ECOLOGY

THE EFFECT OF PREY QUALITY ON BODY CONDITION AND REPRODUCTIVE SUCCESS OF FEMALE STELLER SEA LIONS

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Several Steller sea lion populations in the Gulf of Alaska and the Aleutian Islands have experienced severe reductions in abundance since the mid-1970's (1). The leading explanation for the decline is the nutritional stress hypothesis, which proposes that changes in Steller sea lion prey availability and quality have altered their population growth rate by affecting reproductive success and/or mortality. Research suggests that before the decline, Steller sea lions ate primarily herring and capelin (2). Since the start of the decline, they have come to rely much more heavily on pollock and mackerel – two species that have increased in dominance as competition with herring and capelin wanes (3,4). Studies have also shown that Steller sea lions today have lower body masses than they did before the start of the decline (5), further implicating nutritional stress.

Adult female Steller sea lions raise their pups on islands called haul-outs. They alternate between periods of attendance to their pups and periods of foraging for food. The more time a mother spends searching for food, the less likely it is that her pup will survive. As a consequence, juvenile sea lions are particularly vulnerable to reduced abundances of local prey, which increases the amount of time that pups spend without the protection of their mothers.

The composition of the diet can also affect Steller sea lion population growth (3,4). Studies suggest that populations of sea lions decrease in abundance with decreasing diversity of available prey items. This could be because prey abundance or quality are positively related to prey diversity, or because a diverse diet is nutritionally required. Prey quality has become a topic of increasing interest to researchers of the Steller sea lion decline. Different prey species have different energy contents and digestive efficiencies. Rosen and Trites found that squid and pollock have relatively low, and herring relatively high digestive efficiencies in Steller sea lions (6). This has important implications for the nutritional stress hypothesis, as sea lions appear to have had much more herring in their diet before the decline, and now consume more pollock and cephalopods. Rosen and Trites also found that consumption of low-quality prey can cause loss of body mass (7,8). When sea lions were given unlimited access to pollock, instead of a preferred food, they did not increase their gross energy intake (i.e, they did not consume more pollock to compensate for its lower quality), and consequently lost body mass. This indicates that even if low quality prey is abundant, there may be a physical limit to how much Steller sea lions can consume. Nutrition may also affect Steller sea lion reproductive success. It is energetically expensive for female sea lions to carry a fetus to term. Pitcher et al. found that the body condition of pregnant female Steller sea lions was positively related to the probability that they would still be pregnant later in gestation (9).

Many of the experimental studies on Steller sea lions discussed above have involved only juvenile sea lions. Young sea lions, which need extra energy for growth, may be particularly vulnerable to nutritional stress. Studies comparing the body mass, metabolism, and reproductive success of adult female sea lions on a high-quality diet (herring) versus a low-quality diet (pollock) would serve to support or refute the nutritional stress hypothesis as an explanation for the decline of Steller sea lion populations.

References

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