

Semiannual Progress Report

Project #: F0515

Title: Ice Seal Movements and Stock Structure in a Changing Cryosphere

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Contract Period and Amount of Funding: May 2005- April 2007 (\$203,644)

Report Period: 1 May to 30 June 2005

Report Date: 12 July 2005

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Project Summary:

Ice seasonally covers 14,000,000 km² of northern seas and supports an ecosystem that includes spotted, ribbon, ringed, and bearded seals. These ice-associated seals are the main prey of polar bears and have been vital to the subsistence economy of northern people for thousands of years. The sea ice ecosystem and subsistence economies in the arctic are threatened by decreases in sea ice cover associated with climate change. Assessing the impacts on the ice-associated seals requires knowledge of their movement patterns and population biology. Understanding the population structure of ice-associated seals will help the NMFS and Alaska Natives to manage and protect these important components of “the ecologically diverse marine ecosystems of the North Pacific, and provide long-term, sustained benefits to local communities and the nation,” a research goal of the NPRB. A primary need is to understand the vulnerability of local subpopulations of seals to extinction. If immigration occurs from other populations, vulnerability is low, but if immigration is absent or very rare, the potential for local extinction is high. We are using satellite-linked transmitters to determine whether ringed seals return to the same breeding locations in successive breeding seasons, an indication that immigration rates are low. We also have begun to collect and analyze DNA samples as a further indication of the frequency of immigration.

Progress Summary:

Tracking seal movements

In April and May 2005, we captured and attached satellite-linked and conventional VHF radio tags to the hind flippers of 11 ringed seals and 2 bearded seals near Barrow, Alaska. As of 29 June 2009, all of the tagged seals have remained close to their original capture sites. We have successfully downloaded daily haul out data and imported it to our Access database. We also have begun developing GIS layers to display the seals' movements, sea ice conditions, and bathymetry.

Population genetics

We have successfully extracted and purified DNA from skin samples collected from live seals and from the ice next to breathing holes. The latter skin samples were shed by molting seals. We have collected such samples from over 32 sites in the vicinity of Peard Bay, Alaska during the breeding season of 2005, and we were able to refine a field protocol for expedient sample collection. All 32 epidermal samples yielded DNA and useable genotypes. The eight loci we use (H4-4.2, Hg-6.1, Hg-6.3, Hg-8.10; Allen et al. 1997; Sgpv-2, Sgpv-9, Sgpc-10, Sgpv-16; Goodman 1995) are highly variable both with respect to allelic diversity ($A = 10.7 \pm 3.4$ SD) and heterozygosity ($H = 0.77 \pm 0.17$ SD) in our samples. The characteristics of these loci make them ideal for analyzing low copy DNA such as shed skin. In our preliminary analysis, we found a 1 in 6.34×10^{15} probability that two randomly chosen individuals will share a genotype, indicating that we will be able to distinguish individual seals, and we will have ample power to discriminate local population structure if present.

The samples of shed skin were augmented with skin samples taken from 8 live ringed seals near the McKenzie River delta in the eastern Beaufort Sea, 11 live ringed seals near Peard Bay and Point Barrow in the eastern Chukchi Sea, and 3 bearded seals in Peard Bay. An additional 22 samples collected by from harvested ringed seals in the eastern Beaufort Sea have been collected but not yet analyzed.

The movements data will tell us how consistently adult seals return to the same breeding sites. Our analysis of genetic diversity will tell us whether or not fidelity to breeding sites by seals reflects actual philopatry. The patterns of diversity will indicate whether the observed site fidelity reflects site preferences expressed only in adulthood or that seals return to their natal sites (true philopatry). The former case would be indicated by little genetic structuring, while the latter would show distinct clades associated with breeding sites.

Data collection in the field began less than one month after award of funding thanks to the tremendous efforts of John Moran, Research Associate, University of Alaska Southeast. John was assisted in the field by Oriana Harding (Homer, Alaska), Rex Snyder (Alaska Nanuuq Commission), Jimmy Jones (Barrow, Alaska), Stephanie Sell (University of Alaska Southeast), Brendan P. Kelly (University of Alaska Southeast), Lynn Waterhouse (University of Dayton), Sherman Anderson (Alaska Nanuuq Commission), and seal dogs Jamberry and Cooper.



Rex Snyder and a ringed seal tagged in Peard Bay, Alaska in April 2005.



Ringed seal captured in Peard Bay, Alaska in April 2005.



Bearded seal captured and tagged in Peard Bay, Alaska in May 2005.