

# Using satellite telemetry to study temporal and spatial overlap of marine mammals and industrial activities in northwest Alaska

Frost KJ<sup>1</sup>, Crawford JA<sup>2</sup>, Whiting A<sup>3</sup>, Suydam RS<sup>4</sup>, Quakenbush LT<sup>2</sup>, and Lowry LF<sup>1</sup>

<sup>1</sup>School of Fisheries & Ocean Science, Univ. of Alaska, 73-4388 Pa'iaha Street, Kailua Kona, HI 96740, USA; kjfrost@hawaii.rr.com

<sup>2</sup>Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska 99701, USA

<sup>3</sup>Native Village of Kotzebue, Box 296, Kotzebue, AK 99752, USA

<sup>4</sup>North Slope Borough Dept Wildlife Management, Box 69, Barrow AK 99721, USA

## ABSTRACT

Significant industrial developments are occurring in coastal and offshore waters of northwestern Alaska. At least eight species of marine mammals, both migratory and resident, use this region for feeding, reproducing, or molting. Until recently, broad generalizations were used to describe their presence or absence in impacted areas. To address the need for more detailed information, scientists and Inuit hunters have attached satellite-linked dive recorders (SDRs) to two species of cetaceans (beluga whales (*Delphinapterus leucas*), n=23; bowhead whales (*Balaena mysticetus*), n=19) and three species of pinnipeds (spotted seals (*Phoca largha*), n=12; ringed seals (*Pusa hispida*), n=41; bearded seals (*Erignathus barbatus*), n=37) from this region. Their movement data were overlaid on areas where industrial development is currently occurring (Red Dog lead/zinc mine port and Chukchi Sea outer continental shelf (OCS) oil and gas leases). The Red Dog port region was used only by ringed and bearded seals. OCS lease areas were used mainly by bowhead and beluga whales. Tagged bearded and ringed seals likely did not use the OCS area much because of the location and dates of tagging.

Use of SDRs has made it possible to document distribution and movements of five marine mammal species that range widely in remote areas, and for which we previously had no detailed information about habitat use. However, while our results are informative, they are of limited use for quantitatively evaluating exposure to industrial activities because sample sizes are relatively small, the times and places where animals were captured and tagged may bias the results, and tracking durations have been relatively short. Nonetheless, this information can provide a powerful qualitative tool to demonstrate spatial and temporal overlap of marine mammals with industrial activities. Maps can show when and where the highest or lowest number of species or individuals may be present, and mitigation measures can be developed to minimize potential impacts.

## METHODS

Belugas and seals were caught in summer or autumn, before freeze-up, in specially designed large-mesh nets that were either drifted free where animals were present or anchored along routes where they were expected to move. Bowheads were remotely tagged from small boats. Satellite-linked dive recorders (SPLASH tags made by Wildlife Computers, Redmond, WA) were glued to the hair at the base of a seal's neck, pinned through the dorsal ridge of belugas, and deployed remotely using a jabstick for bowheads. Research projects reported in this poster were conducted under permits required by the US Marine Mammal Protection Act.

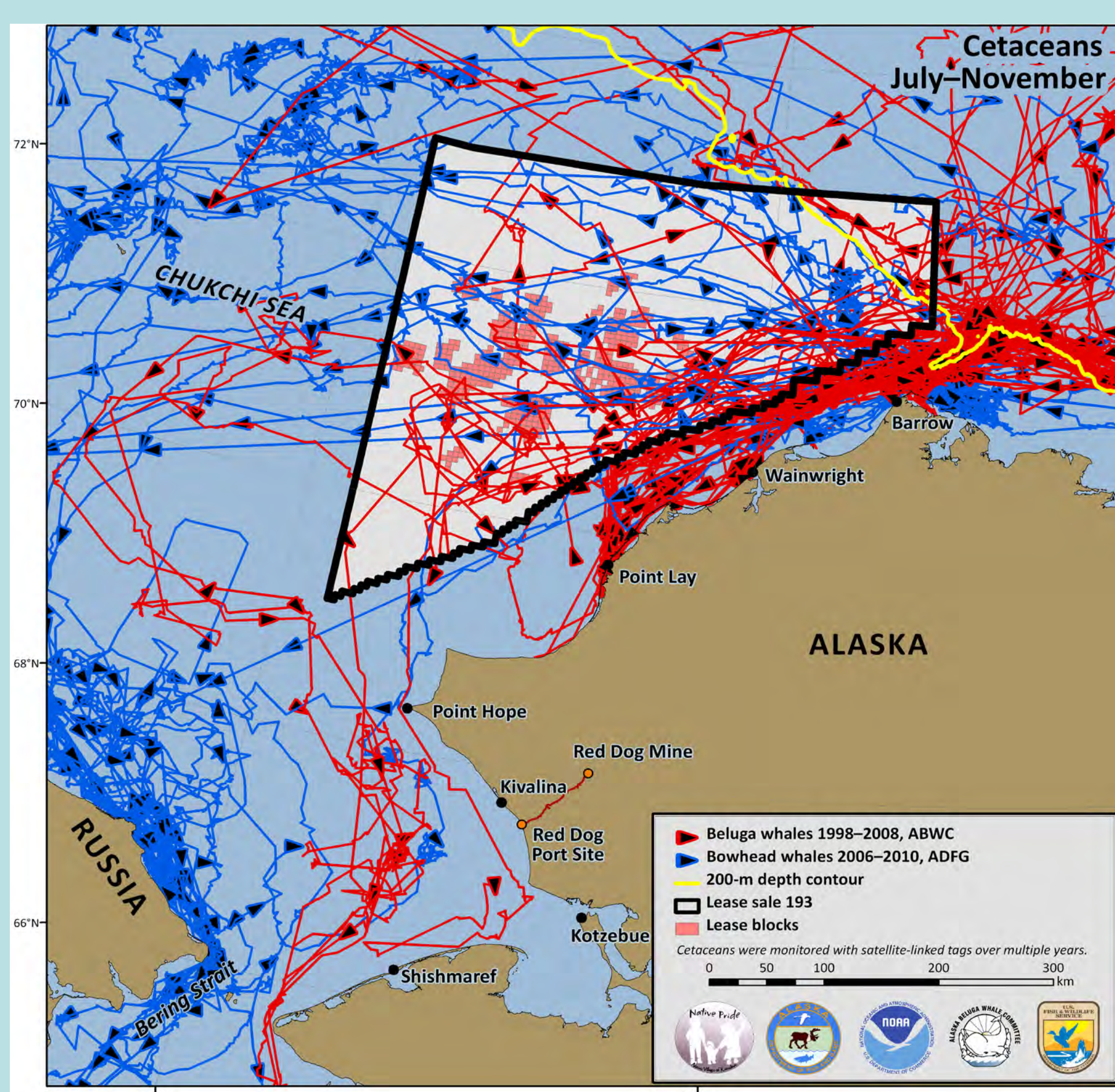
All locations, regardless of quality, were filtered using a Speed-Distance-Angle filter (SDA-filter; Freitas et al. 2008) and R software, version 2.9.2 (Package: *argosfilter*; R Development Core Team, 2007).



## COMMUNITY-BASED RESEARCH

These studies were collaborative efforts between Alaska Native subsistence hunters and research biologists. This approach greatly increased the success of the projects.

- 1) "Hunter-biologists" were familiar with study areas and marine mammal use patterns.
- 2) Hunters could conduct tagging efforts before biologists arrived or after they left (50% of ringed and bearded seals were caught and tagged when project biologists were not present).
- 3) Many of the skills required for tagging (netting, herding, "harpooning" in cold, icy conditions) are a routine part of hunter activities. Belugas tagged at Point Lay were captured in conjunction with the annual drive-hunt. Bowheads were tagged by experienced whaling captains.
- 4) Participation by local hunters enhances research credibility, facilitates local dissemination of results, and encourages local input into marine mammal conservation and management decisions.



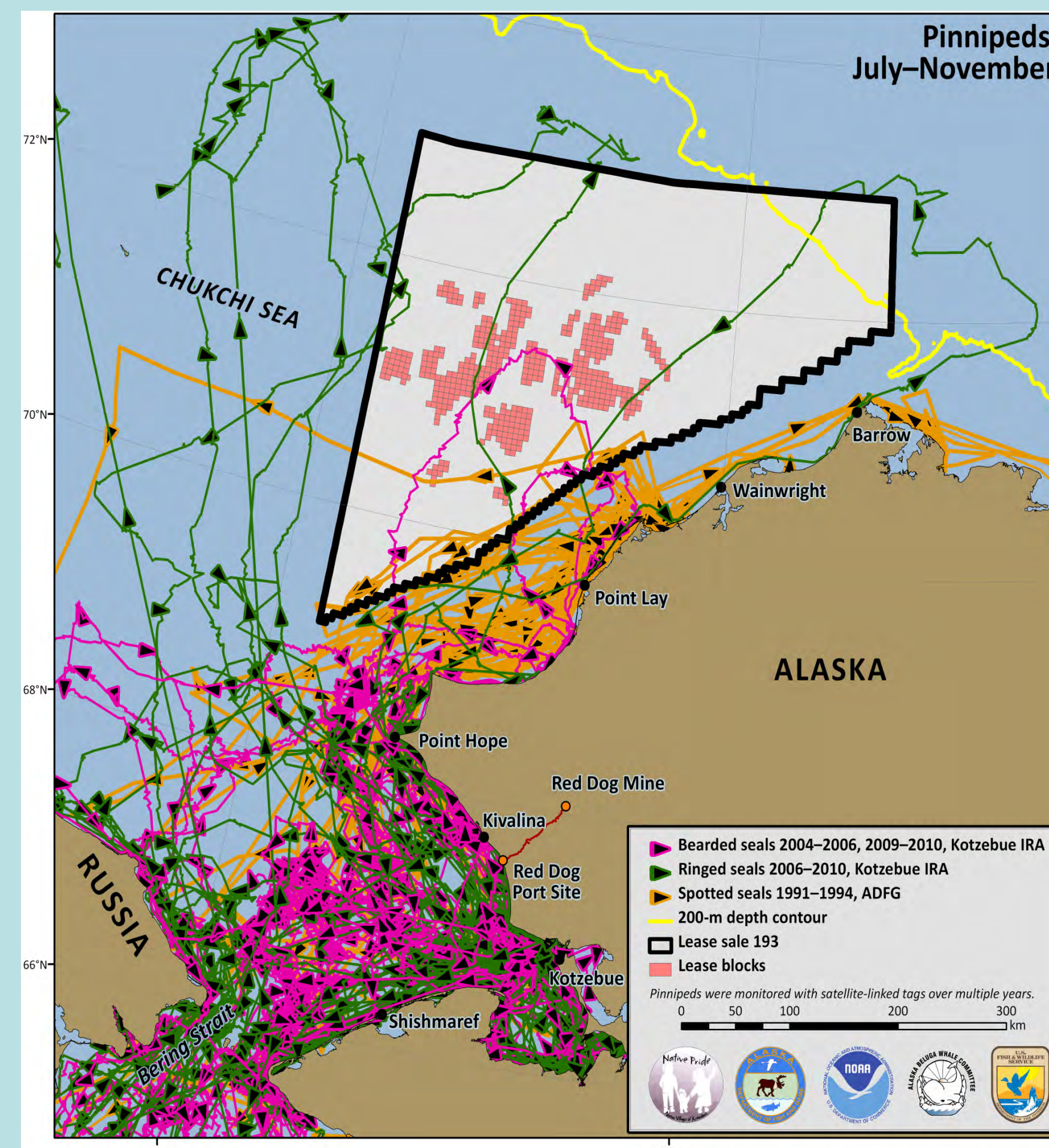
## MOVEMENTS – BOWHEADS and BELUGAS

This map shows the movements of bowhead and beluga whales during July-November relative to an offshore oil and gas lease area in the eastern Chukchi Sea (Suydam 2009; Quakenbush et al. 2010).

Although not quantitative, these simple plots of movement tracks for bowheads and belugas indicate areas of high use.



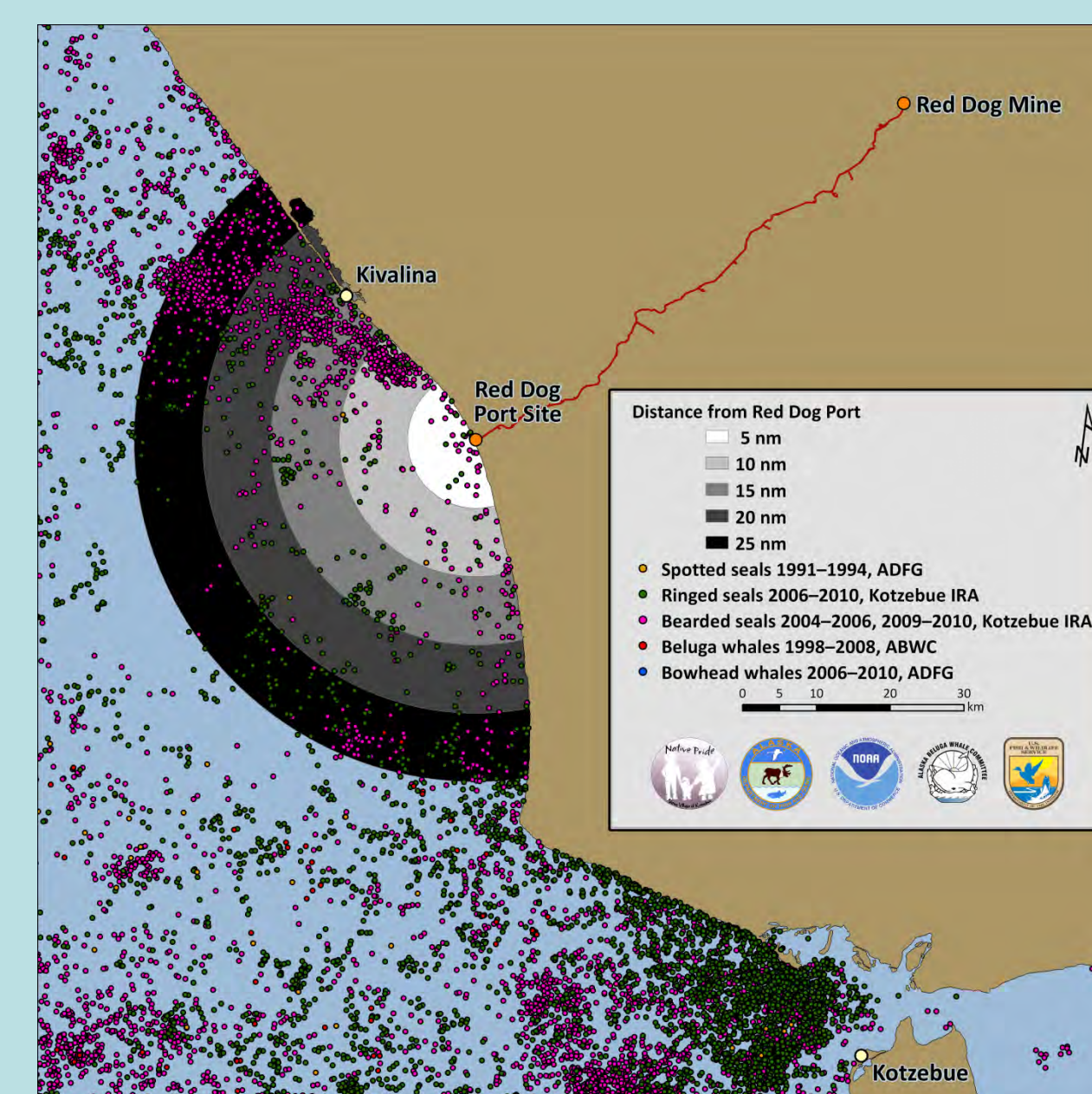
## MOVEMENTS - PINNIPEDS



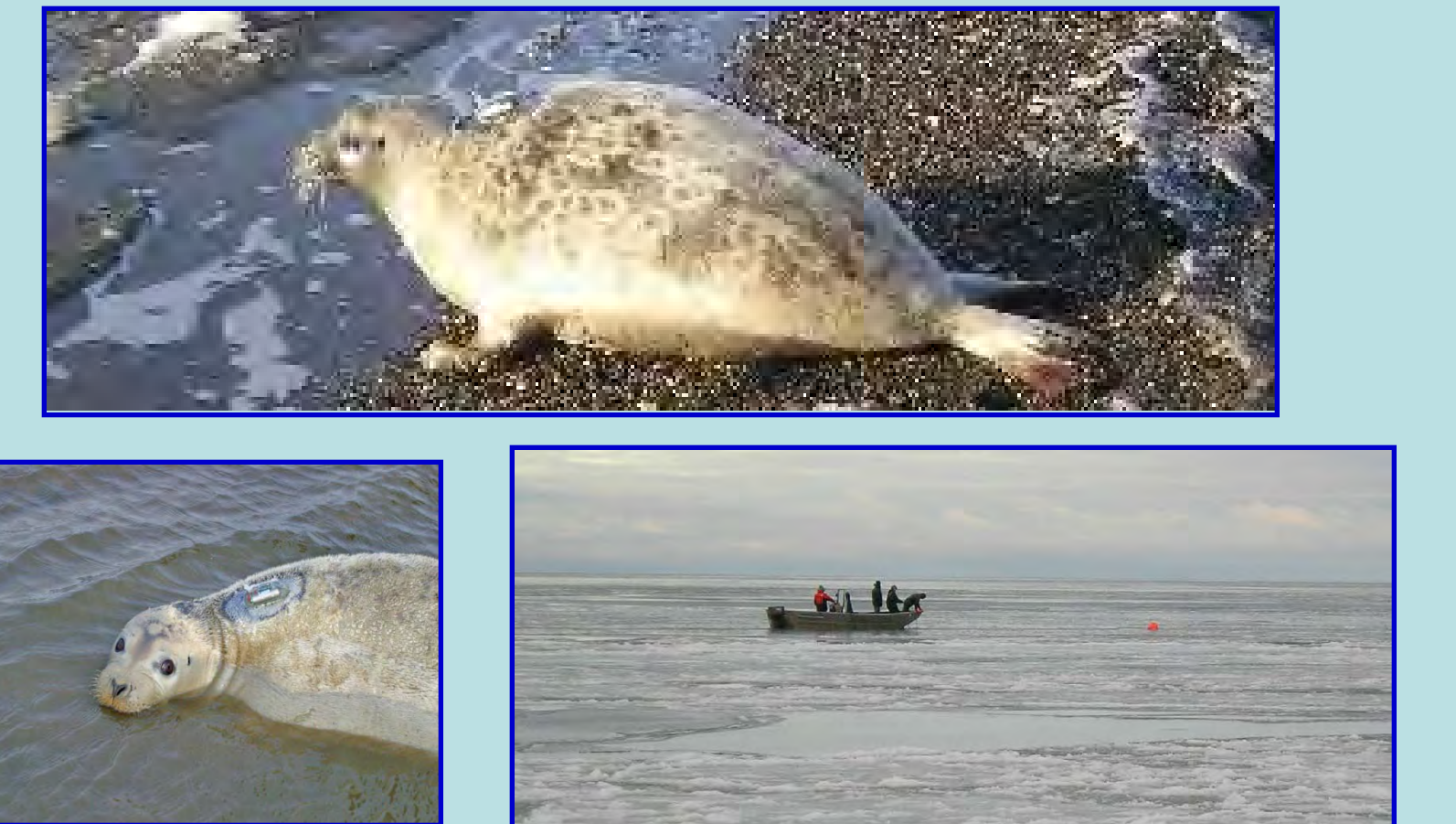
This map shows the movement tracks of spotted, ringed, and bearded seals during July–November relative to the lease area.

Spotted seals were tagged in late summer at Point Lay, ~100 km inshore of the lease area, but they seldom used this area in summer and autumn (Lowry et al. 1998).

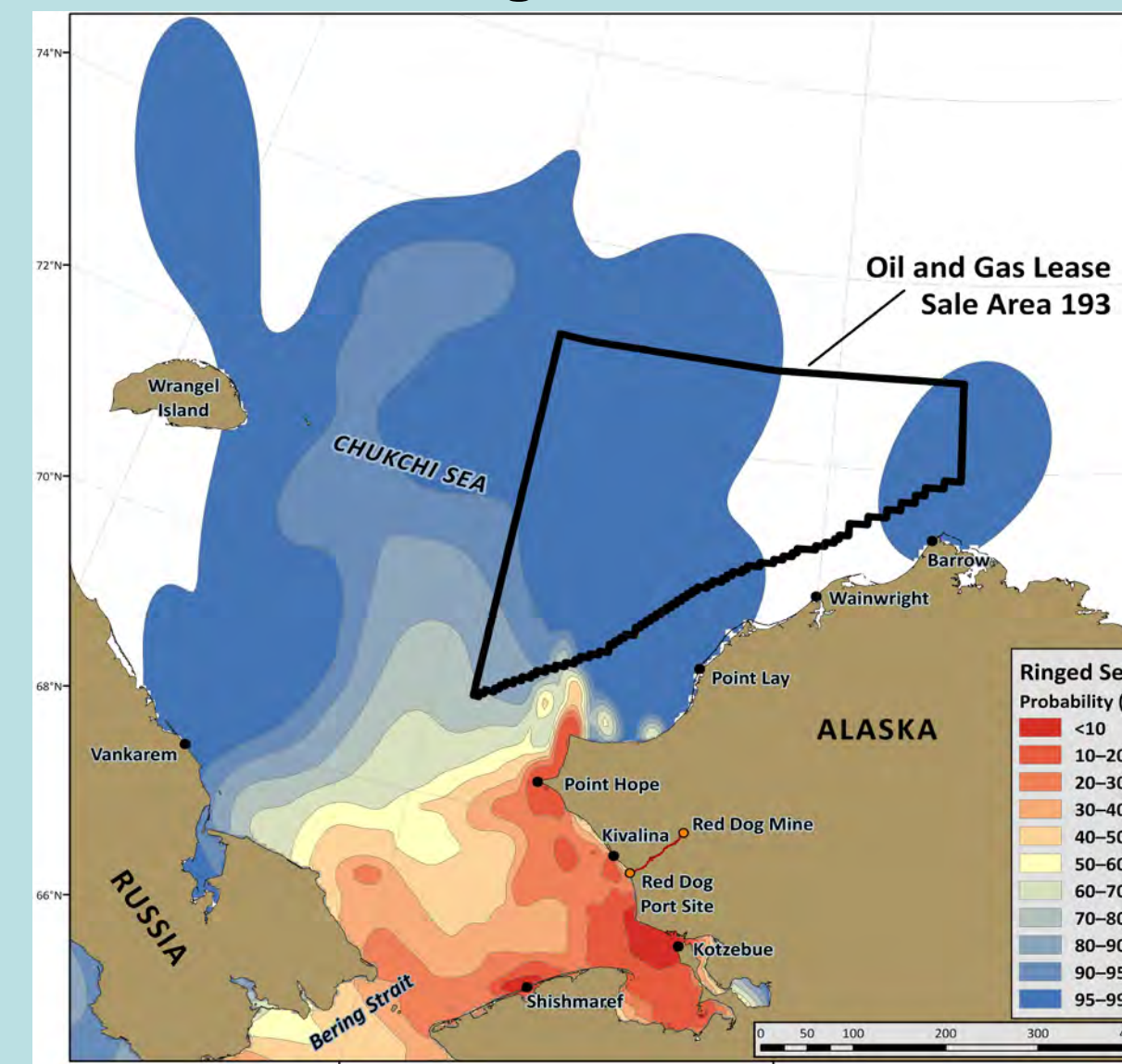
Ringed and bearded seals were tagged in Kotzebue Sound in September and October before freeze-up, and some tags transmitted until the following summer. Few tagged seals used the northern lease area. They did, however, intensively use the southern Chukchi Sea.



Although ringed and bearded seals tagged in Kotzebue Sound did not use the lease area to the north, they did use the area off the Red Dog Mine port site facility.



## Ringed Seals



**Kernel Density Estimates** - Additional analyses of movements data can be used to identify high probability areas of use. These kernel density contours show that the southern Chukchi Sea, particularly Kotzebue Sound, is an area of high use by ringed seals we tagged there. Kernel density contours show that bowhead whales used areas in the northern Chukchi Sea in September. By October, waters off Chukotka were more heavily used (Quakenbush et al. 2010).

**ACKNOWLEDGEMENTS:** Cooperators include the Native Village of Kotzebue; Alaska Department of Fish and Game; University of Alaska, Fairbanks; the Alaska Beluga Whale Committee, and the North Slope Borough Department of Wildlife Management. Special thanks to hunter biologists from Kotzebue, Point Lay and Barrow who participated in all aspects of the projects reported in this poster. Research was conducted under permit #s: bowheads and belugas, NMFS 782-1438, 782-1719; bearded and ringed seals, NMFS 358-1585, 358-1787; spotted seals, NMFS 770; and ADF&G ACUC 06-16 and 09-21.

## REFERENCES

- Freitas C, Lydersen C, Fedak MA, Kovacs KM. 2008. A simple new algorithm to filter marine mammal Argos locations. *Mar Mamm Sci* 24:315–328
- Lowry LF, Frost KJ, Davis R, DeMaster DP, Suydam RS. 1998. Movements and behavior of satellite-tagged spotted seals (*Phoca largha*) in the Bering and Chukchi seas. *Polar Biol* 19:221–230
- Quakenbush LT, Citta JJ, George JC, Small RJ, Heide-Jørgensen MP. 2010. Fall and Winter Movements of Bowhead Whales (*Balaena mysticetus*) in the Chukchi Sea and Within a Potential Petroleum Development Area. *Arctic* 63:289–307
- Suydam RS. 2009. Age, growth, reproduction, and movements of beluga whales (*Delphinapterus leucas*) from the eastern Chukchi Sea. Ph.D. Dissertation. Univ. of Washington, School of Aquatic and Fishery Sciences. Seattle, WA. 169pp