Long-term Monitoring of the Marine Ecosystem in the Bering and Chukchi Seas

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Why is it Important?

- In 2010, the NOAA Alaska Fisheries Science Center (AFSC) expanded its annual eastern Bering Sea shelf survey to include the northern Bering Sea shelf and plans to conduct a similar survey in the Chukchi Sea in 2012 (Fig. 1).
- These surveys are part of an AFSC Loss of Sea Ice (LOSI) Research Plan, the primary purpose of which is to study the impacts of climate change and the loss of sea ice on the marine ecosystem and the subsistence fisheries of Alaska fishing communities.
- Long-term monitoring is necessary for assessing, quantifying, and predicting effects of climate change and other industrial activities on the distribution, abundance, and ecology of fishes, crabs and marine mammals.
- A time series of survey data can be used by the Alaska fishing communities to help manage and protect marine resources that are vital to their culture and livelihood.
- If LOSI funds are maintained, the AFSC plans to continue bottom trawl surveys in the northern Bering and Chukchi Seas every three years.

The 2010 Northern Bering Sea Bottom Trawl Survey

The expanded 2010 survey consisted of 376 standard eastern Bering Sea shelf stations and an additional 142 stations on the northern Bering Sea shelf (Fig. 1). Three chartered fishing vessels, the Vesteraalen, Aldebaran, and Alaska Knight, conducted sampling using a scientific bottom trawl from June-August 2010. Results from the 2010 Bering Sea bottom trawl survey provide valuable broad-scale snapshots of the marine environment and of the spatial distribution and abundance for numerous marine species inhabiting the region (Figs. 2 to 7).

- Total fish biomass was 10X greater in the eastern Bering Sea than in the northern Bering Sea (Fig. 8).
- Fishes regularly exploited in the southeast are not in sufficient quantity in the northern Bering Sea to support a large-scale commercial fishery.
- In the eastern Bering Sea, pollock, yellowfin sole, rock sole, and Pacific cod together comprised 78% of the total biomass compared to the northern Bering Sea where yellowfin sole, Alaska plaice, saffron cod, and Arctic cod comprised 72% of the total fish biomass (Fig. 8).
- As latitude increased, the community structure of fishes changed and there were decreases in total biomass, fish biomass, and individual fish weight (Fig. 9).
- The “cold pool”, the area where bottom water temperatures are below 2°C, is a persistent environmental feature of the Bering Sea shelf that can vary in size each year and affect the distribution of marine fishes.

Fish Catch Comparison of Northern and Eastern Bering Seas

![Fish Catch Comparison Graph](Image 1)

Changes in Ecosystem with Latitude

![Changes in Ecosystem Graph](Image 2)

The 2012 Chukchi Survey

The 2012 Chukchi Sea survey will be an unprecedented and comprehensive fisheries and oceanography study of the Arctic marine ecosystem that will provide valuable baseline information for assessing future effects of climate variability and future human development. The survey will consist of a systematic design that includes 73 fixed sampling stations each at the center of 30 x 30 nautical mile grid squares (Fig. 1). Fishes and zooplankton will be sampled from all layers of the water column and near the bottom using a combination of surface (top 20-m of the water column), midwater, and bottom trawls, as well as plankton nets. The abundance of midwater fishes and plankton will also be measured using multi-frequency acoustics. We will also take water samples and collect vertical profiles of conductivity, temperature, depth, light transmission, chlorophyll-a fluorescence, dissolved oxygen, pH, photosynthetic available radiation, and nutrients, as well as surface along-track measurements of temperature and salinity. Biological and oceanographic data will be used to monitor the health and status of the ecosystem and to better predict effects of climate and human impacts on ocean productivity and Arctic marine ecology.

Bering Sea Bottom Trawl Survey Catch Data Available Online

All the catch and temperature data from AFSC bottom trawl surveys of the eastern Bering Sea and northern Bering Sea are available online at: http://www.afsc.noaa.gov/RACE/ground/fish/survey_data/default.htm