect scenarios in an *in vitro* context and may offer insight on risks to whole organisms. Here, we report on 1) the optimization of (3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) and lactate dehydrogenase (LDH) cytotoxicity assays, and 2) the optimization of a biomarker assays examining gene expression of cytochrome P450 1A genes. For all assays primary skin fibroblast cultures were grown from skin biopsies obtained from healthy loggerhead turtles. Cytotoxicity (MTT and LDH) assays assessed the effects of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) which are globally distributed and known to be present in sea turtle tissue. Cells were dosed with PFOS and PFOA in

environmentally relevant concentrations for 72 and 96 hours. Significant toxicity occurred at the highest dose of PFOA (500 μM) at 96 hours and at the two highest doses of PFOS (50 and 200 μM) at 96 hours. Biomarker assays examining cytochrome P450 1A gene expression were performed using cells exposed to benzo(a)pyrene, a common marine contaminant and prototypical polycyclic aromatic hydrocarbon. The inducibility of CYP1A following exposure was assessed by quantitative polymerase chain reaction.

0756 Fish Biology, Doña Ana/Cimarron, Sunday 14 July 2013

Nicholas Wegner, Owyn Snodgrass, Heidi Dewar, John Hyde

NOAA Fisheries, La Jolla, CA, USA

Evidence for pectoral endothermy in the opah, *Lampris guttatus*

Unlike most pelagic fishes, the opah, *Lampris guttatus*, uses the pectoral fins for continuous swimming. The insulation of the large, red (aerobic) pectoral muscles by a thick layer of fat and connective tissue has led previous researchers to speculate concerning their possible function in heat production and retention. However, temperature measurements have been lacking and there has been no evidence of a countercurrent heat exchanger required to insulate muscle temperatures from convective blood heat loss at the gills. Here we report pectoral muscle temperatures that are significantly elevated above ambient for freshly decked opah and for fish outfitted with intramuscular temperature loggers swimming at depth. We also describe retia mirabilia in the gills of the opah that appear to function as countercurrent heat exchangers to conserve heat derived from the pectoral muscles. These retia (composed of extensions of the afferent and efferent filamental arteries embedded in adipose tissue within thick gill arches) allow for cold blood leaving the respiratory exchange surfaces to be rewarmed by blood entering the gill filaments. The unique placement of these countercurrent exchangers in the gills potentially allows for warm blood to be distributed throughout the body. In addition to the pectoral muscle, temperatures in the heart, gut, and cranial region are all significantly elevated above ambient.

0477 AES GRUBER AWARD, AES Gruber Award Papers, Mesilla, Saturday 13 July 2013

Ornella C. Weideli¹, Kristine L. Stump², Damian Chapman³, Shannon O'Leary³, Steven T. Kessel⁴, Kevin Feldheim⁵, Nigel Hussey⁴, Aaron Fisk⁴, Samuel H. Gruber⁶

¹University of Basel, Basel, Switzerland, ²Rosenstiel School of Marine and Atmospheric Science, Miami, FL, USA, ³Stony Brook University, Stony Brook, NY, USA, ⁴University of Windsor, Windsor, Canada, ⁵Field Museum & Pritzker Laboratory, Chicago, IL, USA, ⁶Bimini Biological Field Station, South Bimini, Bahamas

How effective is the usage of non-lethal stomach eversion to unveil shark diet alterations induced by anthropogenic habitat destruction?

In recent years, non-lethal stomach eversion (gastric lavage) to sample shark stomach contents has become a popular method in dietary studies given the status of global shark populations and the need for non-lethal sampling approaches. Its application has revealed novel insights into diet including temporal and spatial variations, sex differences, and ontogenic shifts in prey selection. The Bimini Islands, Bahamas include several nursery grounds for a well-studied population of juvenile lemon sharks, *Negaprion brevirostris*. The near-shore nursery areas offer large seagrass beds fringed by mangroves, a favourable habitat for a large number of subtropical coastal prey organisms such as teleosts and small invertebrates. A major coastal development in the North Sound nursery starting in 2001, resulted in large-scale removal of shoreline mangroves (~50%), and dredging of seagrass beds (~750,000m³), causing large alterations to the nursery habitat. This study aimed to investigate whether these changes affect the prevalent biodiversity and consequently the trophic linkages. Lemon shark stomach samples and prey species, collected before and after the coastal development (2000-2003 and 2009-2011, respectively), were identified both visually and genetically (through DNA sequencing of the mitochondrial cytochrome 1 gene), and pooled into higher taxonomic groups for analyses. Our results indicate by the application of multivariate analysis that ecosystem restructuring has taken place but that the shark community, which showed little significant changes in diet, is highly adaptable to these environmental alterations. A preliminary stable isotope investigation was used as a complementary technique to assess post development feeding ecology of juvenile lemon sharks.

**0173 SSAR Effects of Energy Development on Herps Symposium,
Galisteo/Aztec, Saturday 13 July 2013**

Scott Weir¹, Larry Talent², Todd Anderson¹, Christopher Salice¹

¹Texas Tech University, Lubbock, TX, USA, ²Oklahoma State University, Stillwater, OK, USA

Understanding Risk of H₂S Gas Emissions to the Dunes Sagebrush Lizard (*Sceloporus arenicolus*): Using the Western Fence Lizard (*Sceloporus occidentalis*) as a Surrogate Species

The dunes sagebrush lizard is a habitat specialist confined to specific shinnery oak sand dune complexes in the southwestern United States. Considerable research has investigated the effect of oil and gas production activities on the presence/absence and ecology of the dunes sagebrush lizard. However, less research has been conducted on the effects of chemicals associated with oil and gas production activities to reptiles. This study investigated the acute toxicity and potential risk of H₂S gas to western fence lizards (used as a surrogate for the dunes sagebrush lizard). We created an exposure chamber in which a small reptile could be exposed to a fairly static concentration of H₂S gas in air. We exposed Western fence lizards to 2 concentrations of H₂S gas: 30 mg/cm³ and 90 mg/cm³ for 90 minutes. Following exposure we measured several behavioral variables including sprint speed, righting reflex, and time to prey capture. We found no significant effects of exposure to H₂S gas on any of the variables measured. Lizards may be specifically resistant to inhalation toxicants due to decreased respiratory rates compared to birds and mammals. Because we exposed lizards to H₂S concentrations that were higher than actual measured concentrations in areas near oil and gas activities, it is very unlikely that exposure to H₂S gas is posing any significant acute risk to reptiles inhabiting these areas. This does not preclude potential indirect effects or consequences associated with longer-term exposures nor habitat degradation associated with oil and gas activities.

**0555 Amphibian Conservation/Herp Morphology & Histology, Ruidoso/Pecos,
Saturday 13 July 2013**

Shane Welch

Marshall University, Huntington, WV, USA

Persistent effects of past land use on *Ambystoma cingulatum* imperilment

Past human land use can add a significant temporal component to landscapes with persistent effects that far exceed specific land use practices. Landscapes within the range of *A. cingulatum* historically included fire-maintained open canopy savanna and

woodland habitats (i.e., flatwoods). These habitats were maintained by high-frequency ground fires with return intervals less than 10 years, until large scale industrial logging and fire exclusion became dominant silvicultural practices in the early 20th centuries. We used historical aerial photography (1948 – 2006), South Carolina Heritage Program data of contemporary and historical *A. cingulatum* locations, and series of Markov chain-based GIS models to examine *A. cingulatum* extirpations via critical habitat loss as a function of past land use within the South Carolina Coastal Plain. Our Markov models used longitudinal GIS data and various absorbing states to examine persistent effects. Seven out of ten *A. cingulatum* locations experienced extirpation during the temporal extent of the study. All supported models indicated a significant relationship with *A. cingulatum* extirpation and critical habitat loss. Model selection indicated that historical land use had persistent effects on *A. cingulatum* extirpation. Parameter weights indicated that fire exclusion and intensive forestry practices had the greatest historical importance as absorbing states and thus had significant persistent effects. These results further highlight the importance of preserving and restoring high integrity landscapes for species recovery.

0785 Reptile Ecology, Mesilla, Monday 15 July 2013

Luke Welton¹, Cameron Siler², Charles Linkem³, Arvin Diesmos⁴, Mae Diesmos⁵, Emerson Sy⁴, Rafe Brown⁶

¹Brigham Young University, Provo, UT, USA, ²University of South Dakota, Vermillion, SD, USA, ³University of Washington, Seattle, WA, USA, ⁴Philippine National Museum, Manila, The Philippines, ⁵University of Santo Tomas, Manila, The Philippines, ⁶University of Kansas, Lawrence, KS, USA

Phylo-forensics of Philippine monitor lizards: an analysis of trade in the genus *Varanus*

A phylogenetic and population genetic evaluation of the illegal pet and bush meat trade of monitor lizards in the Philippines. Using a molecular dataset assembled from vouchered samples with known localities throughout the country as a reference for statistical phylogenetic, population genetic, and DNA barcoding analyses of genetic material obtained during a three year survey of Manila trade markets. Results provide the first genetic evaluation of a major Southeast Asian city's illegal trade in monitors, and establishes several important conclusions regarding actual, versus reported, origins of Manila's black market *Varanus*.

0222 AES Behavior, San Miguel, Sunday 14 July 2013

Kevin Weng¹, Randy Honebrink²

¹University of Hawaii, Honolulu, HI, USA, ²Division of Aquatic Resources, Honolulu, HI, USA

Occurrence of White Sharks (*Carcharodon carcharias*) in Hawaiian Waters

White sharks were observed and captured in Hawaii prior to Western contact (1778), and their presence continues to be documented on rare and brief occasions. Sightings of white sharks often result in considerable media attention, and there is a great deal of public interest in their occurrence. Some purported sightings may have been misidentifications of mako sharks, as was demonstrated in a recent case. Our goal was to provide an updated, definitive record of white shark presence in Hawaii, which can be used as a reference for continued studies, and for media and public informational purposes. We compiled sighting and attack records, catch data from shark control programs, observations from submersibles and remote cameras, and published satellite tag records in an attempt to understand the origins of Hawaii's white sharks, and seasonality of their occurrences. We evaluated life history hypotheses with regard to seasonal differences in the presence of male and female white sharks. We also proposed a new metric for distinguishing white sharks from other related species. In an attempt to provide a clearer picture of our current understanding about the presence of white sharks in Hawaii, it is our intention to make the information from this study available to the media and public in a user-friendly version through various outreach efforts.

0262 General Ichthyology, Doña Ana/Cimarron, Saturday 13 July 2013

Rhiannon West, Abbie Reade

University of New Mexico, Albuquerque, NM, USA

Sexual dimorphism and speciation in three pupfish species (*Cyprinodon*)

A series of saline lakes on San Salvador Island, The Bahamas, is home to a sympatric species flock of pupfish (*Cyprinodon* spp.). The three species, a detritivore, an ostracod-eater, and a scale-eater which preys upon the other two, inhabit distinct trophic niches. We used geometric morphometrics to examine variation in body shape among these three species. Results show that there are significant differences in male, but not female body shape among the scale-eaters, ostracod-eaters, and detritivores. These results suggest that male body shape, specifically nuchal hump height, is under sexual selection and may contribute to reproductive isolation between species.

0601 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Cassandra Whitcombe, Mike Horn

California State University, Fullerton, Fullerton, CA, USA

Kelp pipefish (*Syngnathus californiensis*), even though cryptic, are major prey of a visual, shallow-diving seabird

Species composition of dropped fish collected at Elegant Tern (*Thalasseus elegans*) colonies in southern California shifted from mainly northern anchovy (*Engraulis mordax*) in the 1990s to >60% kelp pipefish (*Syngnathus californiensis*) in 2011. This change was unexpected as the Elegant Tern (ELTE) is an open-water forager, and the pipefish is cryptic in kelp. In response, we tested two hypotheses at the Los Angeles Harbor nesting colony in 2012: 1) Kelp pipefish are incorporated into the ELTE diet 2) Kelp pipefish feed in the water column away from kelp, leaving them vulnerable to predation by the tern. We identified ELTE prey deliveries and determined $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotope values for ELTE and its prey – northern anchovy, kelp pipefish, market squid (*Loligo opalescens*), and California grunion (*Leuresthes tenuis*). Direct observations revealed that the ELTE chick diet comprised 8% kelp pipefish and 61% northern anchovy, though dropped fish still comprised mostly pipefish. All prey were found to have similar $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ signatures, except that California grunion was significantly enriched in $\delta^{15}\text{N}$ compared to anchovy and pipefish. The similarity of prey isotope values hinders using mixing models to determine relative contributions of prey species to the ELTE diet. However, given that anchovy, grunion and squid feed in the plankton, common $\delta^{13}\text{C}$ values suggest that pipefish do also. A laboratory experiment, in progress, is expected to show that kelp pipefish will leave vegetative cover to pursue prey, indicating that when they sacrifice their crypsis to feed they become vulnerable to tern predation.

0349 General Herpetology, San Miguel, Monday 15 July 2013

Mary White, Laura Jackson, Brian Crother

Southeastern Louisiana University, Hammond LA, USA

Oct-4 and the Induced Mechanism of Germ Cell Determination in Reptiles

In sexually reproducing organisms, germ cells are indispensable for continuation of the lineage. In classical model organisms such as nematodes, fruit flies, zebrafish and frogs, primordial germ cells (PGCs) are determined by maternal molecules sequestered in specific regions of the oocyte and embryo. In salamanders and mammals, PGCs are not predetermined and must be induced later in development. Previous results indicate the mechanism seen in salamanders and mammals is primitive and the mechanism in fruit flies, frogs, and zebrafish is derived, contra to conclusions based on model systems. As

such, germ cell development provides an interesting system for studying the evolution of genes associated with the mechanisms.

Our results suggest that phylogenetic relationships of some germ cell genes, particularly Oct-4, unexpectedly track the evolution of the mechanism (induced or predetermined), rather than the organism phylogeny. Oct-4 is a member of the large oct/pou gene family, and we hypothesize that Oct-4 orthologs are only found in organisms that have the induced mechanism. As such, the presence or absence of the Oct-4 ortholog may serve as an indicator of PGC determination mechanism.

Little is known about PGC determination among reptiles, although multiple lines of research have shown that the turtle *Trachemys scripta* uses the induced mechanism. As expected, *Trachemys* does have the Oct-4 ortholog. Our previous work has shown that alligators and anoles also have Oct-4 orthologs. Our survey of the oct/pou family is being extended to include all reptiles for which genome data are available.

0134 Fish Genetics I, Ruidoso/Pecos, Friday 12 July 2013

Matthew White¹, Claire Stegman¹, Joseph Faber², Katherine Zipfel³, Jeffrey Koppelman⁴

¹Ohio University, Athens, OH, USA, ²Ohio University, Lancaster, OH, USA, ³West Virginia Department of Natural Resources, Parkersburg, WV, USA, ⁴Missouri Department of Conservation, Columbia, MO, USA

Distribution and Evolutionary History of the Native Walleye in the Ohio River Drainage

Based on a divergent mitochondrial DNA sequences populations of a native stock of walleye are distributed in the New and Kanawha rivers, the upper Ohio River, Cumberland River, and the Black River in Missouri. Mitochondrial control region sequence data suggests a long-term separation of these stocks from other walleye stocks (Great Lakes and Alabama) and that the Highlands walleye may be basal to these. Diagnostic microsatellite alleles at two loci have been used to identify putatively pure specimens for broodstock use in West Virginia and Kentucky for several years. Microsatellite variation at additional loci has detected some population structure among pure populations and evidence of extensive hybridization with stocked Lake Erie walleye in others. Limited DNA sequence and microsatellite variation among Highlands populations suggests a recent dispersal from a single refuge. Despite similarities among Highlands populations we recommend continued use of local broodstock populations to establish new populations and supplement existing populations.

0432 AES Conservation, San Miguel, Sunday 14 July 2013

Nicholas Whitney¹, Connor White¹, Paul Anderson², Adrian Gleiss³, Gregory Skomal⁴, Robert Hueter¹

¹Mote Marine Laboratory, Sarasota, FL, USA, ²Mystic Aquarium, a division of Sea Research Foundation, Inc., Mystic, CT, USA, ³Hopkins Marine Station, Stanford University, Pacific Grove, CA, USA, ⁴Massachusetts Division of Marine Fisheries, New Bedford, MA, USA

Hook, line, and sinker? Using accelerometers to assess post-release behavior in sharks.

Although post-release mortality in elasmobranchs can be measured by a variety of acoustic and satellite telemetry techniques, many of these are cost- or labor-intensive and sometimes fail to give definitive answers on shark mortality. Studies that have quantified a recovery period in pelagic sharks have used changes in diving patterns that may not be applicable to coastal species that are restricted by bottom depth. We applied acceleration data loggers (ADL's) to measure fine-scale swimming behavior of blacktip sharks (*Carcharhinus limbatus*, N=20) caught in the Florida recreational shark fishery. Mortalities (N=3) all took place within 2 h after release and were apparent from static depth data and the cessation of tailbeat activity, whereas surviving sharks were monitored for 7 to 55 h (27 + 18 h, mean + SD). Using the data collected from ADLs, we evaluated 58 metrics of fine-scale swimming behavior for their potential to indicate a recovery period. We used nonlinear mixed modeling to fit a four-parameter logistic function to these metrics. Once analyzed, 18 of these metrics displayed a significant logistic relationship with time after release, with mean recovery periods from each metric ranging from 7.2 to 14.4 h after release (9.9 + 1.9 h, mean + SD). Our results show the utility of accelerometers to provide definitive information on animal outcomes and the broad applicability of these data to the study of post-release mortality and recovery in coastal sharks.

0465 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Paul Wieczorek, Jonathan Armbruster

Auburn University, Auburn, Alabama, USA

Can morphology be used to accurately predict the successfulness of invasive species? A case study in the Mobile Basin.

The purpose of this study is to uncover if morphology can be used to predict the successfulness of an introduced species becoming invasive in a new environment and to

predict whether or not it will compete with local species. Fish morphology can be used to predict facets of a species' ecology niche. For example, deeper body depth suggest that the species will either be lentic or found in pools in lotic habitats, and shallower body depths suggest that the species will be found in lotic habitats in runs and riffles. The position of the mouth can also be used to determine where a fish species feeds in the water column. Therefore, the use of morphospace can be used as a proxy for ecospace. The Mobile Basin is among the richest temperate fish faunas in the world with the family Cyprinidae constituting much of the biodiversity. Several introduced cyprinid species have become invasive in this already diverse ecosystem. These invasive species are the perfect cases to determine if their morphology played a part in their ability to invade the Mobile Basin. In a previous study, the invasive *Cyprinella lutrensis* did not overlap in morphospace with any of its congeners found in this system.

0734 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Stephanie Wiegel¹, Brian Smith¹, Kenneth Cabarle², John Dixon¹

¹Black Hills State University, Spearfish, South Dakota, USA, ²Dakota College, Bottineau, North Dakota, USA

Detection of Deltamethrin in Salamanders from Wind Cave National Park by High Performance Liquid Chromatography

Black-footed ferrets (*Mustela nigripes*) are a highly endangered mammal being reintroduced at National Park Service units in the western United States. They are a specialized predator of prairie dogs (*Cynomys* spp.) and are introduced to established prairie dog towns. Black-footed ferrets are susceptible to the plague bacterium *Yersinia pestis*, transmitted by fleas that can reside on prairie dogs. At reintroduction sites, the insecticide Deltamethrin (DLM) is used to control fleas. A reintroduction site at Wind Cave National Park is home to a large population of tiger salamanders (*Ambystoma tigrinum*), a common commensal at prairie dog towns. We collected nine *A. tigrinum* at Wind Cave National Park, homogenized 100mg of their liver tissue, and analyzed these samples using High Performance Liquid Chromatography to detect bioaccumulation of DLM. We mixed 65µl of liver homogenate with 135µl of Acetonitrile (ACN). This mixture was put into a centrifuge and spun at 10,000 RPM for 10 minutes. Eighty micro liters of the supernatant was injected into the HPLC. Six of the nine liver samples were found to contain DLM. In future work, samples from the brain and tail will also be analyzed. The assay used on liver tissue will also be used for these analyses.

0137 ASIH Fishes & Morphology Symposium II, Brazos, Monday 15 July 2013

Edward O. Wiley

University of Kansas, Lawrence, KS, USA

A Polyural Interpretation of the Caudal fins of *Danio rerio* and *Gasterosteus aculeatus*: Homology and Discovery of Synapomorphies

Collagen II and alcian blue/alizarin red preparation of developmental series of *Danio rerio* and *Gasterosteus aculeatus* lead to the discovery of new potential synapomorphies if the skeletal elements are interpreted in a polyural rather than diural manner. I review the skeletal morphology of both species under both the diural and polyural paradigms from both a developmental and phylogenetic perspective. I offer two examples in this abstract. Under the diural paradigm the posterior caudal centrum of *Danio rerio* is given the identity "U2." But from a phylogenetic perspective "U2" in basal teleosts is anterior of the hypural diastema and not posterior of that diastema as seen in *Danio*. Under the polyural paradigm developmental evidence indicates that "U2" is actually "U3+U4," a compound centrum. A compound U3+U4 is also observed in clupeomorphs by other investigators, a possible synapomorphy. Under the diural paradigm the identity of the two compound hypurals of *Gasterosteus aculeatus* are ambiguous: are they the result of fusion or loss? Under the polyural paradigm they are not the result of fusion or loss but represent neomorphs that result in all mesenchymal cells in the posterior and anterior fields transforming to produce two separate compound hypural plates rather than the 5-6 hypural plates seen in most euteleosts. Further, this is different from fusion of hypural plates in fishes such as tunas where the compound nature of the fusion is due to perichondral ossification that unite what are developmentally separate hypurals. Other examples are discussed.

0242 SSAR Effects of Energy Development on Herps Symposium, Galisteo/Aztec, Saturday 13 July 2013

Jen Williams¹, Petra Wood²

¹FL Fish and Wildlife Conservation Commission, Ocala, FL, USA, ²West Virginia University, Morgantown, WV, USA

Impact of Mountaintop Removal Mines on Terrestrial and Aquatic Salamanders in Southern West Virginia

Mountaintop removal mining converts landscapes from mature forests to grassland and shrubland. Valley fills associated with these mines bury stream headwaters and impact water quality and ecological function of reaches below fills. We sampled terrestrial salamanders using drift fence arrays and coverboard transects on and near mountaintop

removal mines (MRMs) in southern West Virginia during 2000-2002 and aquatic salamanders during 2002 in 3 streams below valley fills (VFS) and in 3 reference streams (RS). We compared terrestrial salamander relative abundance and species richness of unmined, intact forest with habitats on reclaimed MRMs (reclaimed grassland, reclaimed shrubland, and fragmented forest). Salamanders within forests increased in relative abundance with increasing distance from reclaimed mine edge. Reclaimed grassland and reclaimed shrubland had lower relative abundance and species richness than forests. Characteristics of reclaimed habitats that likely contributed to lower terrestrial salamander abundance included poor soils and reduced tree cover, leaf litter, woody debris and vertical structure of vegetation. The majority (66.7%) of aquatic salamanders captured were from RS. Total salamanders were more abundant in RS than VFS for first- and second-order reaches. Adult salamanders had greater abundance in first-order reaches of RS than VFS. Larval salamanders were more abundant in second-order reaches of RS than VFS. Silt cover, greater in VFS than RS first-order reaches, was a likely contributor to reduced abundance of salamanders in VFS. Our study indicates mountaintop removal mining and its associated reclamation techniques negatively affect terrestrial and aquatic salamander populations and raise regional concerns about their population persistence.

0384 SSAR SEIBERT AWARD ECOLOGY II, San Miguel, Friday 12 July 2013

Laura Williams^{1, 2}, Rulon Clark¹

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The Use of Chemical Cues by Granite Night Lizards (*Xantusia henshawi*) to Evaluate Potential Predation Threat.

Animals have evolved various mechanisms by which they detect predation threat, adapted to the habitat in which the species lives, as well as the specificity of their predators. Organisms use a variety of cues to detect predators such as auditory, visual, and chemosensory. The specialized sensory organs of squamate reptiles (e.g. Vomeronasal organ) make them particularly adapted at detecting predation threat via chemoreception. To test the use of chemosensory-based threat detection in granite night lizards (*Xantusia henshawi*) we examined responses to both predator and conspecific scents. We measured the anti-predator behavior of lizards to the scent of a predator, lyre snake (*Trimorphodon biscutatus*) versus a control, measured if predator diet influenced response using lyre snakes maintained on two different diets (lizard and mouse), and finally measured if threat detection can be assessed from the scent of conspecifics under stress. Scents were collected on filter pads, which were then placed in the entrance of a shelter. Anti-predatory behaviors were recorded over a 60 minute period and quantified until the focal lizard first entered the shelter. Preliminary results suggest that night lizards respond to the scent of predator, as well as to the scent of stressed conspecifics. Diet-based predator responses will be discussed. This is the first research evaluating

chemosensory-based anti-predator behavior in terrestrial systems using diet shift, and results from this will expand the knowledge base of chemosensory-mediated predator avoidance in squamates and could be applicable to other terrestrial taxa.

0086 Fish Conservation, San Miguel, Sunday 14 July 2013

Laura Jay Williams, Stephen Szedlmayer

Auburn University, Fairhope, AL, USA

The Use of Ultrasonic Telemetry to Evaluate Red Snapper, *Lutjanus campechanus*, Fishing Mortality in the Northern Gulf of Mexico

Red snapper, *Lutjanus campechanus*, support important commercial and recreational fisheries in the Gulf of Mexico. In recent years, extensive management efforts have been undertaken to safeguard the red snapper population for future generations. One life history parameter that has been particularly difficult to estimate yet critical for proper management is mortality (*i.e.* fishing and natural). In the present study, we used acoustic telemetry, VR2W Positioning System (VPS, Vemco Ltd, Nova Scotia) to examine the fine-scale movements (~1 m accuracy) of red snapper (n = 16) on 3 unpublished artificial reef sites in the northern Gulf of Mexico. We used telemetry detection data to estimate fishing mortality rates of red snapper in 2012. This method is unique in that it is entirely independent of fisher reported recaptures. Fine-scale movements of red snapper were tracked for transmitter tagged red snapper (n=16) for a minimum of 10 months prior to the beginning of the sport fishing season. During the short sport fishing season 9 fish were caught by fishers (56.25%). Of the 9 fisher captures, 6 fish were reported by fishers (37.5%), while 3 fisher captures were identified based on VPS data (18.75%) but not reported. Following the 2012 sport fishing season, we added a VPS reef site and have tagged and released an additional 36 red snapper. We are continuing to monitor fishing mortality and estimate movement patterns of these tagged fish in 2013.

0120 Fish Conservation I, Doña Ana/Cimarron, Thursday 11 July 2013

Philip Willink, Solomon David

Shedd Aquarium, Chicago, IL, USA

Ichthyological Invasions of the Great Lakes: from Sea Lamprey to Asian Carp

Great Lakes invasive species have attracted considerable attention over the years. At one time the focus was on sea lamprey *Petromyzon marinus* and alewife *Alosa pseudoharengus*. Now we are dealing with Asian carp hysteria. Despite all the attention, there is a surprising amount of misinformation. We are reviewing and updating the data so it is possible to analyze the history of ichthyological invasions within the proper scientific

and historical context. Of the 200 fish species found in the Great Lakes, 32 invaded during the past two centuries. Most (14) were intentionally stocked to promote recreational and commercial fishing. Ten entered through canals, primarily the Erie Canal system in upstate New York. Five entered the Great Lakes via ballast water in freighters. Pet releases (2) and bait releases (1) also played a role. The 17 intentional introductions (i.e., stockings, pet releases, and bait releases) slightly outnumber the 15 accidental introductions (i.e., canals and ballast water). Of the canal invasions, half the species came from the west and half from the east. There is a considerable amount of ambiguity when using the terms invasive, injurious, non-native, exotic, etc. Sometimes it is unclear if a species should be considered invasive because of human influences on the environment, or did it simply enter the Great Lakes via natural processes? Asian carp, specifically bighead carp *Hypophthalmichthys nobilis* and silver carp *H. molitrix*, are not established in the Great Lakes, but we will review the most recent records to clarify any misconceptions.

0513 HL Detectability Symposium, Brazos, Friday 12 July 2013

John Willson

Department of Biological Sciences, University of Arkansas, Fayetteville, AR, USA

More than Nuisance Parameters: Detection Parameters as Indicators of Behavior and Abundance in Aquatic Snakes

Accounting for imperfect detection of animals has become commonplace in wildlife ecology. The application of modern occupancy and abundance estimation techniques to herpetofauna has improved our ability to study many species, especially those that have previously been considered too secretive or rare to study effectively. Such approaches generally involve estimating species detectability or individual detection probability, with the goal of avoiding bias in estimation of occupancy or abundance/survival parameters when detection is less than one and may vary with sampling, site, or individual covariates. In this case, detection probability parameters are not of interest, but must be estimated to inform estimation of occupancy, survival, or abundance. Here, we use six years of aquatic snake trapping data from a well-studied wetland in South Carolina to demonstrate that detectability parameters, themselves, can yield useful information on the ecology of the species being studied. Specifically, we investigate yearly variation in individual capture probability of two aquatic snake species (*Nerodia fasciata* and *Seminatrix pygaea*) and interpret this variation as an indicator of foraging activity. We also correlate yearly estimates of species detection probability with abundance (estimated by mark-recapture) to assess the utility of species detectability as a low-intensity indicator of abundance in this system. Our results demonstrate the utility of detection parameters as useful biological endpoints, rather than simply being "nuisance parameters."

0733 Poster Session III, NW Exhibit Hall, Sunday 14 July 2013

Anthony Wilmes², Justin Rheubert¹, David Gruenewald¹, Robert Aldridge¹

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Conspecific Pheromone Trailing and Pheromone Trail Longevity in the African Colubrid *Boaedon fuliginosus*

In snakes, pheromone trailing is a strategy used for long distance location of conspecifics. The two existing hypotheses for this behavior are: a) to locate individuals for reproductive purposes and b) to form aggregations during the winter/dry season. Pheromone trailing for reproductive purposes has been observed in over 20 snake species representing four different families. The ability of adult male African brown house snakes (*Boaedon fuliginosus*) to track a female producing the sex pheromone, as well as a conspecific male, was tested using a standard Y-maze. The length of time a female's sex pheromone remained distinguishable to a male was also tested using the same methodology. Male *B. fuliginosus* showed a strong ability to trail females both immediately after the trail was left by a female (100%; n=14) and one week after a female left a trail (100%; n=14). After two weeks however, only 71.4% (n=14) of males chose the same arm as the female showing that the pheromone trail did degrade over time. Males also trailed other males in 77.8% (n=18) of trials, which suggests that males may use other male trails to locate females, navigate through unfamiliar territories, or to aggregate for another purpose.

0180 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, San Miguel, Thursday 11 July 2013

Natasha Wilson, Craig Williams

School of Pharmacy and Medical Sciences, University of South Australia, Adelaide, Australia

Predator-Prey Interactions: Common Invertebrate Predators of Native Amphibian Eggs and Tadpoles in South Australia

The primary aim of this study was to identify aquatic invertebrate predators of amphibian eggs and tadpoles in South Australia. Invertebrate predators have received far less attention in Australian research than their vertebrate counterparts. The presence and abundance of aquatic invertebrate predators was monitored at regular intervals for four field sites across Adelaide, South Australia. Field site sampling, which included the use of sweep nets and baited funnel traps, revealed notonectids, caddisfly nymphs, freshwater crayfish and odonates to be amongst the most common invertebrate predator

types. The ability of these predators to consume the eggs and tadpoles of the native frogs *Litoria ewingi* and *Crinia signifera* was compared in 72 h laboratory-based feeding trials. Freshwater crayfish (*Cherax destructor*) consumed the greatest number of eggs and tadpoles. The notonectid *Enithares woodwardi* significantly impacted tadpole survivorship for both anurans while *Anisops* sp. were only successful at consuming *L. ewingi* tadpoles. Caddisfly nymphs (*Lectrides varians* and *Leptorussa darlingtoni*) reduced egg survivorship but not to the same extent as *C. destructor*. Unlike some predators, which consume particular life stages, freshwater crayfish are large, polytrophic omnivores that can act as important predators of both anuran eggs and tadpoles. Given that predation is a key source of mortality in juveniles, identification of likely predators is useful for understanding the regulation of amphibian populations, as well as the potential impact of noxious invasive amphibians (such as the cane toad *Rhinella marina*) on native invertebrates.

0664 SSAR ECOLOGY, NATURAL HISTORY, AND DISTRIBUTION BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Kristin Winchell

University of Massachusetts Boston, Boston, MA, USA

Phenotypic shifts in urban populations of the tropical lizard, *Anolis cristatellus*

Urbanization is widespread and intensifying globally, altering environments and imposing unique pressures on animal species that live in urban areas. Prior studies have revealed adaptive responses to urbanization in a range of plant and animal species, although relatively few have involved reptiles. We investigated morphological adaptation in the tropical lizard, *Anolis cristatellus*, in three paired urban and natural sites in Puerto Rico. Our preliminary results show that urban populations have longer hindlimbs and forelimbs, more subdigital lamellae, and higher body temperatures. Lizards in urban areas were captured on broader surfaces and nearly 50% of urban captures were on manmade substrates such as metal fence posts and painted concrete. We hypothesize that phenotypic differences between urban and natural populations may be due to selection for improved locomotor performance on the wider and smoother artificial substrates typical of urban habitats. Genetic analyses of neutral markers show high gene flow between paired populations, suggesting that differences between populations are not likely to be due to genetic drift. In future research we will directly measure selection in urban habitats as well as test for the genetic basis of the phenotypic trait shifts found in the present study using common-garden rearing experiments. Understanding the novel selective pressures faced by *A. cristatellus* in urban areas, along with how this species may be adaptively responding to these challenges, has the potential to provide considerable insight into the mechanism of rapid microevolution and has implications for conservation of urban-persistent species.

0431 ASIH Fishes & Morphology Symposium I, Brazos, Sunday 14 July 2013

Paul Eckhard Witten

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Mechanisms of teleost skeletal plasticity: modulation, adaptation, remodelling and repair

The teleost skeleton is a plastic organ. Epigenetic factors during development influence the anatomy, mechanical properties and meristic characters. The adult skeleton undergoes lifelong changes connected to mechanical adaptation, repair, mineral homeostasis, sexual maturation and ageing. Cellular mechanisms underlying the plasticity of the teleost skeleton are transdifferentiation and remodelling. Skeletal remodelling in teleosts can only be understood by acknowledging those characteristics that distinguish teleost skeletal remodelling from the process in mammals. These characteristics include (a) the absence of osteocytes in most teleost species; (b) the lack of haematopoietic bone marrow tissue; (c) abundant small mononucleated osteoclasts performing non-lacunar (smooth) bone resorption; (d) a phosphorous-rather than calcium-driven mineral homeostasis and (e) the absence of skeletal resorption from particular sites, related to the lack of endochondral ossification. Specific differences exist between the odontode-derived dermal skeleton and the endoskeleton. The former retains the capacity of regeneration/renewal (teeth, scales, dermal fin rays). Compared to the endoskeleton, the dermal skeleton is also much stronger involved in the teleost mineral metabolism. The endoskeleton can be repaired but has a limited regeneration capacity, a character likely inherited from the primary endoskeletal tissues, notochord and cartilage. Based on examples, the functional significance and the evolutionary origin of teleost skeletal plasticity are being discussed.

0773 Herp Biogeography, Ruidoso/Pecos, Monday 15 July 2013

Guinevere Wogan

University of California, Berkeley, Berkeley, CA, USA

Disassembly and Nestedness of Sundaland Amphibian and Reptile Communities

Continental island systems provide a natural experiment for investigating the fragmentation and disassembly rules that govern community structure. Most of the Sundaland continent currently lies under the Gulf of Thailand. While this has been the general configuration of the region since the Pliocene, when sea-levels drop, much of

this continental shelf becomes land positive. This creates a contiguous landmass connecting mainland SE Asia with Sumatra, Java, Borneo and the many smaller continental shelf islands. The islands of this region vary greatly in species diversity, area, topography, habitat heterogeneity, and their connectedness through time, although they all have the same origin/age. Since isolation 10,000 years ago, island communities have undergone selective extinction. Here I investigate the patterns of extinction and nestedness of anuran, lizard, and snake communities across the Sundaland region. I then evaluate life-history characteristics of the herpetofaunal communities to understand how these traits contribute to community structure. The communities across these islands are diverse and nested in relation to island characteristics. While a suite of life history traits were examined, not all of them appear to contribute to the current community structure. However, body size was important, with species of extreme size lost from small islands. The loss of these species speaks to the importance of niche differences in selective species extinctions, and provides insight into how habitat fragmentation affects mainland communities.

0097 SSAR Effects of Energy Development on Herps Symposium, Galisteo/Aztec, Saturday 13 July 2013

Dustin Wood¹, Amy Vandergast¹, Kelly Barr¹, Rich Inman², Todd Esque², Kenneth Nussear², Robert Fisher¹

¹*U.S. Geological Survey, Western Ecological Research Center, San Diego Field Station, San Diego, CA, USA*, ²*U.S. Geological Survey, Western Ecological Research Center, Las Vegas Field Station, Henderson, NV, USA*

The potential impact of renewable energy development on regional genetic hotspots in the Mojave and Sonoran Deserts

Regions of high species diversity are important targets for conservation. Similarly, identifying regions containing high genetic diversity and divergence may be important to maintain evolutionary potential. When multiple co-distributed species show spatial overlap in high genetic diversity and divergence, these regions can be considered evolutionary hotspots. We mapped spatial population genetic structure for 12 animals to identify hotspots of highest genetic divergence and diversity across the Mojave and Sonoran Deserts and evaluated whether protected lands overlapped with these evolutionary genetic hotspots. We also replicated these analyses within the Mojave Desert using 17 animals to evaluate the extent to which hotspots overlapped with proposed renewable energy projects of the U.S. Bureau of Land Management. We identified six hotspots of high genetic divergence and diversity across the Mojave and Sonoran Deserts that were concentrated along the Colorado River and in the Mojave/Sonoran Desert ecotone. At least some proportion of land within each recovered hotspot was categorized as protected, yet four of the six also overlapped with major areas of human development. Of the hotspots identified across the Mojave Desert, 30 - 40% of the total hotspot area was categorized as protected, between 3 - 7%

overlapped with proposed renewable energy footprints, and up to 17% overlapped with project footprints combined with transmission corridors. Although several hotspots were recovered, they are not strategically paired with areas of protected land. The GIS-based maps produced highlight specific regions where further investigation of impacts to population persistence and genetic connectivity may be warranted.

0369 SSAR SEIBERT AWARD SYSTEMATICS & EVOLUTION, Doña Ana/Cimarron, Thursday 11 July 2013

Yunke Wu

Harvard University, Cambridge, MA, USA

One Species or Four? An Integrative Perspective on Species Delimitation and Speciation Study of Chinese Salamanders (Salamandridae: *Pachytriton brevipes* complex)

The black-spotted stout newts (*Pachytriton brevipes* complex) from montane streams of southeastern China represent an example where species are hard to delimit due to conserved morphology and highly variable external color patterns. We applied two independent coalescent-based methods to assess evolutionary independence of four species in this complex, which are currently recognized based on mitochondrial sequence data. The four-species taxonomy is significantly favored over the single-species taxonomy by two mitochondrial and two nuclear loci. Bayesian cluster and distance-based analyses also support the classification of multiple species, despite signal of weak interspecific gene flow, which likely contributes to the conflict between the mitochondrial gene tree and species tree. We further statistically compare niches of the four species predicted by ecological niche modeling and multivariate analyses. Because species occupy different latitudes, their niches have undergone differentiation in the ecological space. However, these montane salamanders exhibit strong evidence of niche conservatism. Given the non-overlapped geographic distribution among species, speciation most likely occurred through allopatric isolation of lineages, which have been constrained at high elevations, although we cannot rule out parapatric speciation with ongoing gene flow. Our research provides an integrative perspective on species delimitation and study of speciation process. Coupling the two components yields important insights into species richness and the driving force for such richness in mountains from southeastern China, which harbors high diversity of Chinese amphibians and plants.

0116 Herp Systematics & Evolution, San Miguel, Saturday 13 July 2013

Wolfgang Wüster¹, Axel Barlow¹, Laurent Chirio², Eli Greenbaum³, Cara Hall¹, Ivan Ineich², Kate Jackson⁴, Zoltan T. Nagy⁵, Richard Storey¹, Jean François Trape⁶, Donald G. Broadley⁷

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Mitochondrial and nuclear gene sequences and morphological data reveal unexpected diversity in the African forest cobra (*Naja melanoleuca*)

The combined use of molecular and morphological data have contributed substantially to the rapid increase in the number of known species of reptiles and amphibians. Cobras have been no exception to this rule: integrative morphological and molecular studies have added 8 species to the known total since 1994. The African forest cobra (*Naja melanoleuca*) is the only widespread species not yet subjected to a range-wide analysis, despite substantial differences in body pattern. Prior discussion has focussed on the status of the subspecies *N. m. subfulva*. Prompted by preliminary observations of high levels of mtDNA sequence divergence between some populations, we use two mitochondrial (cytochrome b and ND4) and two nuclear genes (PRLR and UBN1) and multivariate analysis of morphological data to investigate species limits in this complex. Congruent patterns of mitochondrial, nuclear and morphological variation suggest the existence of five separate species, with extensive zones of sympatry between them. The Dahomey Gap, separating the Central and West African forests, appears to have played a major role in the diversification of this complex.

0113 AES Systematics & Genetics, Mesilla, Sunday 14 July 2013

Jennifer Wyfels

University of Delaware, Newark, DE, USA

The Skate Genome Project

The North East Bioinformatics Collaborative (NEBC) of the North East Cyberinfrastructure Consortium (NECC) is a team of bioinformatics experts from Vermont, New Hampshire, Rhode Island, Maine and Delaware responsible for sequencing the genome of the little skate, *Leucoraja erinacea*. Chondrichthyan fishes are important model organisms for comparative genomics because of their basal position in vertebrate evolutionary history and fundamental gnathostome characteristics. The

genome of a Stage 32 embryo was sequenced using whole genome shotgun sequencing and Illumina high-throughput, next generation sequencing at 59x coverage. An initial *de novo* genome assembly represents approximately 40% of the estimated 3.4 Gbp genome. Genome project sequence data are registered under GenBank BioProject PRJNA60893 and the raw data is available using NCBI's Sequence Read Archive (SRA026856). Acting as a nexus for curation activities and dissemination of project data, a web portal, SkateBase (<http://skatebase.org>) has been developed. Project data including GBrowse views for mitochondrial genomes of 3 elasmobranch species, SkateBLAST (a tool for homology searching), and training materials from three annotation workshops are accessible through SkateBase. Provisionary genome annotations are given for proteins with evidence of homology through sequence similarity searches. Other large scale sequencing projects deposited in NCBI databases are linked, making Skatebase a comprehensive genomic resource for the chondrichthyan research community. Through outreach, we expect to add features and tools of interest as suggested by the research community. Efforts are ongoing to enhance and streamline the genome annotation workflow, as we look toward larger-scale functional and structural community annotation of the *L. erinacea* genome.

0577 Snake Conservation, Ruidoso/Pecos, Saturday 13 July 2013

Dan Wylie¹, Sarah Wylie¹, Matthew Allender², Michael Dreslik¹, Christopher Phillips¹

¹INHS, Champaign, IL, USA, ²University of Illinois, Vet Med, Champaign, IL, USA

Detection of *Chrysosporium* Infections in two North American Viper Species

Disease has been identified as a major factor affecting population persistence in reptiles and could be particularly important for endangered species suffering from small population size. Since 2008, we have diagnosed several Eastern Massasaugas (*Sistrurus catenatus*) from the Carlyle Lake region with a *Chrysosporium* infection. Signs of infection include severe facial swelling around the loreal pits and all infections were fatal despite treatment with anti-fungal medications. In 2011, we continued a populational health assessment focusing on early detection of fungal infections. Using facial swabbing and subsequent PCR, we did not detect a *Chrysosporium* infection in the 38 snakes assessed. To assess the efficacy of using loreal swabs and saline flushing of the loreal pits for detecting *Chrysosporium*, we performed a challenge study on five *Agkistrodon piscivorous*. We infected five wild caught *A. piscivorous* with a pure culture of *Chrysosporium* delivered directly into the loreal pits. To evaluate detection techniques, we sampled each pit using cotton swabs and saline flushes twice weekly. Three of the five snakes intermittently displayed facial disfiguration syndrome and subsequently died before completion of the study. Neither swabs nor flushes detected *Chrysosporium* using conventional PCR during the first 12 weeks of study. We analyzed hematological response to infection for 14 weeks to determine if other health parameters signaled disease.

0119 Herp Ecology II, Galisteo/Aztec, Monday 15 July 2013

Sarah Wylie^{1,2}, Daniel Wylie^{1,2}, Michael Dreslik^{1,2}, Christopher Phillips^{1,2}

¹Illinois Natural History Survey, Champaign, IL, USA, ²University of Illinois, Urbana-Champaign, IL, USA

Spatial Ecology and Mortality in Neonate Eastern Massasaugas

Although the spatial ecology of adult vipers has been extensively studied, little is known regarding juvenile age classes. The increased availability of small externally attached transmitters now allows for more detailed study of snakes from younger age classes. The goal of our study was to determine habitat preferences, movement patterns, and mortality rates in neonate Eastern Massasaugas (*Sistrurus catenatus*). From 2009 - 2011 we captured gravid female Eastern Massasaugas and allowed them to give birth in captivity. Following their post-birth ecdysis, we externally attached 1 gram radio transmitters to 76 neonates weighing at least 10 grams. To determine habitat preferences and movement patterns, neonates were located at least every other day and a GPS location and standardized set of habitat characteristics were taken at each unique location. We recorded all observed mortality in the field and determined cause of death when possible. To determine winter mortality we encircled hibernation burrows with a wire mesh cage to ensure recapture of neonates the following spring. We found that neonate home ranges were variable in size, most neonates moved randomly, and mortality rates were higher than expected.

0642 Poster Session I, NW Exhibit Hall, Friday 12 July 2013, ASIH STORER ICHTHYOLOGY AWARD

Qianna Xu, Richard Mayden

Saint Louis University, St. Louis, MO, USA

Diversity of Trout in Mexico as Evaluated by Geometric Morphometrics of Head Morphology (*Onchorhynchus*, Salmonidae)

Only one trout species has been described from mainland Mexico, the Mexican Golden Trout, *Oncorhynchus chrysogaster*. Ongoing inventory efforts over two decades have amassed a great number of specimens of *Onchorhynchus* in river systems from western Mexico. The vast majority of these samples are from areas where trout have never been reported to occur or were originally thought to be introductions. Examination of diversity through multiple laboratory studies on various aspects of morphology and genetics of these various populations have revealed considerably more diversity of species endemic to Mexico. In this analysis we focus on external aspects of the head

morphology of trout from multiple major drainage from northern Rio Yaqui south to and including rios Baluate and Acaponeta. The geometric morphometric methods are use to examine both sexual dimorphism, changes associated with growth within a drainage, and differences between the hypothesized new species.

0099 AES Stingray Symposium, Mesilla, Friday 12 July 2013

Atsuko Yamaguchi, Keisuke Furumitsu

Nagasaki University, Nagasaki, Japan

Long-term biological study of longheaded eagle ray *Aetobatus flagellum* in Ariake Bay Japan

The number of longheaded eagle ray, *Aetobatus flagellum*, in south-western coastal areas of Japan has increased since the late 90s. *A. flagellum* feeds on bivalves and is considered to be responsible for the decrease of the bivalve catches in coastal areas such as Ariake Bay. In an attempt to reduce the predation pressure on bivalves, a predator control program was implemented in 2001. Since the biology of *A. flagellum* was poorly known at that time, we started examining their life history, behavior, seasonal migrations, and population structure of the ray populations since 2001. Our findings showed that *A. flagellum* is a seasonal resident of Ariake Bay, with numbers peaking in summer. Their low fecundity and slow rate of sexual maturation suggested that the predator control programs have been effective in reducing eagle ray population size. We hypothesize that the drastic changes in Ariake Bay ecosystem, such as the marked increase observed in eagle ray numbers, may have occurred in response to a decrease of the number of apex predators such as sharks. We therefore clarified the fish fauna of the bay and are currently investigating food web structure and ecosystem functioning in the bay. Here, we will present our recent findings on the biology of *A. flagellum*, with a focus on behavior and seasonal migration patterns inferred using Argos satellite transmitters, pop-up satellite archival tags, and acoustic coded transmitters. We will also discuss the need for a new ecosystem monitoring method to replace the current predator control programs.

0392 AES Morphology & Physiology, Mesilla, Sunday 14 July 2013

Kara Yopak¹, Rebecca Wassell¹, Grace Goh¹, Kathy Heel², R. Glenn Northcutt³, Shaun Collin¹

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Are Sharks “Smart”? Developing Quantitative Measures of Cognitive Ability in Fishes

Relationships between the body, brain, and major brain regions have traditionally been used to infer cognitive abilities across a range of vertebrates, providing vital information about life history traits, behavior and “intelligence”. Indeed, broad variability has been documented in the size and complexity of these brain areas in chondrichthyans (sharks, batoids, and chimaeras), which has been associated with differences in habitat and/or specific behavior patterns. However, new neuronal scaling rules based on a method of accurately assessing the number of neurons in the brain in mammals, isotropic fractionation [see Herculano-Houzel and Lent, 2005, *J Neurosci*], suggest that brain mass may be a poor predictor of cognitive ability and enhanced associative function. Here, we present the first application of this technique in fishes, using the Port Jackson shark, *Heterodontus portusjacksoni*, to accurately assess total neuron number (as compared to non-neuronal glia) in the brain and its component parts. We present detailed strategies for the optimisation of brain homogenisation, neuronal staining, calibration, imaging, and quantification of brain cells in fishes. Based on preliminary results, we suggest the isotropic fractionation method may serve as an effective tool to assess functional ability and processing power in the brains of chondrichthyans. These data will pave the way for future work to assess whether the number of neurons within the major brain regions show a linear relationship or reveals differential rates of addition in relation to higher cognitive abilities and/or more complex behavioral repertoires in chondrichthyans, with implications for how “intelligence” has evolved across vertebrates.

0268 SSAR EVOLUTION, SYSTEMATICS, AND GENETICS BEST STUDENT POSTER AWARD, Poster Session I, NW Exhibit Hall, Friday 12 July 2013

Shuangying Yu¹, Song Tang¹, Gregory Mayer¹, George Cobb², Jonathan Maul¹

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Endosulfan and Alpha-cypermethrin Inhibit Repair of DNA Photo Adducts and Decrease Transcription of Nucleotide Excision Repair Genes in *Xenopus laevis* Embryos

Pesticide use and UVB radiation have been both suggested to adversely affect amphibians; however, little is known about their interactive effects and potential mechanisms. Studies have shown that greater toxicity associated with pesticide photo degradation products contributes to the synergistic effect of pesticides and UVB. However, other mechanisms may exist. One possible mechanism is that genotoxic pesticides may inhibit repair of UVB-induced DNA adducts by interfering with DNA repair pathways. In the present study, we investigated the combined effects of UVB and each of the two common pesticides (endosulfan and α -cypermethrin) on induction of DNA adducts and transcription of nucleotide excision repair (NER) genes in African clawed frog (*Xenopus laevis*) embryos. We exposed embryos to a low and high concentration for each pesticide (25 and 50 $\mu\text{g}/\text{L}$ for endosulfan, 2.5 and 5.0 $\mu\text{g}/\text{L}$ for α -cypermethrin) for 96 h, and added environmentally relevant levels of UVB during the last 7 h. Levels of cyclobutane pyrimidine dimers (CPDs) and transcription of DNA repair genes were measured immediately after the exposure. Both pesticides at high concentrations, when combined with UVB, induced higher levels of CPD compared to control or UVB only. Both pesticides alone reduced transcription of XPA and endosulfan also reduced transcription of HR23B, indicating direct effects of pesticides on key NER enzymes. Our results indicate that UVB and pesticides can act synergistically on DNA photo adduct formation and a potential mechanism is the alteration of transcription of critical NER genes.

0475 Poster Session II, NW Exhibit Hall, Saturday 13 July 2013

Frederic Zaidan III¹, Miguel Borja², Alejandro Zugasti-Cruz², David Lazcano Villarreal²

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Testosterone Cycles in the Rock Rattlesnake (*Crotalus lepidus morulus*) in Nuevo Leon, Mexico

The majority of studies of the major male androgen, testosterone, in snakes have focused on members of the paraphyletic "Colubridae". Considerably less attention has been given to Viperid snakes. We investigated the seasonal effects of testosterone cycles in male Tamaulipan rock rattlesnakes (*Crotalus lepidus morulus*), a Mexican endemic and threatened subspecies, to assess the breeding pattern. Testosterone concentrations and reproductive behaviors were measured in a laboratory group, consisting of the captive colony of *C. l. morulus* at the Laboratorio de Herpetología at the Universidad Autónoma de Nuevo León. The colony received approximated natural temperature and photoperiod conditions for southern Nuevo León. The colony response showed two testosterone peaks, with one occurring in the spring (16.19 ng/ml) and the other occurring in the fall (9.01 ng/ml). However, individual snakes had a single peak. The timing of the peaks was related to elevation of origin. Fall peaks occurred throughout the elevation range (900-2600 m), but spring peaks were only observed above 2000 m. The addition of a spring peak at high altitudes may allow for increased reproductive opportunities in areas with reduced active season length.

0507 Ecology & Ethology, Doña Ana/Cimarron, Friday 12 July 2013; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Jeffrey Zeyl, Daniel Holt, Carol Johnston

Auburn University, Auburn, Alabama, USA

Acoustic Communication in the Banded Sculpin, *Cottus carolinae*

The efficacy of information transfer between individuals depends on associations between signal design and receiver sensory performance. As such, characterizing a communication system at each of these levels can reveal insights into behavioral outcomes during signalling interactions. We examined acoustic signal production and hearing performance in the banded sculpin, *Cottus carolinae*. Wild fish were captured during the reproductive season and observed for acoustic behaviors in the laboratory, and hearing performance was measured with auditory evoked potential (AEP) responses to tones and conspecific calls. The most common call type produced was a

pulsed 'knock', which was produced nocturnally in agonistic contexts by males defending shelters. Harmonic 'moans' were produced less commonly by selected males. Hearing sensitivity was greatest at 100 Hz and decreased with increasing frequency up to 1000 Hz. Sensitivities to the 'knock' and 'moan' calls were similar and comparable to tone sensitivities at frequencies near the calls' dominant sound energies. Analysis of suprathreshold AEP waveforms revealed that the *C. carolinae* auditory system is sensitive to amplitude and spectral features of conspecific calls. Using behavioral and physiological approaches we have provided the first characterization of acoustic communication in the banded sculpin.

0296 Euteleost Tree of Life/Fish Development, Doña Ana/Cimarron, Saturday 13 July 2013

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EToL: Positive Selection on Mitochondrial OXPHOS Genes in Fishes with Different Swimming Performance

The oxidative phosphorylation (OXPHOS) pathway, which consists of the electron transport chain and ATP synthase, is the major energy producing pathway in eukaryotes. High-performance fishes (e.g., tunas and billfishes) have higher energy demands than their relatives (e.g., flatfishes, jacks, and mackerels). We hypothesized that OXPHOS genes in fishes with different swimming performance experienced different selection pressures in response to different energy demands. We tested this hypothesis by investigating how natural selection acted on 13 mitochondrial OXPHOS genes in five different performance groups: tunas, billfishes, flatfishes, jacks, and mackerels by estimating the ratio of nonsynonymous substitution rates to synonymous substitution rates in protein-coding sequences. Our results showed that 11 of 13 OXPHOS genes in four internal lineages were most likely under positive natural selection. In contrast, the lineages leading directly to high-performance fishes were shown to have experienced strong purifying selection. We then inferred the functional importance of positively selected amino acid sites on OXPHOS complexes III (bc1 complex) and IV (cytochrome c oxidase) by mapping them onto vertebrate 3-dimensional crystal structures. We found that four amino acid sites of specific functional importance were under positive selection.

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