Muscle Physiology of Ice-Associated Alaskan Seals

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Given their reliance on sea ice for a number of critical life-history periods, understanding species-specific physiology of Arctic seals is necessary to better predict the potential consequences of rapid sea ice loss. To gain insight into how skeletal muscle physiology relates to diving and foraging behavior we evaluated myoglobin content ([Mb]), non-bicarbonate buffering capacity (β), and fiber-type profiles of a major locomotor muscle in three Arctic seal species. Longissimus dorsi muscle was collected and analyzed from subsistence harvested ringed (*Pusa hispida*; n=11), bearded (*Erignathus barbatus*; n=41), and spotted (*Phoca largha*; n=12) seals. We found adult ringed seal muscle [Mb] to be 6.4±0.5 g Mb 100 g wet tissue-1, while adult spotted seal muscle averaged 5.5±0.5 g Mb 100 g wet tissue-1. These data agree with previously reported values for other phocid species. In contrast, adult bearded seals had much lower muscle [Mb] at 4.6±0.4 g Mb 100 g wet tissue-1, suggesting their aerobic capacity is more similar to benthically foraging walruses than to other phocids. Adult β was fairly similar across all species (ringed, β = 84±1.0 slykes; bearded, β = 81±1.1 slykes; spotted, β = 77±0.6 slykes). Fiber-type analyses revealed species-specific differences in the relative proportion of fast- and slow- twitch muscle fibers. Spotted seals exhibited an even mix of fast- and slow-twitch fibers (52% : 48%), while ringed and bearded seals had higher proportions of fast-twitch fibers (62% and 70%, respectively). These results provide a comprehensive overview of the aerobic and anaerobic properties of locomotor muscle in several ice-associated seal species. Together, these properties can be used to predict routine diving behavior and define physiological limits for ringed, bearded, and spotted seals. Our data suggest a strong link between muscle physiology, life-history strategies, and foraging behavior, and provide insight into the diving capacities and limitations of data-deficient species.