BOEM ENVIRONMENTAL STUDIES PROGRAM: Ongoing Studies

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea (AK-08-12-05)

BOEM Information Need(s) to be Addressed: This study will provide BOEM NEPA analysts with needed basic diet information for both fish and seals in the Chukchi Sea. Because of the close association of the three trophic levels, it will greatly increase understanding of the ecological connections between invertebrates, fish, and seals and also provide measures of natural variability across a series of years that include both warm and cold ocean temperatures. This information will support Essential Fish Habitat, Marine Mammal Protection Act, and NEPA requirements for Chukchi Lease Sales.

Total Cost: $532,173 plus Joint Funding

Period of Performance: FY 2009-2014

Conducting Organization: CMI, UAF

BOEM Contact: Kate Wedemeyer

Description:

Background: In preparation for oil and gas exploration and the impending Lease Sale 193, MMS Alaska OCS Region conducted a Chukchi Offshore Monitoring in Drilling Area (COMIDA) workshop in November 2006. That workshop identified a clear need for knowledge about distribution and abundance of forage fish prey resources for marine mammals in the Chukchi Sea. Not only is there a pressing need for knowledge about fishes in the Chukchi Sea, but it is also essential to evaluate those fishes as prey resources for marine mammals. An additional factor that is making the requirement for information in the Chukchi Sea imperative is the potential listing of three species of ice seals under the Endangered Species Act. The decision to list is still pending for ringed seals (*Phoca hispida*), bearded seals (*Erignathus barbatus*), and spotted seals (*Phoca largha*). The petition for listing prepared by the Center for Biological Diversity states that global warming is threatening ice seals with extinction due to loss of sea ice habitat as argued for the recently-listed polar bears. An additional ice seal species, the ribbon seal (*Phoca fasciata*), was also proposed for listing, but NOAA decided not to list the ribbon seal at this time.

Oil exploration is likely to take place in the northeast Chukchi Sea simultaneously with ever-increasing rates of global warming. It will not be possible to discern the cause or extent of effects on this Arctic ecosystem without first determining its current status. There is a paucity of data and limited ecological understanding for pelagic and demersal fishes in Lease Sale areas. The rapidly receding sea ice in the Arctic has received much attention recently and record minima were recorded in both 2007 and 2008. The loss of

habitat for ice seals has resulted in three species being considered for listing under the Endanger Species Act. Dietary differences among forage fishes in the Lease Sale area may propagate into higher trophic levels such as ice seals. Thus, it is essential to evaluate fishes as prey resources, or "forage," for marine mammals. The study design aligns fish, prey and seals sampled in the Chukchi Sea, not only across both diet and isotopic signals, but also matched over three recent and consecutive years to provide an essential measure of interannual variability. The proposed study will produce a more comprehensive picture of forage fishes in the Chukchi Sea and then trophically relate fishes and their prey to ice seals and their diets in the Chukchi Sea to provide an essential new understanding of the ecosystem. The resulting increase in basic knowledge of the Chukchi Sea ecosystem will facilitate good stewardship by the oil and gas industry.

Objectives:

- Assess the diet composition of forage fishes;
- Establish trophic level of forage fish species and of their prey;
- Analyze interannual differences in diet of fishes and in the trophic level of fishes and their prey;
- Document the trophic level of ice seals;
- Document ice seal trophic history;
- Develop isotopic mixing models;
- Compare trophic levels of forage fishes to those of ice seals;
- Provide diet and trophic level data to BOEM in electronic format;
- Complete data archiving with NODC and make available to BOEM in a GIS compatible format.

Methods: This study will: 1) conduct interannual diet and trophic analyses using fishes caught during 2007, 2008 and 2009; 2) analyze fish muscle for the effect of lipid-removal on stable carbon and nitrogen ratios; 3) assess the relative importance of functional groups of prey taxa in the diet of each fish species; 4) perform stable isotope analysis to assess the trophic level of the fish species that are consumed by ice seals.

Current Status: Awaiting final report

Final Report Due: January 2014

Publications Completed:

Carroll, S. 2010. Insight into the Diet History of Ice Seals Using Isotopic Signatures of Muscle Tissue and Claws, MS Thesis, University of Alaska.

Carroll, S. 2012. Insight into the Diet History of Ice Seals, Fish, Fish PreyUsing Isotopic Signatures of Muscle Tissue and Claws. Poster at US-Canada Oil and Gas Research Forum, Nov 15, 2012 Anchorage, Alaska

Carroll, S. S. et al. 2012. Fish, Fish Prey and Seal Trophic Relationships. Annual CMI meeting, Nov 20, 2012, University of Alaska, Fairbanks.
Carroll, S. S., L. Horstmann-Dehn, B. L. Norcross. 2013. Diet history of ice seals using stable isotope rations in claw growth bands. Can. J. Zool. 91: 191–202 (2013)

Affiliated WWW Sites: http://www.boem.gov/akstudies/
http://www.sfos.uaf.edu/cmi/

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ESPIS: Environmental Studies Program Information System
All *completed* ESP studies can be found
here: http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp