computational approach provides a rapid, low-cost means to delineate sound reception parameters across a diverse array of marine mammal species. At the same time, these tools increase our understanding of hearing performance, the potential effects of anthropogenic sounds, and the evolution of biosonar in odontocetes.

Ringed seals and climate change: current status of ringed seals inAlaska

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Arctic sea ice has declined in extent, thickness, and duration; these declines are predicted to continue, along with a reduction in snow cover. Declines in snow cover and sea ice are expected to negatively affect body condition, productivity, and pup survival of ringed seals (*Pusa hispida*), which are believed to be dependent upon snow cover for the construction of pupping dens and sea ice for resting, pupping, and molting. There are no reliable estimates of ringed seal abundance or trend in Alaska; however, since 1960, the Alaska Department of Fish and Game has collected data from the Alaska Native subsistence harvest that can be used to index population health and status. We examined population indices between 1960 and 2012 to determine if declines in sea ice are currently affecting ringed seals. From 2000 to 2009, sternum blubber thickness was consistent with the recent 50 year average; from 2010 to 2012, however, seals had thicker blubber (0.5 cm increase). Seals born during the 2000s (except for 2006) tended to be longer than average, suggesting that the growth rate has increased in recent years. Pregnancy rates have varied minimally since the 1960s (range: 76–89%); however, since 1999, the average age of maturity has been the youngest observed (3.2 years, $P <$ 0.05). Additionally, pups were harvested in greater proportions during the 2000s (56%) than before (31%), indicating that pups are being produced, weaned, and are surviving to be harvested. Although it may be too early to observe effects of climate change on ringed seals, due to lag effects or minimum sea ice thresholds, ringed seals in Alaska currently have more blubber, are larger, and show no reduction in productivity or pup survival as was predicted to occur with climate change.

Expanding the known range of the extinct Steller's sea cow (*Hydrodamalis gigas*) to include St. Lawrence Island, Alaska: A new population?

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Steller's sea cows (*Hydrodamalis gigas*) were driven to extinction by humans in 1768. In recent history, sea cows were believed to have been primarily restricted to Bering and Copper Islands, Russia. However, bone purported to be Steller's sea cow was obtained from St. Lawrence Island, Alaska, located 1630 kilometers (km) away and 8 degrees of latitude further north. In order to validate this alleged provenance, DNA sequences from the cytochrome *b*gene of the mitochondria, AMS carbon dating and stable isotope levels were obtained for five samples from St. Lawrence Island and one from Bering Island. The $\delta^{15}N/\ \delta^{13}C$ values for bone samples from St. Lawrence Island were significantly ($p \leq 0.05$) different from Bering Island samples. The bone samples were dated using AMS carbon dating to between 1030 and 1150 ± 30 conventional years BP. This study, therefore, provides evidence for a second population of Steller's sea cows in the North Pacific.

Queen Charlotte Sound, New Zealand: A region of high species diversity and significance for *nationally endangered* cetacea

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Queen Charlotte Sound, New Zealand, is a small, shallow sound located at the northeastern tip of New Zealand's South Island. This area hosts the main ferry terminus between the North and South islands and is subject to commercial marine tourism, recreational vessel activity and marine farming. Despite this, no methodical examination of cetacean occurrence and distribution has previously been conducted, in spite of anecdotal evidence suggesting the region's importance for cetaceans. Between November 2011 and April 2013, a total of 341 surveys were undertaken from two opportunistic platforms (systematic and non-systematic) to assess spatial and temporal cetacean distribution throughout the Sound. Six species were identified including Hector's (*Cephalorhynchus hectori hectori*), bottlenose (*Tursiops truncatus*), dusky (*Lagenorhynchus obscurus*) and common dolphins; killer (*Orcinus orca*) and humpback whales (*Megaptera novaengliae*). Monthly trip encounter rates (TER) for bottlenose dolphins ranged from 0.35-0.55 with peaks during austral spring. Hector's dolphin encounter rates were higher in summer and autumn (0.28 and 0.26, respectively) than in spring and winter (0.025 and 0.019, respectively). These data suggest that bottlenose and Hector's dolphins are present year round, with seasonal variation. Temporal habitat partitioning was demonstrated by the presence of dusky dolphins from autumn through spring (TER=0.012-0.09), common dolphins in autumn (TER=0.012) and summer (TER=0.014), killer whales in summer (TER=0.056) and humpback whales in winter (TER=0.018). Cetaceans were distributed throughout the Sound; however, spatial habitat partitioning was exhibited amongst Hector's dolphins, which were consistently encountered in several small, mid-channel bays. The region has proven significance for *nationally endangered* Hector's and bottlenose dolphins; and *nationally critical* killer whales. Information of cetacean distribution patterns in Queen Charlotte Sound will benefit management decisions associated with vessel regulations, routing and future development, thus, lending to *nationally endangered* species and habitat preservation in a small area with overlapping high anthropogenic activity.

Seals, sea lions and salmon fisheries: are pinnipeds skewing survivorship data through the selective predation of acoustically tagged fish?

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Ultrasonic coded transmitters (UCTs) are high-frequency acoustic tags commonly used to conduct survivorship studies of vulnerable and economically important salmonid species. Recently, unexpectedly high mortality rates for acoustically instrumented fish on the West Coast of the United States have led to the so-called "dinner bell" hypothesis: marine mammals foraging in delta and riverine environments are utilizing information from UCTs to selectively prey upon tagged fish. In order to test the viability of this hypothesis, high-frequency hearing data were obtained for a trained harbor seal (*Phoca vitulina)* and a trained California sea lion

(*Zalophus californianus)*. Detection thresholds were measured for each subject using long (500 ms) and short (10 ms) duration 69 kHz stimuli designed to approximate common tag outputs. In addition, detection thresholds were measured for a signal recorded directly from a Vemco V16-3H UCT, composed of a series of 10 ms, 69 kHz pulses. Thresholds for the harbor seal were as expected based on existing data for this species, while thresholds for the California sea lion were 33 dB lower than predicted. These findings indicate that both species can detect a 69 kHz UCT at distances exceeding 100 meters. In turn, this confirms that harbor seals and California sea lions foraging in salmonid habitats are indeed capable of using tag outputs to selectively prey upon acoustically instrumented fish, thereby skewing critical survivorship data.

Behavioral responses of pilot whales, sperm whales and humpback whales to sound playbacks of their potential predator, the killer whale

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This study is part of the 3S (**S**ea mammal **S**onar **S**afety) project investigating how naval sonar affects cetaceans and aims to assess how reactions to sonar sounds relate to reactions to natural disturbance sounds such as predator (killer whale, *Orcinus orca*) sounds. Indeed, both stimuli may create similar trade-offs between the costs or benefits of reacting and we expect that reactions to killer whale playbacks should be shaped by how sounds are perceived. Killer whales can predate upon other marine mammals including cetacean species so the detection of their vocalizations by cetaceans may indicate increased predation risk. To test the hypothesis that cetaceans' behavior is altered by the detection of killer whale vocalizations, we conducted in Norwegian waters playbacks of killer whale sounds to free ranging long-finned pilot whales (*Globicephala melas*), sperm whales (*Physeter macrocephalus*) and humpback whales (*Megaptera novaeangliae*). Behavioural data were collected using D-TAGs that were temporally and non-invasively attached on animals with suction cups prior to the sound playback. To assess whether killer whale playbacks induced behavioral changes in these three studied species, we compared behavioral data collected before sound exposure to those collected during sound exposure. Our most striking results showed that killer whale sound playbacks induced 1) in sperm whales, an interruption in the descent phase of diving and a return to the surface; 2) in pilot whales, a clear attraction towards the speaker; 3) in humpback whales, a strong avoidance response. These results suggest that when encountering killer whales, animals would likely to stop fitness-enhancing activities such as feeding and to exhibit characteristic behavioral reactions in a context of potential predation. These clear and consistent reactions to killer whale playbacks contrast with the variability of results with sonar exposures.

Risk governance of swimming-with-whales tourism activities in the Great Barrier Reef.

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Viewing and interacting with wild animals, particularly in the marine environment, presents a range of risks to the health and safety of both humans and the animals involved. The management of such risks often forms a part of the standard procedures of tourism operators, however where such risks are elevated additional management tools may be necessary (e.g. regulation, codes of practice) to eliminate or mitigate potential negative outcomes. This study adopted a risk governance approach to develop guidelines and recommendations for enhancing the safety and sustainability of swim-with tourism interactions involving dwarf minke whales (*Balaenoptera acutorostrata* subsp.) in the Great Barrier Reef. Risk governance is defined as the application of good governance principles to risk assessment and management, and requires the participation of all relevant stakeholders. Tourism operators, managers and other key stakeholders participated in an iterative research process to assess risks to both whales and human participants, via in-depth key informant interviews (n=11 respondents) and two facilitated workshops (n=40 participants in total). The process resulted in the identification of a range of risks, and a comprehensive framework to address those that were within the stakeholders' present capacity. Significant uncertainties and knowledge gaps were identified, including risks and threats to the whales and their habitat, particularly during the nine to ten months of the year when they leave the Great Barrier Reef. Similarly, there are many uncertainties surrounding risks to the Great Barrier Reef itself and to tourism businesses. The risk governance model used in this study provided a valuable framework to improve the management of this economically important tourism activity, and key lessons from the study can be used to assist the management of whale watching elsewhere.

Incorporating cetacean research into K-12 educational activities

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The creation of educational activities based on marine mammal research helpsdisseminate information that scientists obtain through research, and it allowsstudents to be engaged in the work regardless of their proximity to the coast. In addition, students who utilize actual data are able to apply mathematics, science, and geography to real-world situations. We created several K-12interdisciplinary activities based on cetacean research methods and implemented these lessons in 7 schools. In one activity, students used data from sightings of common bottlenose dolphins *Tursiops truncatus* to calculate association indices. The students then hypothesized about the relationships of the dolphins based on the derived association indices and the background information provided on social bonds in dolphins. The second activity focused on analyzing the spatial patterns of cetaceans. Students mappedsighting locations of common bottlenose dolphins using latitudinal andlongitudinal coordinates and then examined the data for spatial patterns. We also designed an activity to teach students about marine mammal communication and vocal mimicry. In particular, we played examples of dolphin whistle mimicry and then implemented an interactive activity in which students attempted to imitate dolphin whistles, which we recorded and discussed. Visually impaired students listened to examples of vocal mimicry and were able to differentiate small variations in the whistles. In each of theseactivities, students enjoyed learning about the behaviors exhibited bybottlenose dolphins, such as begging, strand feeding, or vocal mimicry. K-12 activities based on actual research can increase the reach of scientific findings, improve ocean literacy, and enhance educational opportunities for students.

Spatially-explicit semi-quantitative risk assessment of threats to Maui's dolphins (*Cephalorhynchus hectori maui*)