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Physiological Adaptations for Diving in the Bearded Seal

The bearded seal (*Erignathus barbatus*) is a circumpolar Arctic marine mammal that forages beneath broken, moving pack-ice. Within this dynamic system, seals use sea ice as a platform for rest, but must also dive beneath it to find benthic prey and return to the surface to breathe. For marine mammals, diving capacities depend largely on two factors: how much oxygen an individual carries to depth and how quickly that oxygen is used. A common metric for diving capacity is the aerobic dive limit (ADL), or the time an animal can spend diving before there is an increase in blood lactate. In this study, we utilize data from wild and captive bearded seals to provide the first ADL estimate for this species. Hematological parameters including, hemoglobin (19-31g dL^{-1}) and hematocrit (52-65%) were obtained from free-ranging bearded seals (n = 10) in the Chukchi and Bering Seas, muscle myoglobin content (3.26-4.65g Mb 100g wet $tissue^{-1}$) was determined by analyzing samples obtained from subsistence harvested seals (n = 7) in Alaska, and diving lung volume was estimated based on published values from related species. In addition, seasonal changes in resting metabolic rate (RMR: 3.7-5.5 mL O2 min^{-1} kg^{-1}) were examined in a juvenile male bearded seal trained to participate in metabolic data collection sessions. Using these source data we calculated a range of possible ADL values by dividing total body oxygen stores by different multiples of RMR (providing a range of potential diving metabolic rates). Depending on the assumed seal mass and metabolic rate, we estimate the ADL of an adult bearded seal to be between 4 and 16 minutes; this estimate will be refined as additional source data become available and used to improve predictions regarding the sensitivity of this species to changing conditions.