Patterns of stable isotope (C and N) variability in bearded, ringed, and spotted seals from the Bering and Chukchi Seas

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Stable isotope analyses have become useful for understanding dietary patterns of marine mammals. However, dietary comparisons may be confounded by the choice of tissue or the timing of tissue collection. To better understand variation in isotope ratios and seal diets, we quantified stable carbon ($^{13}C/^{12}C$) and stable nitrogen ($^{15}N/^{14}N$) in liver, kidney, and muscle tissue of 27 bearded (*Erignathus barbatus*), 30 ringed (*Phoca hispida*), and 30 spotted seals (*P. largha*) harvested by Native hunters in the Bering and Chukchi seas of Alaska between 2004 and 2005. We expected the most enriched $\delta^{13}C$ ratios and most depleted $\delta^{15}N$ ratios in bearded seals, which are predominantly benthic feeders. In contrast, we expected the most depleted $\delta^{13}C$ and most enriched $\delta^{15}N$ ratios in spotted seals, which are predominantly piscivorous. We used a model selection framework to describe variation in isotope ratios by species, gender, season (fall, winter, and spring), age, and tissue type. For $\delta^{13}C$, the best model indicated fractionation rates were similar across tissues for different species and did not vary by season. As expected, $\delta^{13}C$ was most enriched for bearded seals ($P < 0.01$) compared to spotted and ringed seals, which were similar to each other ($P = 0.67$). For $\delta^{15}N$, the best model indicated that isotopic ratios changed by season and species and we could only discern isotopic differences among species if we controlled for seasonal effects. Within the same season, $\delta^{15}N$ generally was most enriched for spotted seals and most depleted for bearded seals, with ringed seals at intermediate levels. To correctly interpret dietary patterns among species of ice-associated seals, $\delta^{13}C$ and $\delta^{15}N$ should be assessed using the same type of tissue and for $\delta^{15}N$ only samples collected within the same season should be used.

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