

BOEM ENVIRONMENTAL STUDIES PROGRAM: Ongoing Studies

Study Area(s): Beaufort Sea

Administered By: Alaska OCS Region

Title: U.S.-Canada Transboundary Fish and Lower Trophic Communities (AK-12-04)

BOEM Information Need(s) to be Addressed: BOEM needs ecological baseline data for fish and lower trophic organisms in transboundary marine waters in the eastern Beaufort Sea. Information needs include documentation of fish species presence, abundance and distribution in the lease area as well as their ecological interactions with habitat and other trophic levels (prey species and plankton). This project extends recent marine fish and lower trophic surveys in the Beaufort Sea to assess potential effects of OCS development on lower trophic food webs and essential fish habitat (EFH). Study information will support NEPA and other environmental analyses for future lease sales, exploration plans, and potential development and production plans. The information may also be used by Canada in relation to their oil and gas activities.

Total Cost: \$5,191,125
plus Joint Funding (~\$5,000,000)

Period of Performance: FY 2012-2017

Conducting Organization: UAF; Department of Fisheries and Oceans, Canada

BOEM Contact: [Kate Wedemeyer](#)

Description:

Background: Information needs in the eastern Beaufort Sea are growing, especially in light of new emphasis on marine spatial planning, EFH consultation, food web modeling and Arctic climate change issues. Currently, NEPA analysts must rely on limited historical data and extrapolation to analyze potential development impacts on eastern Beaufort Sea marine fish and lower trophic communities. A 2008 MMS fish survey in the western Beaufort documented unexpected diversity, including several commercial fish species (cod, pollock, crab) previously unknown in the region. We need better information in the eastern Beaufort about what fish species inhabit the area, as well as baseline information about abundance, distribution, habitat, and seasonal and inter-annual variability of fish and invertebrates in the understudied lower foodweb. An under-ice fish and invertebrate baseline, while challenging to obtain, is needed because Beaufort species live under ice three-fourths of the year. Additional oceanographic information about currents, upwelling, and hydrographic structure through fine-scale CTD resolution is needed to document biological habitats. Data from the study will support NEPA analysis to support Essential Fish Habitat (EFH) ecological analyses of fish, their prey and their habitat established for three additional Beaufort fish species (Arctic cod, saffron cod, and snow crab).

This transboundary survey effort, jointly-funded with the Canadian Department of Fisheries and Oceans (DFO), Central and Arctic Region, will share a research vessel, as

well as expertise and methods. Costs will be shared in proportion to area surveyed. The collaboration will advance our knowledge of the Beaufort Sea shelf ecosystem, transboundary fish stocks, essential fish habitat, life stage history, and oceanographic variability. Inclusion of invertebrate and primary production sampling will address lower trophic food webs and ecological relationships to bird and marine mammal populations. This work will also contribute to other studies including long-term monitoring efforts near Camden Bay and future international Arctic cod studies.

Objectives:

- Document baseline fish and invertebrate species presence, abundance, distribution and biomass.
- Analyze dietary habits, age and growth patterns of the most abundant species to support Canadian development of a Beaufort shelf fish and marine mammal food web model.
- Test under-ice methods and provide baseline information for the ice-covered season.
- Estimate seasonal variability of fish and habitats.
- Document the hydrographic structure of the eastern Beaufort shelf.
- Enhance understanding of how habitat variables (such as temperature and salinity) affect distributions under different climate conditions.

Methods: The survey will sample fish, invertebrates, and related biological and oceanographic habitat characteristics between longitudes 141° and 147° in the U.S. and into Canadian waters to ~138° (across the Canadian border to Herschel Island and the Mackenzie canyon). Field surveys will be performed every other year in order to reduce autocorrelation of climate conditions and to refine sampling strategy based on analysis of first year data. Field sampling will occur in years 1 and 3. Additional funds will be sought for a third survey in year 4 to better evaluate inter-annual variability.

This survey will expand the scope and reach of a Beaufort Sea Pilot Fish Survey conducted in 2008. Methodologies will follow those from the 2008 survey and the ongoing BOEM Central Beaufort Sea Fish Survey, modified in consideration of lessons learned from the earlier work. Sampling will deploy gear types such as beam trawl (10m wide), otter trawl, Isaacs-Kidd, and bongo nets. This study will include additional field surveys in both the under-ice and open water seasons to provide a better understanding of variability and collect additional habitat characteristics; collect invertebrates in both the water column and benthos; collect CTD data to document hydrographic structure; and collect and analyze ecological (e.g. energetics, isotope, genetic and otolith) samples for a foodweb model. This contemporaneous collection of integrated data over the lower food chain and physical environment supports an ecosystem management approach.

Products will include annual progress reports, final synthesis, databases, and GIS based maps and attribute tables of marine fish and lower trophic communities for inclusion in the in-house fisheries database and use in NEPA analyses.

Current Status: Awaiting final report

Final Report Due: July 2017

Publications Completed:

Lauren M. Divine, Bodil A. Bluhm, Franz J. Mueter and Katrin Iken, In Press. Diet analysis of Alaska Arctic snow crabs (*Chionoecetes opilio*) using stomach contents and $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotopes. Deep -Sea Research Part II, <http://dx.doi.org/10.1016/j.dsr2.2015.11.009>

Bluhm B. and Iken K. 2013. Population assessment of snow crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas: Preliminary findings. (Oral) 28th Lowell Wakefield Symposium: Responses of Arctic Marine Ecosystems to Climate Change, March 2013, Anchorage, AK.

Bell L., Iken K. and Bluhm B. 2013. Trophic structure of benthic primary consumers on the U.S. Eastern Beaufort Sea shelf. Poster, Alaska Marine Science Symposium, January 2013, Anchorage, AK.

Grey, B. 2013. Comparing the Feeding Ecologies of three abundant Fish Species in the Chukchi and Beaufort Seas. Poster, Lowell Wakefield Symposium: Responses of Arctic Marine Ecosystems to Climate

Norcross, B. 2013. Beaufort Sea marine Fish Surveys in the U.S.-Canada Transboundary Area. Lowell Wakefield Symposium: Responses of Arctic Marine Ecosystems to Climate Change. March 27, 2013

Norcross, B.L., and L.E. Edenfield. 2012. U.S. Beaufort Sea fish communities. Oral presentation, U.S.-Canada Northern Oil and Gas Research Forum, November 2012, Anchorage, AK.

Norcross, B.L. and L.E. Edenfield. 2013. Beaufort Sea marine fish surveys. Oral presentation, 28th Lowell Wakefield Symposium: Responses of Arctic Marine Ecosystems to Climate Change, March 2013, Anchorage, AK.

Norcross, B. et al. 2012. U.S. Canada Transboundary Survey. U.S.-Canada Oil and Gas Research Conference, Nov 12-15, 2012, Anchorage, Alaska.

Reist, Majewsky, Loseto. 2012. Canada BREA program fish survey. U.S.-Canada Oil and Gas Research Conference, Nov 12-15, 2012, Anchorage, Alaska.

Smoot et al. 2013. Toward a contemporary baseline for zooplankton communities in the American Beaufort Sea. (Poster) Alaska Marine Science Symposium, January 2013, Anchorage, AK. March 27, 2013

Smoot, C.A. and R.R. Hopcroft. Beaufort Sea zooplankton communities 2010–14 and relation to hydrography. Abstract submitted to the 2016 Alaska Marine Science Symposium.

Divine, L.M., F.J. Mueter, G.H. Kruse, B.A. Bluhm, and K. Iken. New estimates of growth, size of maturity, mortality and biomass of snow crab, *Chionoecetes opilio*, in the Arctic Ocean off Alaska. Abstract submitted to the 2016 Alaska Marine Science Symposium.

Apsons S.J. and B.L. Norcross. Abiotic and biotic influences on eelpout diet composition in the U.S. Beaufort Sea. Oral Presentation. American Fisheries Society Meeting, Alaska Chapter, 2–6 November 2015, Homer, Alaska.

Frothingham, A., and B.L. Norcross. Evaluating growth rates of Arctic Cod, *Boreogadus saida* collected from 2009 to 2014 across the Chukchi and Beaufort seas. Oral Presentation.

American Fisheries Society Meeting, Alaska Chapter, 2–6 November 2015, Homer, Alaska.

Walker K. and B.L. Norcross. Otolith length-fish length relationships for 11 US Arctic fish species. Oral Presentation. American Fisheries Society Meeting, Alaska Chapter, 2-6 November 2015, Homer, Alaska.

Affiliated WWW Sites: <http://www.boem.gov/akstudies/>

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All *completed* ESP studies can be found here: <https://www.boem.gov/ESPIS/>