Arctic | Ecosystem Perspectives

Trophic roles of spotted seals in Alaskan Arctic marine ecosystems

Presenter: Peter Boveng, peter.boveng@noaa.gov, NOAA Alaska Fisheries Science Center
Michael Cameron, michael.cameron@noaa.gov, NOAA Alaska Fisheries Science Center
Paul Conn, paul.conn@noaa.gov, NOAA Alaska Fisheries Science Center
Justin Crawford, justin.crawford@alaska.gov, Alaska Department of Fish & Game
Brenna Groom, brenna.groom@noaa.gov, NOAA Alaska Fisheries Science Center
Thomas Helser, thomas.helser@noaa.gov, NOAA Alaska Fisheries Science Center
Stacie Koslovsky, stacie.koslovsky@noaa.gov, NOAA Alaska Fisheries Science Center
Josh London, josh.london@noaa.gov, NOAA Alaska Fisheries Science Center
Beth Matta, beth.matta@noaa.gov, NOAA Alaska Fisheries Science Center
Brett McClintock, brett.mcclintock@noaa.gov, NOAA Alaska Fisheries Science Center
Lori Quakenbush, lori.quakenbush@alaska.gov, Alaska Department of Fish & Game
Colleen Reichmuth, coll@ucsc.edu, University of California, Santa Cruz
David Rosen, d.rosen@oceans.ubc.ca, University of British Columbia
Raphaela Stimmelmayr, Raphaela.Stimmelmayr@north-slope.org, North Slope Borough
Nicole Thometz, nthometz@usfca.edu, University of San Francisco
James Thorson, james.thorson@noaa.gov, NOAA Alaska Fisheries Science Center
Johanna Vollenweider, johanna.vollenweider@noaa.gov, NOAA Alaska Fisheries Science Center
Andrew von Duyke, Andrew.VonDuyke@north-slope.org, North Slope Borough
Heather Ziel, heather.ziel@noaa.gov, NOAA Alaska Fisheries Science Center

Bearded, ringed, spotted, and ribbon seals are highly abundant in the Arctic marine ecosystems of Alaska, yet their roles and significance as high-trophic predators are poorly understood and currently underrepresented in ecosystem models. To begin addressing these gaps, we estimated the consumption of prey by spotted seals (*Phoca largha*) in the Bering and Chukchi seas during the winter (December – April) and open-water (May – November) seasons. Our approach integrated stomach contents analysis, fish morphometrics, fish energy contents, energy intake data from captive spotted seals, seal morphometrics, and estimates of seal abundance, distribution, and age structure to make inferences about the biomass of each prey species consumed. For most of the model inputs, we were able to propagate uncertainty to the final estimates. Because spotted seals are mostly piscivorous we focused on nine fish species, seven of which are the most common prey identified in spotted seal diets: Arctic cod (*Boreogadus saida*), saffron cod (*Eleginus gracilis*), walleye pollock (*Gadus chalcogrammus*), capelin (*Mallotus villosus*), Pacific herring (*Clupea pallasii*), rainbow smelt (*Osmerus mordax*), and Pacific sand lance (*Ammodytes hexapterus*). The remaining two species are important commercially but less common as spotted seal prey: Pacific cod (*Gadus macrocephalus*) and yellowfin sole (*Limanda aspera*). We determined that spotted seals obtain roughly two thirds of their annual energy intake from the Bering Sea and one third from the Chukchi Sea, where they are absent for much of the winter. They consume small fish or small age-classes of larger species; the largest prey, herring, weighed about 125 g, on average. Capelin, saffron cod, Arctic cod, and herring were by far the dominant prey species. Overall, we estimate that the more than 250,000 spotted seals in the Bering and Chukchi seas consume at least 300,000 metric tons of prey annually, a quantity that merits ecological comparison with other predators' needs, fishery stocks, and catches.