

Protocol Development Summary

Protocol: Sea Ice

Parks Where Protocol Will be Implemented: Cape Krusenstern National Monument, Bering Land Bridge National Preserve

Justification/Issues Being Addressed:

The maritime climate, ecological dynamics and taxonomic diversity of the coastal environment of Arctic Network are governed largely by the extent and duration of sea ice. Sea ice is important because it buffers the water from extreme atmospheric temperatures; it has a high albedo affecting the amount of sunlight absorbed in the arctic, and it forms an important biological habitat for seals, polar bear, arctic fox, and other animals that hunt and feed on the ice. Sea ice also forms an important barrier to international shipping lanes, reducing the exposure of Arctic Network coastlines to ocean-going threats much of the year. Sea ice has been shown to be undergoing dramatic changes in the thickness and extent that may profoundly impact Arctic Network coastlines. Furthermore, sea ice is thought to be a sensitive indicator of climate change in high-latitude areas.

Sea ice is an important hydrologic variable which increases in significance with latitude, and produces a diverse array of impacts on physical, chemical, and ecological processes. Formation and movement of coastal sea ice may affect prey and predators directly, by scraping and reworking nearshore habitats and controlling access to open water or preferred habitats, or indirectly, as changes in the sea ice cover affect landscape variables such as coastal erosion.

Over the past few centuries late summer sea ice in the Arctic Ocean has been decreasing at a rate of ten percent per decade. Over the past century, years 2005 and 2007 hold the record for having the lowest annual extent of sea ice cover. In 2007, for the first time in a 28-year record, an area the size of California was completely ice-free in September and the Northwest Passage, a historical barrier to international shipping, was completely ice-free for several weeks during September and August (National Snow and Ice Data Center 2007).

These changes in sea-ice will have widespread impacts on the marine and terrestrial ecosystems in Bering Land Bridge National Preserve and Cape Krusenstern National Monument. Changes in weather patterns, migratory corridors, marine mammal distributions, and vegetation are just a few of the ways in which the coastal environment will be impacted. Alterations to the sea floor due to ice scouring are likely to have profound impacts on the eelgrass populations that persist here in the northernmost eelgrass communities. Shrinking sea ice has already impacted the subsistence activities of native peoples in the region. Changes, particularly recent decreases, in shorefast ice extent and duration have significantly altered winter overland travel and subsistence harvest by local residents throughout the Arctic (Whiting 2002, Gearheard et al. 2006). Ice conditions in the shoulder seasons are considerably more dangerous. Longer open

water seasons have lengthened the hunting season for caribou and shortened the hunting season for marine mammals on the sea ice. Increasing storm frequency and intensity have already impacted small coastal communities by damaging infrastructure and destroying critical coastline (Arctic Climate Impact Assessment 2005). Collecting data on the extent and distribution of sea ice will provide park managers with critical information for making sound decisions on managing the fragile coastal environments and provide information to communities regarding the condition of the ice.

Specific Monitoring Questions and Monitoring Objectives to be Addressed by the Protocol

Some of the specific monitoring questions that will be addressed by this protocol include:

1. What is the annual and seasonal variability in timing and extent of shorefast sea ice?
2. How is the duration and spatial extent of sea ice changing?

Objectives are as follows:

1. Determine long-term trends and annual variability in the timing and extent of shorefast ice in Bering Land Bridge National Preserve and Cape Krusenstern National Monument.
2. Determine the long term trend and variability in the ice free period in Bering Land Bridge National Preserve and Cape Krusenstern National Monument.

Basic Approach

Many organizations are currently monitoring the extent, duration and thickness of sea ice using a variety of techniques, including multispectral satellite imagery, ice-profiling sonar and submarine-based sonar, and web cams. The NOAA Sea Ice Center, Cold Regions Research and Engineering Laboratory, the University of Alaska Geophysical Institute and International Arctic Research Center are potential data sources. The most feasible approach for monitoring sea ice along the Arctic Network coastline is to acquire data from these institutions annually and populate a network database on sea ice. In FY 2009 Arctic Network will begin scoping the available datasets for shorefast sea ice in the areas adjacent to Bering Land Bridge National Preserve and Cape Krusenstern National Monument. We will identify long-term sources of data and assess the feasibility of acquiring data for analysis and reporting annually.

Principal Investigators and NPS Lead:

The NPS Lead for protocol development is Scott Miller (Arctic Network-Data Manager).

Development Schedule, Budget, and Expected Interim Products:

In FY2009 we will scope the availability of sea ice data along the coastlines of Bering Land Bridge National Preserve and Cape Krusenstern National Monument. During FY2009 we will develop the protocols to acquire data from sources identified during the 2008 scoping process. Implementation will be in 2010.

Literature Cited:

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