

## **Hunter-assisted study on ringed and bearded seal movements, habitat use, and traditional knowledge**

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Ringed (*Pusa hispida*), and bearded (*Erignathus barbatus*) seals are considered “ice associated seals” or “ice seals” because sea ice is important for pupping, nursing, molting, and resting. In Alaska, these seals are found in the Bering, Chukchi, and Beaufort seas. They are important subsistence species used by Alaska Natives for food, oil, clothing, and handicrafts. Changes in the timing and extent of sea ice have increased access to the Arctic, increasing the need to plan shipping lanes, oil and gas lease sales, and to develop mitigation measures to minimize effects on seals. Our understanding of important seal habitats and the timing and magnitude of movements by species, sex, and age, however, is limited. Cooperative hunter-biologist satellite-tagging studies in Kotzebue Sound, and more recently at Barrow and Hooper Bay, have begun to gather this information. The focus of this study is to deploy satellite transmitters on ringed and bearded seals through additional cooperative projects with coastal Alaska communities. In 2014, we trained hunter-taggers from the Norton Sound villages of Koyuk, St. Michael, Unalakleet, and Elim. Four ringed seals and one bearded seal were satellite-tagged near Kotzebue in June, as were three bearded seals near Koyuk in September. All five seals tagged near Kotzebue traveled north for the summer. The bearded seal stayed in the Chukchi Sea near Cape Lisburne. One ringed seal spent time offshore from Wainwright, one near Barrow canyon, one near Wrangel Island, and one traveled east through the Beaufort Sea to Mackenzie Bay and back to Kotzebue Sound. The Koyuk bearded seals spent time in the local rivers before moving out into Norton Sound. Tracking seals tagged at several widely-spaced locations will allow us to better understand the range and timing of movements, their use of sea ice including haul out behavior, important habitats, and seasonal site fidelity. Future plans include training more hunter-taggers, and documenting local and traditional knowledge to better understand how seals are responding to changing sea ice, increased shipping, and oil and gas activity.

337 words (350 max)

# Hunter-assisted study on ringed and bearded seal movements, habitat use, and TEK

Appendix A. Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, John Goodwin<sup>2</sup>, Merlin Henry<sup>3</sup>, Alex Whiting<sup>4</sup>, Kathy Frost<sup>5</sup>, and Justin Crawford<sup>1</sup>



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## Introduction

Ringed (*Pusa hispida*) and bearded (*Erignathus barbatus*) seals are called “ice seals” because they use sea ice for pupping, nursing, molting, and resting. In Alaska, these seals are found in the Bering, Chukchi, and Beaufort seas. They are important subsistence species used by Alaska Natives for food, oil, clothing, and handicrafts. Changes in the timing and extent of sea ice not only effect ice seal habitat, but also have increased access to the Arctic, increasing the need to plan shipping lanes, oil and gas lease sales, and to develop mitigation measures to minimize these effects on seals. Cooperative hunter-biologist satellite-tagging studies are increasing our understanding of important seal habitats, seasonal movements, use of sea ice including haul out behavior, and seasonal site fidelity. This project will build on past studies by tagging seals at several widely-spaced locations from Hooper Bay to Barrow (including Norton Sound and Kotzebue Sound) and by incorporating traditional knowledge.

## Objectives

Work with seal hunters to:

- capture and tag ringed and bearded seals,
- document habitat use, movement patterns, and movement timing, and
- gather and document local and traditional knowledge of ringed and bearded seals.

## 2014 Activities

- Seal hunters were trained to tag seals with satellite-linked transmitters in Norton Sound and Hooper Bay.
- Hunter-taggers determined when and where to capture seals using local knowledge.
- Four ringed and one bearded seal were tagged near Kotzebue in June (Fig. 1).
- Three bearded seals were tagged near Koyuk in September (Fig. 1).

## Future plans

- Continue to work with trained hunter-taggers and with new hunters and communities.
- Conduct workshops to document local and traditional knowledge to better understand seals movements in response to changing sea ice.

## Acknowledgements

This project is funded by the Bureau of Ocean Energy Management. We appreciate the assistance of all the hunter-tagger crews; Albert Simon, Alexander Niksik Jr., Denali Whiting, Edward Ahyakak, Edwin Kotangan Jr., Frank Garfield, Gordon Eakon, Henry “Boyuk” Goodwin, and Pearl Goodwin. Research on ice seals was conducted under permit #15324 issued to the Alaska Department of Fish and Game by the National Marine Fisheries Service and under an approved ADF&G Animal Care and Use Committee Protocol #2014-03.

## Movements of tagged seals during 2014



Figure 1. Movements of seals tagged in June and September during 2014. Seals tagged in Kotzebue Sound (KS) and Norton Sound (NS).

## Norton Sound hunter-tagger training

Hunters from Elim, Koyuk, Unalakleet, and St. Michael learned how to tag seals with satellite transmitters in March.



Gordon Eakon practices attaching a transmitter to a seal flipper while Edwin Kotangan and Merlin Henry look on.



Gordon Eakon shows a transmitter he attached to a subsistence harvested seal flipper.



Alexander Niksik practices gluing a transmitter while Gordon Eakon and Merlin Henry look on.

## Kotzebue Sound tagging - June

Four ringed and one bearded seal were tagged in Kotzebue Sound during June.



Pearl Goodwin keeps track of the data.



A young bearded seal is tagged and ready for release.



Edward Ahyakak applying epoxy to the back of a young bearded seal.



Frank Garfield, Boyuk Goodwin, Edward Ahyakak, and Kathy Frost tagging a ringed seal.

## Norton Sound tagging - September

Three young bearded seals were tagged near Koyuk in September.



Merlin Henry prepares to tag a young bearded seal 15 miles up the Koyuk River.



Merlin Henry with a young bearded seal prior to release into the Koyuk River.



# Effects of Changing Sea Ice on Marine Mammals and Subsistence Hunters in Northern Alaska

Appendix B.

Paper number:

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## Overview

Marine mammals are important sources of food for indigenous residents of northern Alaska. Changing sea ice extent and thickness affect the behavior of animals and thus the success of hunters. Documenting the traditional knowledge of Iñupiaq and Yup'ik hunters concerning marine mammals and sea ice makes a wide range of information and insight relevant to ecology, conservation, and human activity. We interviewed hunters in villages from the northern Bering Sea to the Beaufort Sea about bowhead whales, walrus, and ice seals, (ringed, bearded, spotted, and ribbon). Traditional knowledge is the product of careful, systematic observation of the environment, confirmed by repeated observation or comparison with the observations of others. This knowledge is shared among hunters through stories and conversation, and treated with care and attention, including attributing the observations and interpretations to the individuals who made them (Noongwook et al. 2007). We documented observations of the migratory and local movements of marine mammals, feeding and reproductive behavior, predation, habitat use, response to disturbance including human activity, and other aspects of the life history and ecology of these animals.

## Methods

- We used the semi-directive interview method to collect traditional knowledge from subsistence hunters and community members (Huntington 1998).
- We interviewed people from 8 communities between 2007 and 2015 (Table 1).
- After the interviews, we prepared a draft report that was reviewed and approved by all the participants.
- The final report was prepared after all the comments had been addressed.

Table 1. Summary of interviews.

Community	Year	Species Focus	No. of Participants
Kaktovik	2007	Bowhead whales	6
Barrow	2007	Bowhead whales	6
Wainwright	2008	Bowhead whales	7
Point Lay	2011	Walrus	5
Wainwright	2011	Walrus	13
Point Hope	2013	Walrus	8
Barrow	2015	Walrus and ice seals	10
Elim	2015	Ice seals and walrus	8
St. Michael & Stebbins	2015	Ice seals and walrus	8
Total 8 communities	5 years	6 species	71 participants

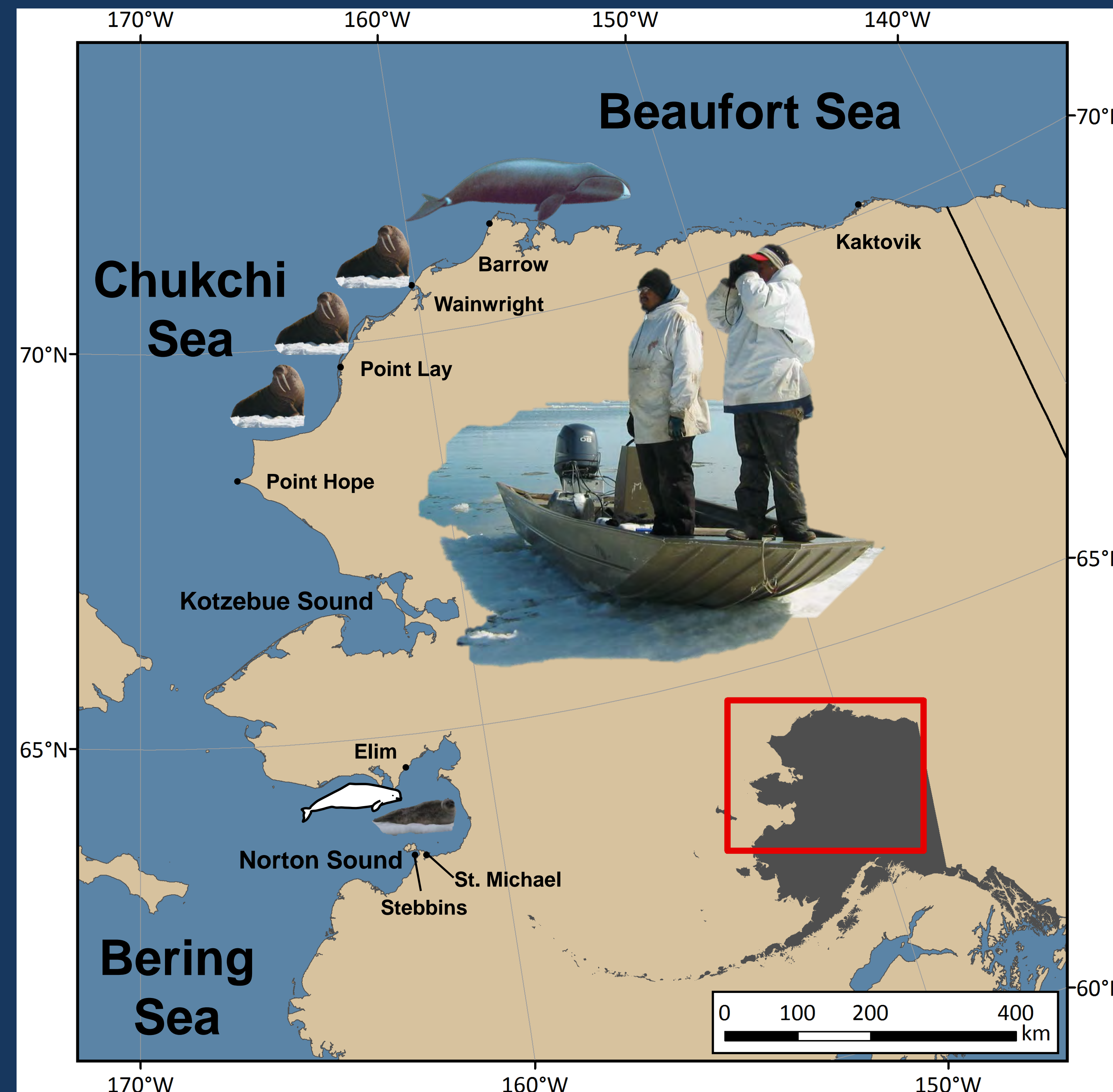


Figure 1. Map of study area and participating communities. Icons correspond to detailed observations about walrus, ice seals, and beluga and bowhead whales.

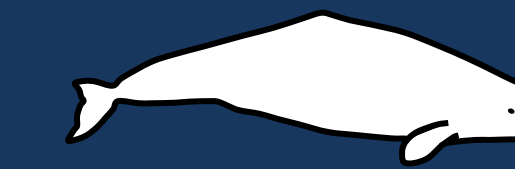
## General Observations

(Recorded in many communities)

- Ice seals are available for a shorter period of time.
- In the past, pack ice came and went all summer, but now retreats from shore and does not return until freeze-up.
- Because of thinner sea ice, it is harder to find a place to haul a bowhead whale onto ice for butchering.
- Hunting and traveling is more dangerous because of thinner ice in winter and spring.
- More efficient boat motors enable hunters to travel farther to retreating ice.
- Less sea ice and bigger storms reduce the number of good hunting days.
- Increased oil and gas activity and greater shipping traffic are concerns; impacts to subsistence are still unknown but potentially large.
- Hunters have adjusted for changing sea ice by hunting earlier in the spring and later into the fall and winter to get what they need.

## Specific Observations

(Recorded in one or two communities)



Beluga whales (*Delphinapterus leucas*) and killer whales (*Orcinus orca*) were seen near Elim in Norton Bay in January 2015, when ice was unusually late in forming (Figure 1).



Walrus are hauling out on land near Point Lay in the tens of thousands. Walrus hauled out on land many times in the past century but in smaller groups.



There is less snow on the sea ice in Norton Bay, reducing the habitat available for seal dens; however; there are still many breathing holes in the ice in spring.



Thinner shorefast ice off of Barrow has shifted spring feeding areas and the distribution of bowhead whales, so that few are now seen along the ice edge to the southwest of the community, which used to be a good hunting area.



Snowmachine noise near Barrow may be changing migration patterns away from shorefast ice.

## Conclusions

Our findings are consistent with other recent studies of traditional knowledge and marine mammals in the region (e.g., Noongwook et al. 2007, Galginaitis 2013, Huntington et al. 2013, Kawerak 2013, Voorhees et al. 2014), which note both the responses of marine mammals to changing conditions and the innovations of hunters to shifts in timing, distribution, and behavior of the animals they seek. In these studies and in ours, hunters emphasized that the impacts to animals and people are a result of the interactions among many factors rather than to changing sea ice acting alone.

## Acknowledgements

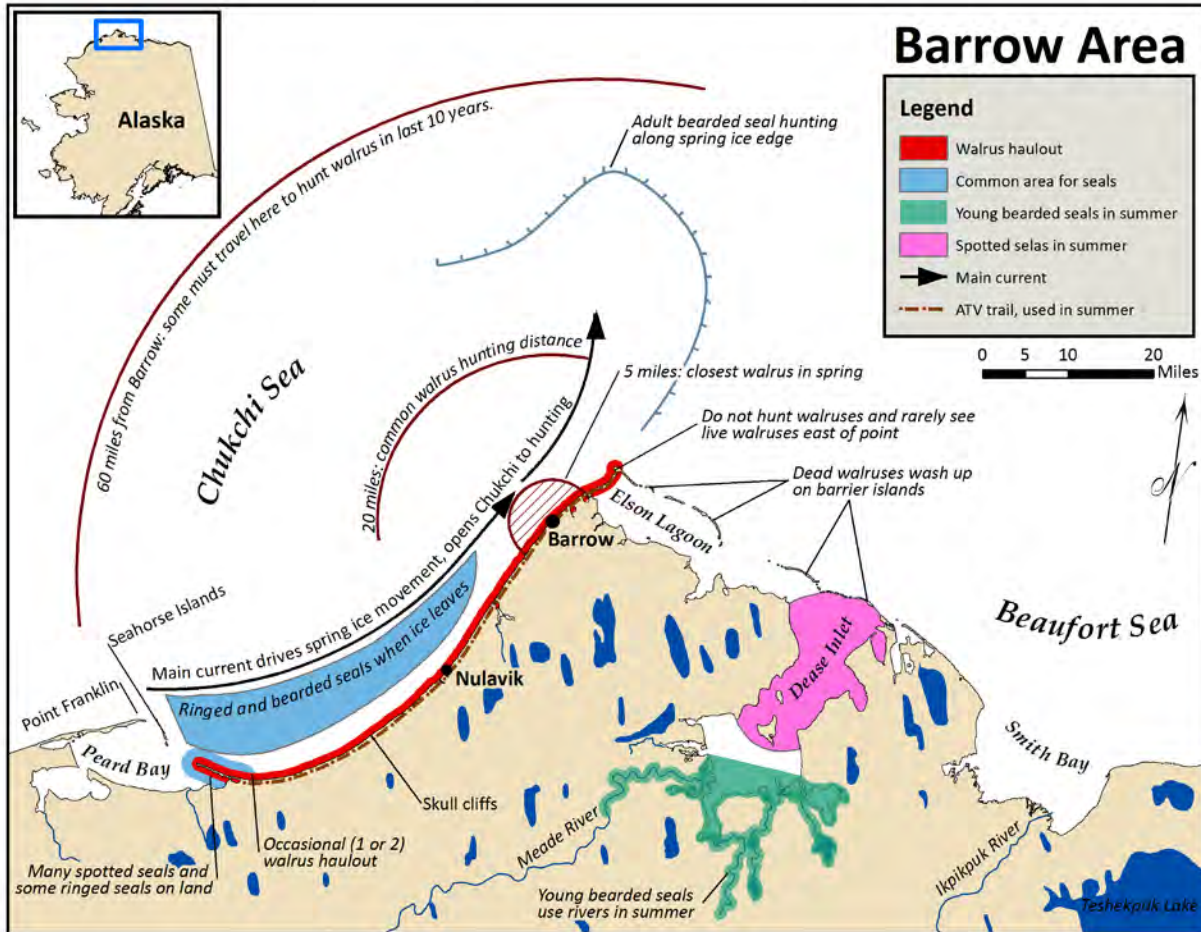
We appreciate the skill, expertise, and generosity of the 71 hunters who participated in the interviews, and the communities and Tribal Councils of Kaktovik, Barrow, Wainwright, Point Lay, Point Hope, Elim, Stebbins, and St. Michael that facilitated this work. We also thank the Alaska Eskimo Whaling Commission, the Eskimo Walrus Commission, and the Ice Seal Committee for their support and guidance. We are grateful to the Bureau of Ocean Energy Management, the Minerals Management Service, ConocoPhillips, and the Coastal Marine Institute for funding.

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# Traditional Knowledge Regarding Walrus, Ringed Seals, and Bearded Seals near Barrow, Alaska





# **Traditional Knowledge Regarding Walrus, Ringed Seals, and Bearded Seals near Barrow, Alaska**

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Final Report

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## **Introduction**

Walrus, ringed seals, and bearded seals are important species for subsistence harvests by Iñupiat hunters in northern Alaska. They are also iconic Arctic marine mammals, and at risk from climate change. Increasing industrial activity in the Chukchi Sea is an additional potential stressor to walrus and seal populations. A satellite telemetry study of the distribution, behavior, and movements of walrus and seals is an important contribution to monitoring the effects of a changing environment and the potential effects from industrial activity. While placing satellite transmitters on walrus and seals provides detailed information about the movements and some behaviors of individual animals, documenting traditional knowledge about walrus and seals, through interviews with residents of coastal communities, provides valuable complementary contemporaneous and historical information about the general patterns of each species.

This report summarizes information gathered from interviews with hunters and other knowledgeable residents in Barrow, Alaska, in January 2015. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## **Methods**

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting his/her knowledge, the associations made between walrus and other parts of the environment, and so on. The interviewers use their list of topics to raise additional points for discussion, but do not curtail discussion of additional topics introduced by persons being interviewed.

In Barrow, we interviewed ten people: one group of four, two groups of two each, and two individually. Those interviewed were Ernest Nageak, Van Edwardsen, Ronald Uyeno, Jonah Leavitt, Willie Koonaloak, John Heffle, and four people who wished to remain anonymous. The interviews were conducted on January 29, at the Iñupiat Heritage Center.

The topics identified by the research team in advance of the interviewers were:

- Haul-out patterns on land
- Observations of orphaned calves
- Timing and location of walrus and seal sightings
- Behavior of walrus and seals
- Parts of walrus and seals eaten by humans
- Changes over time for all topics

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

## ***Ringed and Bearded Seals***



Ringed seals are generally found on the Chukchi Sea side of Point Barrow, including in front of the town of Barrow. They are usually found closer to shore and so are the first seals seen when boating out to hunt seals or walrus. When hunting from boats, Barrow hunters prefer to hunt bearded seals, passing ringed seals by, unless they are teaching a young hunter how to hunt for seals. When the ice is far out, seals may be found near river and creek mouths, where feeding is often good.

In spring, many ringed seals haul out on the ice. Ringed seals may haul out on land to rest. This can be seen south of Barrow towards Peard Bay. It is less common near Barrow, where there is often a lot of four-wheeler traffic. Ringed seals with bald spots and sores, which were most common in the summer of 2011, hauled out more frequently on the beach than ringed seals usually do. Seals with these signs of disease have been seen in subsequent years, too, but less often. The diseased seals are thin and do not flee an approaching person. Instead, it is possible to walk right up to them. Hunters avoid animals with signs of disease, so these animals were not hunted. Hunters also avoid ringed seals with black faces, as these seals taste like kerosene (Note: these are known to be adult males in rut, which develop a strong taste and smell).

Bearded seals are generally found farther from shore. They used to be found closer to Barrow. In summer, they may be 20–30 miles north of Point Barrow, along the ice or where the Chukchi and Beaufort waters meet. They are often plentiful that far out, but not seen as often closer to shore. While bearded seals are often associated with ice, they will remain in ice-free waters, too. They can be seen in front of Barrow, and juveniles are often seen off Elson Lagoon. In summer when there is no ice, bearded seals can be found in the current about 7 miles from shore. Hunters are taught to go out to the current and drift along until they see seals. Sometimes fewer seals are seen later in the summer. In these conditions, many boats may compete while chasing the same seal, which is not the way it used to be. The best hunting time for bearded seals is in July when the ice is beginning to go out.

Bearded seals can also sleep in open water. Hunters have come across bearded seals lying on the surface. When the seals are awakened by the boat, they react quickly, diving with a splash.

Bearded seals swim up the rivers that flow into Admiralty Bay. Bearded seals of all ages have been seen to do this. The seals are probably eating whitefish in the rivers. This is not a common occurrence however, most young bearded seals are found around the barrier islands and outside Dease Inlet during the summer.

In recent years, bearded seals have had thinner blubber. Hunters need to get to a seal quickly before it sinks. The seal oil they produce is also different from the way seal oil used to be.



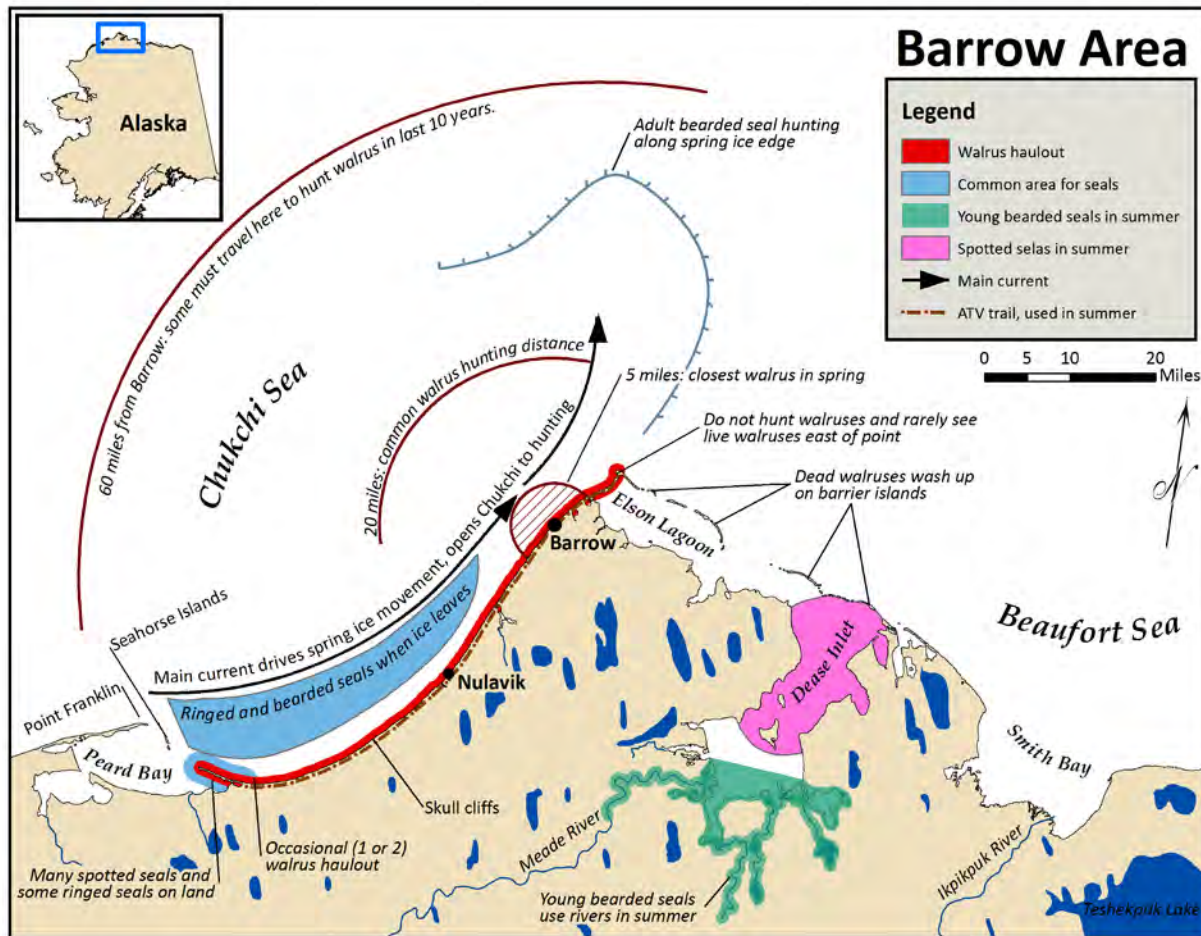


Figure 1. Movements and behavior of ringed seal, bearded seal, spotted seal, and walrus near Barrow as described during traditional knowledge interviews, January 2015.

### Walrus

Walrus are harvested in Barrow when they are accessible. Walrus hunting occurs in the Chukchi Sea, but not the Beaufort Sea. Hunters typically head west, or first go south to Peard Bay and then offshore. Access depends primarily on ice conditions and can vary greatly from year to year near Barrow. Some hunters have gone as far as 60 miles offshore, which is possible now due to the fuel efficiency of four-stroke engines. Traveling this far, however carries risks if the weather changes for the worse. Recent changes in sea ice distribution and thickness have been the dominant factor responsible for changes in walrus distribution and behavior in recent years.

Walrus migrate north in spring, drifting with sea ice carried in the northbound currents of the Chukchi Sea. When shorefast ice breaks up, which is happening earlier and earlier, Barrow hunters are able to begin hunting by boat. East winds carry sea ice away from shore, making access difficult. West winds bring sea ice closer to the Barrow coast, bringing walrus and bearded seals with the ice. Walrus are typically carried north past the City of Barrow and onwards past Point Barrow. Only occasionally are walrus seen in the Beaufort Sea, to the east of Point Barrow. The eddies that form to the northeast of Point Barrow do attract beluga whales

and bearded seals, and may be responsible for walrus carcasses washing up on the barrier islands that border Elson Lagoon. Formerly, the ice would come and go during the summer as the winds shift, bringing ice and animals back several times, providing several hunting opportunities. In recent years, the ice usually does not return after it leaves the Barrow area and may leave faster when it goes out. The hunting season is thus shorter now, though still variable depending on the conditions of each year.

Ice thickness plays a role, too. Formerly, walrus were found on large ice floes in herds of up to 3,000 animals. Today, ice floes are smaller and thinner, so walrus are typically found in small groups (10–15 animals) or mid-size groups (50–100). Hunters could smell the large herds a long way away, but the smaller groups do not have as strong an odor. When walrus leave the ice floes, the floes rebound and rise higher out of the water. Thinner ice is noticeable at other times, too. During spring whaling, it is harder to find flat areas of ice that are thick enough to support a large bowhead whale for butchering. Formerly, any flat area was thick enough, but this is no longer the case.

Walrus are occasionally seen swimming in open water, presumably traveling from haulouts to feeding areas. This has been observed 4–5 miles offshore, with the walrus heading south, and no ice in sight. Individual walrus have been seen swimming along the shore in late August, with no ice in sight. Walrus can be hunted in open water, but it is much harder than hunting them when hauled out on ice floes, and they must be towed to ice or land for butchering. Walrus are also very dangerous when in the water. They can be aggressive and attack boats, and have been known to team up when doing so. This can occur when a walrus has been killed and the other walrus do not want to leave it. Dropping empty rifle shells into the water can scare walrus away, perhaps from the appearance or the sound.

Occasionally a single walrus, and more rarely two walrus together, will haul out on shore in the Barrow area. This is more common to the south of Barrow, towards Nulavik and Skull Cliffs, but can also be seen towards Point Barrow. Hunters have not seen three or more walrus hauling out together in the Barrow area. Walrus that haul out near Barrow are usually hunted; they will be seen by people who travel up and down the coast by four-wheeler, a common summer activity. Once, a sick walrus went inland from Elson Lagoon behind the Naval Arctic Research Lab (NARL) hangars. Sick walrus and sick polar bears will take themselves off to die. There does not appear to be a change in hauling out behavior in the Barrow area, although it may be more common in the past decade or so.

One hunter/carver recently saw a walrus skull that had many cavities in its teeth. He had not seen that before.

Orphaned calves are found occasionally in the Barrow area, but this is not common. It typically occurs after there has been a hunt. The last instance was three or more years prior to the interviews. When calves can be nursed to health, they are given to a zoo or other facility. There does not appear to be any trend in the frequency of orphaned calf sightings.

Walrus have excellent hearing. They do not react to people speaking in normal voices. Instead, they become suspicious if people are whispering or otherwise trying to be quiet. Walrus are



generally noisy animals, so the additional noise does not bother them. The same is sometimes true of other animals—they react more to people who are trying to sneak up to them or sneak past, than to those who show that they have seen the animals and are aware that the animals have seen or heard them.

Offshore oil and gas activity could have impacts to walrus and walrus prey. This could have a bigger impact on walrus-dependent communities, especially Gambell and Savoonga.

Barrow residents eat the skin, blubber, meat, kidneys, and heart of walrus. They do not typically eat liver or intestines. All parts are equally likely to be eaten by anyone eating walrus; there are no parts that are given specially to people of different ages or gender. Some people like to eat clams from walrus stomachs, but recently the stomachs have been mostly empty.

### ***Polar Bears***

Polar bears occasionally swim ashore in summer, having come a long way from the ice. They are typically exhausted. Polar bear monitors let them rest, rather than scaring them back into the water right away. Elders also say to leave animals alone when they come to shore, to let them rest. One bear collapsed on reaching shore and slept for a day or two, before getting up and walking to the Barrow bone pile.

### ***Other Observations***

Many things are changing. Skin boats left in the open in summer will now discolor and turn dark. They need to be covered with a tarp, whereas before they could be left out and would bleach in the sun.

Multi-year ice rarely shows up now, whereas it used to arrive reliably in October as the ocean began to freeze.

### ***Traditional and Modern Knowledge and Ideas for Research***

Younger hunters distinguished traditional knowledge from modern knowledge. The former is what can be learned from elders and others with long experience. Younger hunters have modern knowledge, having only hunted from motorboat and snowmachine, not with dog teams and other older equipment. They thus have different knowledge than their fathers and grandfathers, though they still have the skills to hunt effectively and to know how to interact with animals. The younger hunters are also well aware of how rapidly conditions are changing, and are able to provide knowledge about recent changes in a way that elders who have not hunted for many years may not.

The U.S. Fish and Wildlife Service has been paying more attention to traditional knowledge, which is a good thing and can be very helpful in many situations. At the same time, however, there are concerns about asking the same people the same kinds of questions over and over, or going to the same people to ask about different species but still taking up their time repeatedly. Better coordination in meetings and in research can help reduce the burden on the community, as it can on the ecosystem for field studies. Doing things once rather than several times would be better.

The U.S. Fish and Wildlife Service is also good at circulating information about their polar bear surveys, including photos of the aircraft involved, and flight plans and dates. This lets people know what to expect and how to recognize the aircraft and personnel who are involved, instead of wondering who is doing what and what impact they are having on hunters and on animals.

When walrus are being hunted from Barrow, there may be as many as 30–40 boats on the water. Finding ways to record the observations of these hunters could be a big contribution to walrus monitoring and research, and for other species, too. Hunters pay attention to oddities, such as unusual body condition or markings, and could take photos and bring this to the attention of biologists. Facebook might be a great way to organize hunters and report observations.

### **Acknowledgements**

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# **Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near Elim, Alaska**

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## **Introduction**

Ringed seals and bearded seals are important species for subsistence harvests by Iñupiat and Yup'ik hunters from Elim, in northern Norton Sound, in western Alaska. Walrus are found and hunted in this area, too. These marine mammals are iconic Arctic animals, and at risk from climate change. Increasing industrial activity in the Chukchi Sea, coastal development in the Norton Sound region, and shipping through the Bering Strait are additional potential stressors to seal and walrus populations. A satellite telemetry study of the distribution, behavior, and movements of seals and walrus is an important contribution to monitoring the effects of a changing environment and the potential effects from industrial activity. While placing satellite transmitters on seals and walrus provides detailed information about the movements and some behaviors of individual animals, documenting traditional knowledge about seals and walrus, through interviews with residents of coastal communities, provides valuable complementary contemporaneous and historical information about the general patterns of each species.

This report summarizes information gathered from interviews with hunters and other knowledgeable residents in Elim, Alaska, in February 2015. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

Previous projects on traditional knowledge of seals have been conducted, one under the Elim-Shaktoolik-Koyuk Marine Mammal Commission in 1999 (Huntington 2000) and another on walrus and ice seals conducted by Kawerak Inc., in 2010–2013 in communities throughout the Bering Strait region, including Elim (Kawerak, Inc., 2013). Except as noted below, the information presented here comes from our February 2015 interviews and not from either prior project. A compilation of results from all three projects may be carried out later, to document changes over time and other aspects of seals and walrus.

## **Methods**

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting his/her knowledge, the associations made between walrus and other parts of the environment, and so on. The interviewers use their list of topics to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In Elim, we interviewed eight people in one group. Those interviewed were Darlene Katchatag, Martin Murray, Charles Saccheus, and five others who wished to remain anonymous. The interview was conducted on February 3, at the Elim IRA Council office.

The topics identified by the research team in advance of the interviews were:

- Haulouts on land
- Overwintering areas and behavior
- Use of lagoons and rivers
- Feeding patterns and prey

Differences between ringed and bearded seals  
Impacts from climate change  
Parts of seals that people eat

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### ***Ringed Seals***

In early spring, ringed seals will lie on the sea ice by the hundreds throughout Norton Bay and stay in the area until the ice starts to break up more in the later spring. A few areas hold higher numbers of seals throughout the year and especially during the spring; Besboro Island, Golovin Bay, upper Norton Bay, Rocky Point and around Cape Darby. There is a persistent pressure ridge that forms from Moses Point to Dexter Point during the winter and spring that also holds many ringed and bearded seals. The snow is not as deep now as it used to be and there are fewer seal dens on the ice because of it, but there are still lots of seal breathing holes noticed mostly by fishermen who go out on the ice to deploy their crab pots in spring between Elim and Cape Darby. Pressure ridges like the one from Moses Point to Dexter Point are important for breathing holes and denning habitat. Ringed and bearded seals have always wintered in Norton Bay, especially near the mouths of creeks where fish are plentiful.

Ringed seals are occasionally seen hauled out on the beach. Usually this is young seals in the spring. Ringed seals do not haul out in large groups like walrus and are much more solitary. Historically in the spring and summer seals were taken with nets for subsistence, but this is less common now with most hunters choosing to use a rifle and harpoon instead. When a ringed seal is caught alive they are generally easy to control as they do not bite people. They will use their powerful claws to scratch at a person though.

Ringed seals feed on mostly fish such as herring, capelin, tomcod, skipjack (smelt, cisco?), and sometimes shrimp. Herring are found in large numbers along the pressure ridges especially between Moses Point and Dexter Point where they are sometimes pushed out onto the ice and preyed on by seagulls.

Elim residents eat the blubber (oil), meat, heart, kidneys, liver, and intestines of ringed seals. Seal oil is very healthy, especially for brain development in children. Coastal residents trade seal oil with interior Indians. A seal taken in November yielded clear seal oil with little flavor, so salt had to be added to give it more flavor.

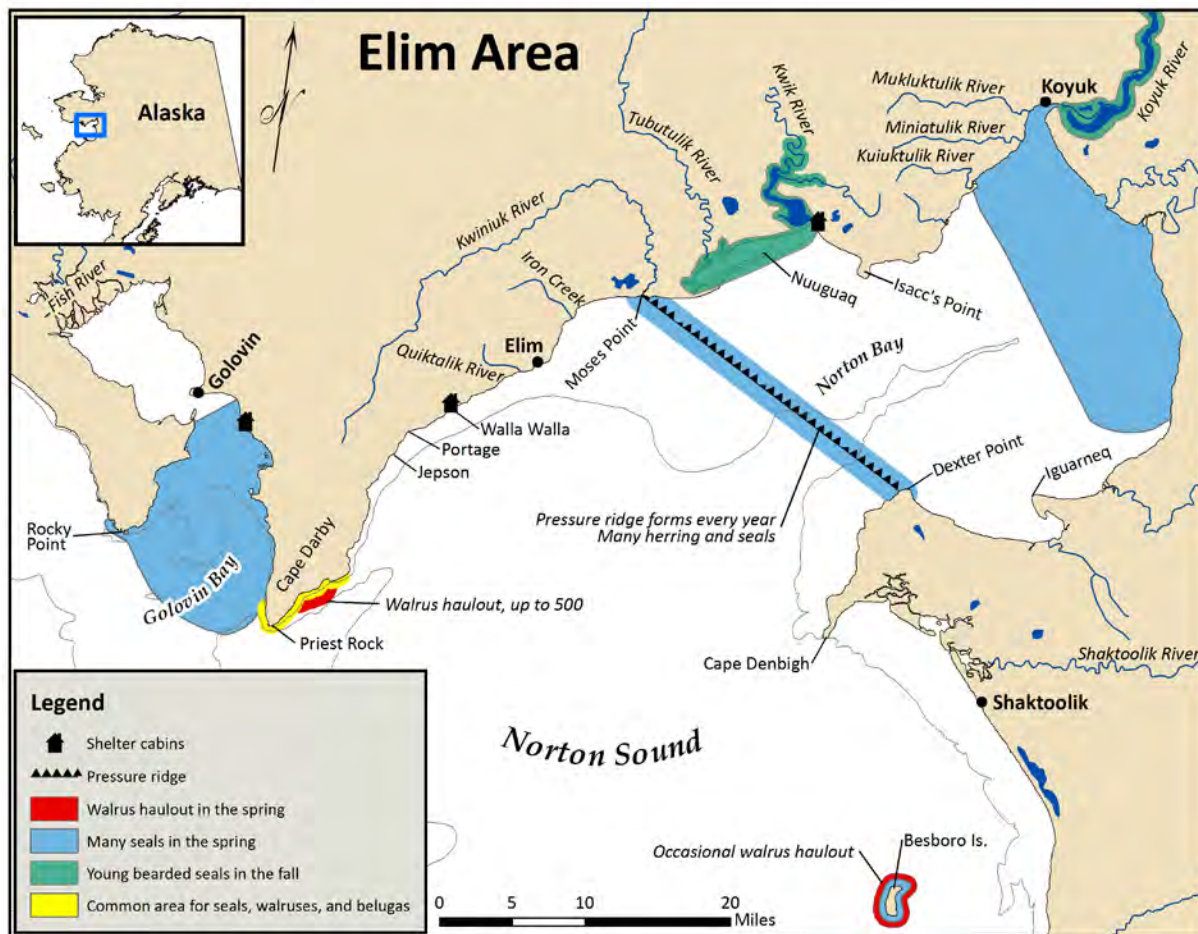


Figure 1. Movements and behavior of ringed seal, bearded seal, spotted seal, walrus, and beluga whales near Elim as described during traditional knowledge interviews, February 2015.

### ***Bearded Seals***

Bearded seals will haul out on the sea ice in spring, younger animals closer to shore on shorefast ice and older animals further out on the pack ice usually more than 15 miles from Elim. Young-of-the-year bearded seals will go up the Koyuk and Kwik Rivers in August and September. They eat clams, which can be found far upriver, and isopods. They are not found up the Tubutulik River, but can be seen in the lagoon at the mouth of the river. Adult bearded seals have been seen occasionally up the Kwik River, but not very often.

Bearded seals are more sensitive to noise than ringed or ribbon seals for example; if a ribbon seal on an ice floe is approached by hunters in a boat, it will flee away from the hunters across the floe, even if there is open water right next to it in the direction of the boat but bearded seals will dive into the open water instead. Hunters say that this behavior shows that bearded seals are much smarter and more wary than ribbon seals. Young bearded seals will fight back when caught in a net. They have long claws and will try to scratch a person, but they do not bite.



Bearded seals have clams, shrimp, and isopods in their stomachs. They do not have fish in their stomachs except for young bearded seals in rivers, they feed on whitefish. Old bearded seals have teeth that are worn down to the gums. Their blubber is yellow and yields yellow seal oil.

Elim residents eat the blubber (oil), meat, heart, kidneys, liver, and outer covering of the intestines of bearded seals.

### ***Walrus***

Walrus haul out occasionally on the east side of Cape Darby. This happens when there is no ice in Norton Sound. The walrus do not haul out on the west side of the Cape. There may be 500 or more walrus hauled out at a time. When there is no more room for walrus to haul out, other walrus will inflate their necks and float as they sleep, drifting in the current. After they drift a mile or two, they swim back to the haulout and repeat this behavior. There are sometimes some baby walrus in the haulout, in June. Walrus also haul out, though less frequently, on Besboro Island, in similar numbers to those seen at Cape Darby.

Walrus usually have clams in their stomachs. If the walrus has been on top of the ice for a while, the clams are partly digested. If the walrus has just hauled out on the ice after diving or still swimming, the clams will be fresh. These clams are ready to be cooked. Many people enjoy eating them.

### ***Other Information***

*Qairaliq* seals are no longer seen. These were described in the 1999 project (Huntington 2000) as small seals seen in April, May, and June, with thin skin that was useful for many purposes. The 1999 study reported that *qairaliq* seals came to the area in great numbers in the 1980s, but fewer were seen by 1999.

Elim hunters had no further information about *iigliq* seals, also reported in the 1999 study.

A bearded seal was once taken that had metal in the muscle near its ribs.

Green algae grows on the bottom of the sea ice, attracting fish. This has always happened.

In the summer of 2014 there were so many jellyfish they clogged fishing nets. The jellyfish were also larger than usual. Starfish taken in crab pots appeared to be eating jellyfish.

Small, pink krill are common throughout Norton Bay. They can be found under rocks and come to the surface with crab pots that are hauled up.

A few years ago, orange foam was found on the beaches throughout the area. The cause of this was not known and it only happened the one time.

Sea ice formed very late in the winter of 2014–15. There was a lot of open water near Unalakleet and even by Koyuk into December 2014. Beluga whales were seen swimming past Elim in January, being pursued by killer whales. It is very rare for belugas to be seen near Elim in January.

Belugas prefer to eat tomcod and shrimp, even if there are herring in the area. They also like salmon, which they eat all summer. Silver salmon in September are a favorite food of belugas. Belugas chase salmon and, when they are right behind the fish, give a blast of sound that stuns the fish, so the fish turns belly up. Then the beluga swallows the salmon whole.

Belugas can drown in a net in 10 minutes or less. They struggle, which uses up their air quickly. The belugas are used for subsistence and the lungs used to be fed to dogs. They feel spongy and were not eaten by people.

Spotted seals haul out in groups in many locations, including Rocky Point and have teeth like dogs. Spotted seals will bite people.

Animals carry their history, like human beings, including their own lives and the lives of their parents and grandparents. Animals have brains and spirits. It is essential to keep the ocean free and clean so that the animals can flourish and live healthy lives.

### ***Concerns***

Elim residents asked whether there have been any studies in the Nome area to determine if there are impacts from dredging and port construction. They expect more activity along the coastline of the region, and think it is important to learn what we can from the development that is occurring already. They pointed out that the dredging results in muddy water, which they expect affects marine mammals and other sea animals.

There is a lot more commercial crabbing in summer in the Norton Bay area now.

More hunters from other villages seem to be coming to the Norton Bay area to hunt.

### **Acknowledgements**

We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to Charles Saccheus and Carol Nagaruk for helping to set up the group interview. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract Nos. M09PC00027 and M13PC00015 and we appreciate the support of Charles Monnett, Catherine Coon, and Dan Holiday. Justin Crawford prepared the maps used during the interviews and the figures in this report.

### **References**

Huntington, H.P. 1998. Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic* 51(3):237-242.

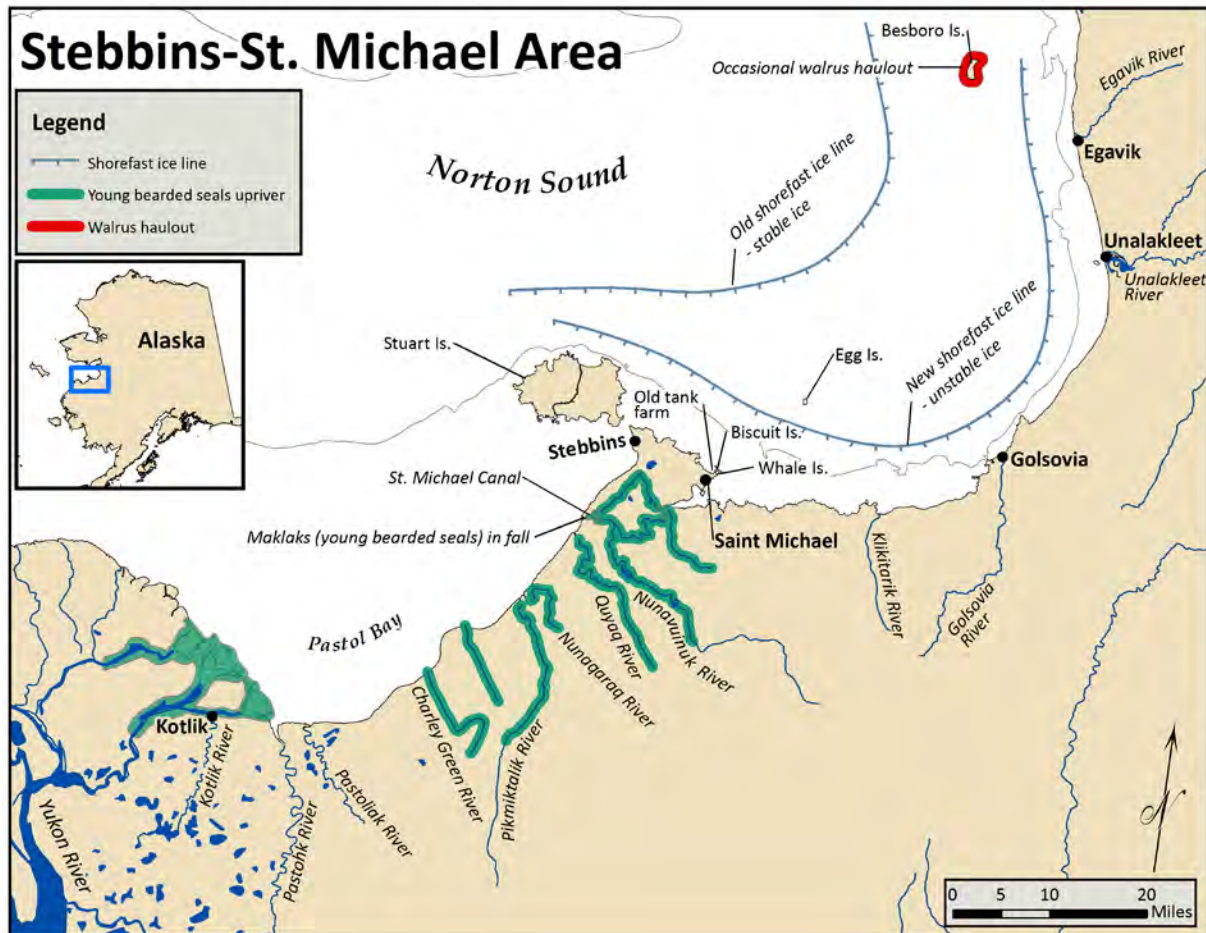
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# Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near St. Michael and Stebbins, Alaska



# **Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near St. Michael and Stebbins, Alaska**

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**Final Report  
Approved December 2015**

Final report should be cited as:

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## **Introduction**

Ringed seals and bearded seals are important species for subsistence harvests by Iñupiaq and Yup'ik hunters from St. Michael and Stebbins in southern Norton Sound, Alaska. Walrus are found and hunted in this area, too. These marine mammals are iconic Arctic animals, and at risk from climate change. Increasing industrial activity in the Chukchi Sea, coastal development in the Norton Sound region, and shipping through the Bering Strait are additional potential stressors to seal and walrus populations. A satellite telemetry study of the distribution, behavior, and movements of seal and walrus is an important contribution to monitoring the effects of a changing environment and the potential effects from industrial activity. While placing satellite transmitters on seals and walrus provides detailed information about the movements and some behaviors of individual animals, documenting traditional knowledge about seals and walrus, through interviews with residents of coastal communities, provides valuable complementary contemporaneous and historical information about the general patterns of each species.

This report summarizes information gathered from interviews held in St. Michael with hunters and other knowledgeable residents from St. Michael and Stebbins in February 2015. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

A previous project on traditional knowledge of walrus and ice seals was conducted by Kawerak Inc., in 2010–2013 in communities throughout the Bering Strait region, including St. Michael and Stebbins (Kawerak, Inc., 2013). Except as noted below, the information presented here comes from our February 2015 interviews and not from the Kawerak project. A compilation of results from the two projects may be carried out later, to document changes over time and other aspects of seals and walrus.

## **Methods**

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting his/her knowledge, the associations made between walrus and other parts of the environment, and so on. The interviewers use their list of topics to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In St. Michael, we interviewed eight people in one group. Those interviewed from St. Michael were Charlie Fitka, Harold T. Kobuk, Nick Lupsin, Alexander Niksik Jr., and two others that wished to remain anonymous. Two people from Stebbins were interviewed who wished to remain anonymous. The interview was conducted on February 4, at the St. Michael IRA Council office.



The topics identified by the research team in advance of the interviews were:

- Haulouts on land
- Overwintering areas and behavior
- Use of lagoons and rivers
- Feeding patterns and prey
- Differences between ringed and bearded seals
- Impacts from climate change
- Parts of seals that people eat

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewees were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### ***Ringed Seals***

During the winter and spring there are many ringed seals near Stebbins and St. Michael. They maintain breathing holes in the shorefast ice and in the drifting pack ice. When it is sunny there will be many ringed seals hauled out on the ice, occasionally they make enough noise that they can be heard from town. Ringed seals start to leave when the ice diminishes in Norton Sound, but there are still a lot around during the herring runs in June. Ringed, bearded, and spotted seals all eat herring when they are spawning and their face and whiskers are sometimes covered with herring eggs when they surface to breathe. Seals gain weight quickly during the herring run. Ringed seals also eat tomcod (i.e., saffron cod, *Eleginus gracilis*) and other fish, but also eat small shrimp, which are especially plentiful in the Golsovia area.

Ringed seals start sunning with the increasing light in February and by April have started pupping in their snow dens. The rutting males during this time have black faces, smell like gasoline, and are not hunted or eaten. These rutting males are called *tiigaq*.

Residents of St. Michael and Stebbins eat seal meat, blubber (oil), heart, liver, kidneys, intestines, and the spinal cord of ringed and bearded seals. Some people like to eat aged seal flipper, but this is not common anymore.

Some sick seals were seen in 2011, but not large numbers of them. One sick young ringed seal was seen on the beach in the summer of 2014. It did not flee when approached on a four-wheeler. A sick spotted seal was seen in the fall of 2014.

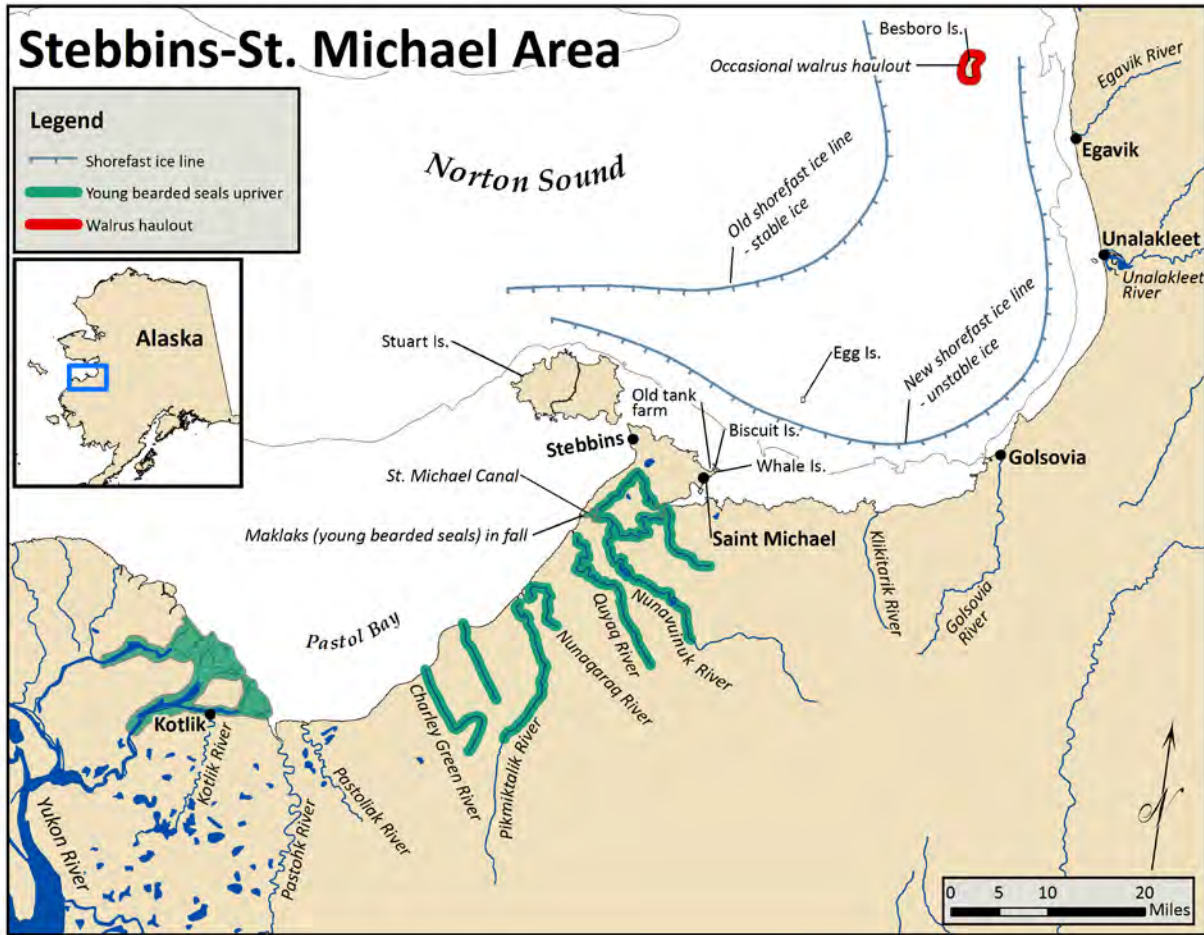


Figure 1. Movements and behavior of ringed seal, bearded seal, spotted seal and walrus near St. Michael and Stebbins as described during traditional knowledge interviews, February 2015.

### ***Bearded Seals***

Adult bearded seals are found farther away from the shore in winter and spring, than ringed seals. They are rarely seen near shore hauled out on shorefast ice, but are hunted around Whale Island. Young bearded seals are sometimes found up rivers, including the Yukon as well as smaller rivers around St. Michael and Stebbins. Older bearded seals and ringed seals are not seen in the rivers. Young bearded seals may haul out on riverbanks or mudflats but adult bearded seals are never seen on land.

*Ugruq* is the term for adult bearded seals; this is an Iñupiaq word. Hunters here also use the Yup'ik word *Omnigaq* for adult bearded seals. The Yup'ik word *maklak* is used for young bearded seals.

The size of adult bearded seals has decreased in recent years. In the past, hunters would see very large bearded seals off of Stuart Island that are believed to have come from farther north. More recently, it is more common to find bearded seals that are a little smaller than these very large ones.

Bearded seals eat whatever they can find farther out in the ocean: shrimp, crab, clams, and fish such as flounder. Some of the shrimp found in bearded seal stomachs are large, the size of a person's hand. When young bearded seals are in rivers they will eat whitefish and tomcod.

One hunter reported harvesting an *ugruq* with a white tissue around its liver. They described it to be white as paper and did not eat the liver, but did eat the meat and blubber.

### ***Walrus***

Walrus arrive in spring, hauled out on ice that is carried by currents. They are usually farther from shore, for example near Egg Island. The walrus include bulls, cows, and calves. Walrus are not often seen on land around Stebbins or St. Michael, but occasionally one or two will haul out on Egg Island and Whale Island; one of the small islands just north of St. Michael. One walrus swam up the Yukon River as far as Pilot Station (~120 miles) and stayed in the Pitka's Point (~100 river miles from coast) area for a while. Other walrus have been seen near the mouth of the Yukon and also in St. Michael and Little St. Michael Canal in fall. Even though living walrus are not seen very often, dead walrus wash up on shore regularly in the spring when the currents are just right.

Walrus cows will search for their calves when they become separated. The cows can find the calves when this happens.

St. Michael and Stebbins residents eat the meat, blubber, heart, and liver of walrus. They do not eat the kidney or intestines and only occasionally eat the clams from walrus stomachs.

### ***Sea Ice***

The ice has changed greatly and rapidly in the past two decades. In the 1970s and 1980s, the shorefast ice extended out to Egg Island. Hunters could travel over the ice to Egg Island or to Golsovia. Today the shorefast ice extends only a few miles from shore and it is not possible to travel that far on the ice. The ice is also thinner and breaks off more easily, making conditions more dangerous. The ice used to form large pans, but now it is more crumbled up.

In the winter of 2014–15, the ice did not freeze near Stebbins until December. The ice was only a few inches thick when it went out again. There was rain in January, and the ice remains thin and unstable.

### ***Other Information***

There are fewer spotted seals in this area since the ice started changing in the 1990s and 2000s. Spotted seals may be seen on the ice near shore during the fall and spring. Steller sea lions, gray whales, and humpback whales are rare occurrences in the area and may scare away other animals when they are around. There used to be puffins in the St. Michael/Stebbins area, but they are no longer seen here.

There used to be commercial beach seiners operating in this area during herring season. They would sometimes snag buoys and anchors belonging to St. Michael and Stebbins residents, which was not popular. This fishery is no longer being conducted.

The water level is higher in summer now than it used to be. There is more algae, and the fish are changing, too. Some St. Michael residents caught what they thought were chum salmon, but which turned out to be another kind of fish. Another fisherman caught two chum salmon a couple years ago, but they smelled like gas when his wife cut their heads off.

The old St. Michael village fuel tank farm may have affected seals. There are fewer seals around there now than there used to be. The tank farm has been moved to the west end of the village now.

### **Acknowledgements**

We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to Alexander Niksik Jr. for helping to set up the group interview. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract Nos. M09PC00027 and M13PC00015 with the support of Charles Monnett, Catherine Coon, and Dan Holiday. Justin Crawford prepared the maps used during the interviews and the figure in this report.

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## **Hunter-assisted study on ringed and bearded seal movements, habitat use, and traditional knowledge**

Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, Merlin Henry<sup>2</sup>, Alexander Niksik<sup>3</sup>, Albert Simon<sup>4</sup>, John Goodwin<sup>5</sup>, Alex Whiting<sup>5</sup>, Kathy Frost<sup>6</sup>, and Justin Crawford<sup>1</sup>

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*Alaska Marine Science Symposium, 25–29 January 2016, Anchorage AK*

Ringed (*Pusa hispida*) and bearded (*Erignathus barbatus*) seals depend on sea ice for pupping, nursing, molting, and resting. In Alaska, these seals are found in the Bering, Chukchi, and Beaufort seas and are important subsistence species used by Alaska Natives for food, oil, clothing, and handicrafts. Changes in the timing and extent of sea ice have increased access to the Arctic, increasing the need to plan shipping lanes, oil and gas lease sales, and develop mitigation measures to minimize effects on seals. Our understanding of important seal habitats and the timing and magnitude of movements by species, sex, and age, however, is limited. Expanding upon a cooperative satellite-tagging study with hunter-taggers and biologists in Kotzebue Sound that tagged more than 70 ringed and bearded seals, this study works with hunter-taggers from other regions in widely spaced villages to better understand range and timing of movements, relationship with sea ice, important habitats, and degree of seasonal site fidelity and minimize the effects of one tagging location. In 2014 and 2015, hunter-taggers from Kotzebue, Koyuk, St. Michael, and Hooper Bay captured, tagged, and released 12 bearded seals and six ringed seals. In 2014, four ringed seals and one bearded seal tagged in Kotzebue Sound spent the winter in Kotzebue Sound (2 ringed and 1 bearded) and Norton Sound (2 ringed). Two of three bearded seals tagged in Norton Sound in 2014 spent the winter there while one wintered in the Bering Sea. In 2015, three of eight bearded seals tagged in August in Norton Sound moved north into the Chukchi Sea, a fourth spent time due west in Mechigmenan Inlet (Russia), a fifth moved south to near St. Paul Island, and the remaining three stayed in Norton Sound. Local and traditional knowledge is also important to understand how seals respond to changing sea ice conditions. We met with hunter-taggers and other subsistence users in Barrow, Elim, St. Michael, and Stebbins to document historic seal behavior and recent changes. Future plans include training more hunter-taggers, and documenting more local and traditional knowledge to better understand how seals are responding to their changing environment.



# Hunter-assisted study on ringed and bearded seal movements, habitat use, and TEK



Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, Merlin Henry<sup>2</sup>, Alexander Niksik<sup>3</sup>, Albert Simon<sup>4</sup>,  
John Goodwin<sup>5</sup>, Alex Whiting<sup>6</sup>, Kathy Frost<sup>7</sup>, and Justin Crawford<sup>1</sup>

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## Introduction

Ringed (*Pusa hispida*) and bearded (*Erignathus barbatus*) seals are called “ice seals” because they use sea ice for pupping, nursing, molting, and resting. In Alaska, these seals are found in the Bering, Chukchi, and Beaufort seas. They are important subsistence species used by Alaska Natives for food, oil, clothing, and handicrafts. The timing and extent of sea ice have increased access to the Arctic, increasing the need to plan shipping lanes, oil and gas lease sales, and to develop mitigation measures to minimize these effects on seals, but understanding how these changes will affect ice seals and their habitat is less clear. Cooperative hunter-biologist satellite-tagging studies are increasing our understanding of important seal habitats, seasonal movements, use of sea ice including haul out behavior, and seasonal site fidelity. This project builds on past studies by tagging seals at several widely-spaced locations and by incorporating traditional knowledge.

## Objectives

Work with seal hunters to:

- capture and tag ringed and bearded seals;
- document ice seal habitat use and movement; and
- gather and document local and traditional knowledge.

## Activities

2014

- Seal hunters were trained to tag seals with satellite-linked transmitters in Norton Sound, Hooper Bay, and Kotzebue.
- Hunter-taggers determined when and where to capture seals using local knowledge.
- Four ringed and one bearded seal were tagged near Kotzebue in June (Fig. 1).
- Three bearded seals were tagged near Koyuk in September (Fig. 1).

2015

- Traditional knowledge was collected in Barrow, Elim, St. Michael, and Stebbins in January and February. See results in Poster 103 (Row 10).
- The Ice Seal Committee (ISC) brought hunters from the North Slope, Northwest Arctic, Bering Strait, Yukon-Kuskokwim Delta, and Bristol Bay together in March to learn how to deploy satellite tags on seals.
- One ringed seal was tagged near Hooper Bay in May (Fig. 1).
- Four bearded seals were tagged near Koyuk in August (Fig. 1).
- One ringed and four bearded seals were tagged near St. Michael in August (Fig. 1).

## Norton Sound



Alex Niksik prepares to release a bearded seal near St. Michael.



Palsson Fitka and Alex Niksik releasing a bearded seal.



Merlin Henry prepares to release a tagged bearded seal near Koyuk.



Young bearded seals look toward the water upon release.

## Hooper Bay



Albert Simon II prepares to tag a ringed seal near Hooper Bay.



Albert Simon and Evan Napoleon looking for seals near Hooper Bay.

## Kotzebue Sound

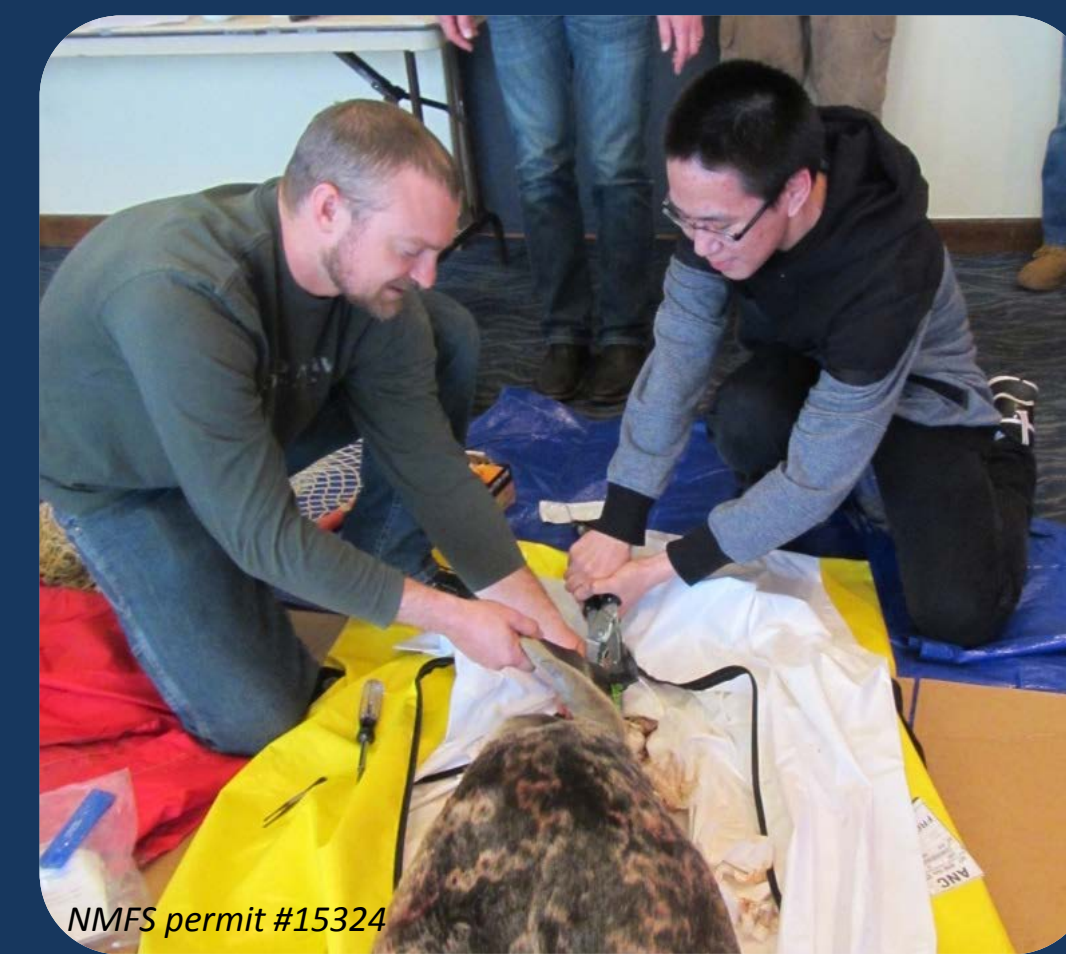


John Goodwin and crew search for bearded seals in Kotzebue Sound.

## Hunter-tagger Training



NMFS permit #15324



NMFS permit #15324

The training was funded by the ISC, with assistance from ADF&G, NSB, and NMML.

## Movements of tagged seals

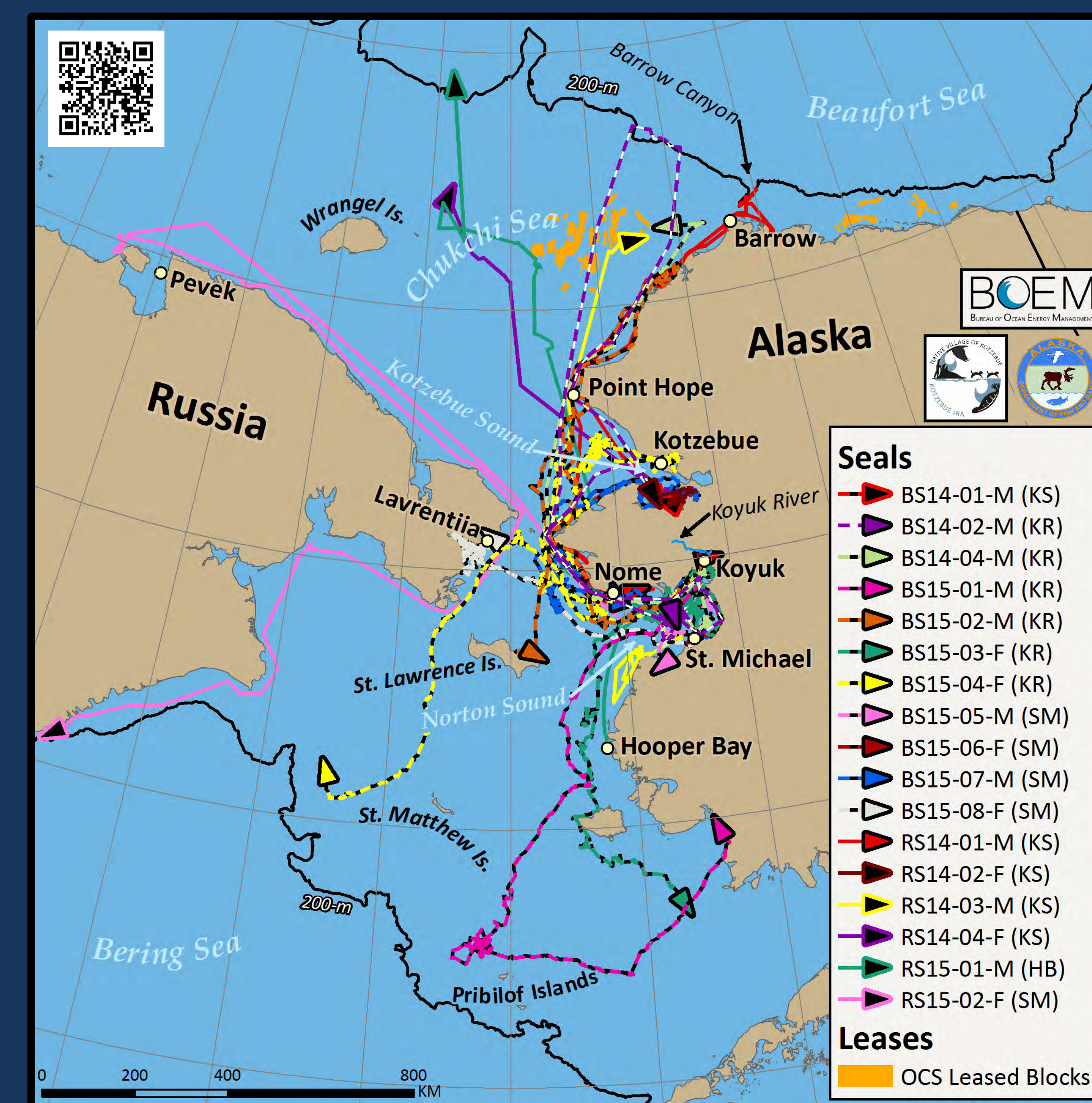


Figure 1. Movements of seals tagged during 2014 and 2015 near Kotzebue Sound (KS), Koyuk River (KR), St. Michael (SM), and Hooper Bay (HB).

## Future plans

- Continue to work with trained hunter-taggers and with new hunters and communities.
- Conduct workshops to document local and traditional knowledge to better understand seal movements in response to changing sea ice.

## Acknowledgements

This project is funded by the Bureau of Ocean Energy Management. We appreciate the assistance of all the hunter-tagger crews; Albert Simon II, Palsson Fitka, Denali Whiting, Edward Ahyakak, Edwin Kotangan Jr., Frank Garfield, Gordon Eakon, Henry “Boyuk” Goodwin, Allen Stone, and Pearl Goodwin. Research on ice seals was conducted under permit #15324 issued to the Alaska Department of Fish and Game by the National Marine Fisheries Service and under an approved ADF&G Animal Care and Use Committee Protocol #2014-03 and 2015-25.



## **Changing Sea Ice, Marine Mammals, and Subsistence Hunters in Northern Alaska**

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Marine mammals are important sources of food for indigenous residents of northern Alaska. Changing sea ice patterns affect the behavior of animals and thus the success of hunters. Documenting the traditional knowledge of Iñupiaq and Yup'ik hunters concerning marine mammals and sea ice makes a wide range of information and insight relevant to ecology, conservation, and human activity accessible. We interviewed hunters in villages from the northern Bering, Chukchi, and Beaufort seas about the movements and behaviors of bowhead whales, walruses, and ice seals (ringed, bearded, spotted, and ribbon seals). Information gathered through the interview process is combined with movements of animals from tracking data (i.e., satellite telemetry), from three different projects funded by the Bureau of Ocean Energy Management, to provide a more complete picture than either method would alone. Hunters reported extensive changes in sea ice, with resulting effects on the timing of migrations, the distribution and behavior of the animals, and the efficacy of certain hunting practices. For example, it has become increasingly difficult to find ice thick enough to support a bowhead whale for butchering and seal hunters must hunt earlier in the spring for seals due to the rapid break-up and retreat of sea ice. While many changes are limiting, some expand opportunities; St. Lawrence Island can now hunt bowhead whales in winter as well as spring. Hunters acknowledged the positive changes of technological advances, such as more powerful and efficient outboard engines, that have increased their hunting range. Effects of changes, such as increased shipping traffic and oil and gas development are still largely unknown but have the potential to be negative. Continued environmental changes, increased disturbance from human activity, and how marine mammals respond to these changes will likely further challenge the ability of hunters to secure food for their communities. Iñupiaq and Yup'ik hunters, however, are well known for their innovation and flexibility, which may be tested while adjusting to the rapid changes.



# The Effects of Changing Sea Ice on Marine Mammals and their Hunters in Northern Alaska



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## Overview

Marine mammals are important sources of food for indigenous residents of northern Alaska. Changing sea ice extent and thickness may affect the behavior of animals and thus the success of hunters. Documenting the traditional knowledge of Iñupiaq and Yup'ik hunters concerning marine mammals and sea ice makes a wide range of information and insight relevant to ecology, conservation, and human activity. We interviewed hunters in villages from the northern Bering Sea to the Beaufort Sea about bowhead whales, walrus, and ice seals, (ringed, bearded, spotted, and ribbon). Traditional knowledge is the product of careful, systematic observation of the environment, confirmed by repeated observation or comparison with the observations of others. This knowledge is shared among hunters through stories and conversation, and treated with care and attention, including attributing the observations and interpretations to the individuals who made them (Noongwook et al. 2007). We documented observations of the migratory and local movements of marine mammals, feeding and reproductive behavior, predation, habitat use, response to disturbance including human activity, and other aspects of the life history and ecology of these animals.

## Methods

- We used the semi-directive interview method to collect traditional knowledge from subsistence hunters and community members (Huntington 1998).
- We interviewed people from 11 communities between 2007 and 2016 (Table 1).
- After the interviews, we prepared a draft report that was reviewed and approved by all the participants.
- The final report was prepared after all the comments had been addressed.

Table 1. Summary of interviews  
\* data pending participant approval and not presented here

Community	Year	Species Focus	No. of Participants
Kaktovik	2007	Bowhead whales	6
Barrow	2007	Bowhead whales	6
Wainwright	2008	Bowhead whales	7
Point Lay	2011	Walrus	5
Wainwright	2011	Walrus	13
Point Hope	2013	Walrus	8
Barrow	2015	Walrus and ice seals	10
Elim	2015	Ice seals and walrus	8
St. Michael & Stebbins	2015	Ice seals and walrus	8
*Shishmaref	2016	Ice seals	5
*Kotzebue	2016	Ice seals	6
*Kivalina	2016	Ice seals	5
Total 11 communities	6 years	7 species	87 participants

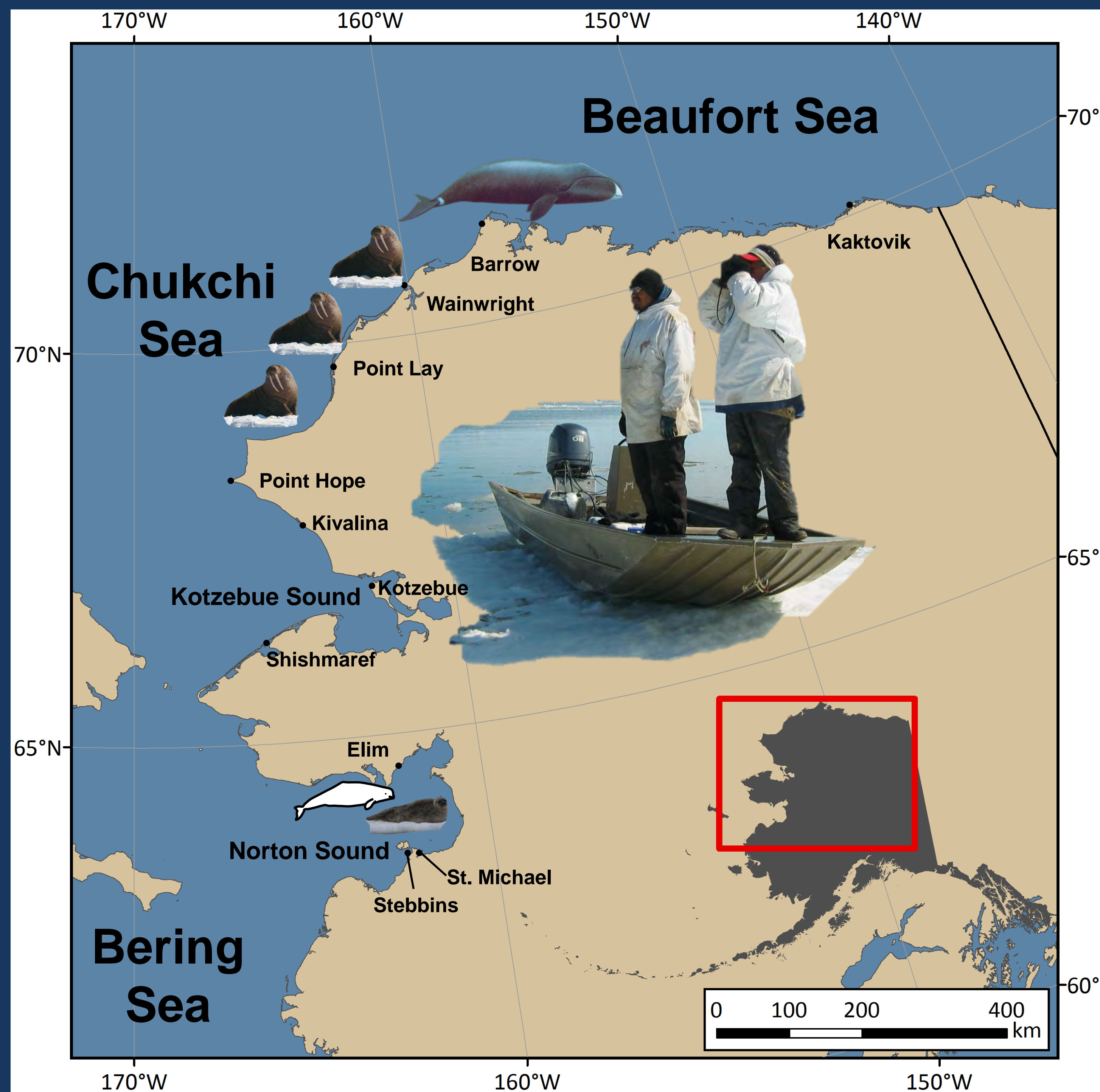


Figure 1. Map of study area and participating communities. Icons correspond to detailed observations about walrus, ice seals, and beluga and bowhead whales.

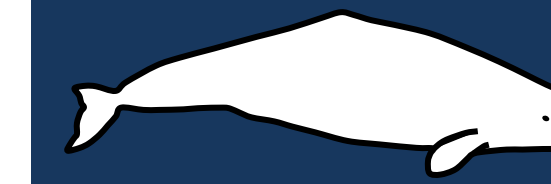
## General Observations

(Recorded in many communities)

- Ice seals are available for a shorter period of time.
- In the past, pack ice came and went all summer, but now retreats from shore and does not return until freeze-up.
- Because of thinner sea ice, it is harder to find a place to haul a bowhead whale onto ice for butchering.
- Hunting and traveling is more dangerous because of thinner ice in winter and spring.
- More efficient boat motors enable hunters to travel farther to retreating ice.
- Less sea ice and bigger storms reduce the number of good hunting days.
- Increased oil and gas activity and greater shipping traffic are concerns; impacts to subsistence are still unknown but potentially large.
- Hunters have adjusted to changing sea ice by hunting earlier in the spring and later into the fall and winter to get what they need.

## Specific Observations

(Recorded in one or two communities)



Beluga whales (*Delphinapterus leucas*) and killer whales (*Orcinus orca*) were seen near Elim in Norton Bay in January 2015, when ice was unusually late in forming (Figure 1).



Walrus are hauling out on land near Point Lay by the tens of thousands. Walrus hauled out on land many times in the past century but in smaller groups.



There is less snow on the sea ice in Norton Sound, reducing the habitat available for seal dens; however, there are still many breathing holes in the ice in spring.



Thinner shorefast ice off of Barrow has shifted spring feeding areas and the distribution of bowhead whales, so that few are now seen along the ice edge to the southwest of the community, which used to be a good hunting area.



Snowmachine noise near Barrow may be changing migration patterns away from shorefast ice.

## Conclusions

Our findings are consistent with other recent studies of traditional knowledge and marine mammals in the region (e.g., Noongwook et al. 2007, Galginaitis 2013, Huntington et al. 2013, Kawerak 2013, Voorhees et al. 2014), which note both the responses of marine mammals to changing conditions and the innovations of hunters to shifts in timing, distribution, and behavior of the animals they seek. In these studies, and in ours, hunters emphasized that the impacts to animals and people are a result of the interactions among many factors rather than to changing sea ice acting alone.

## Acknowledgements

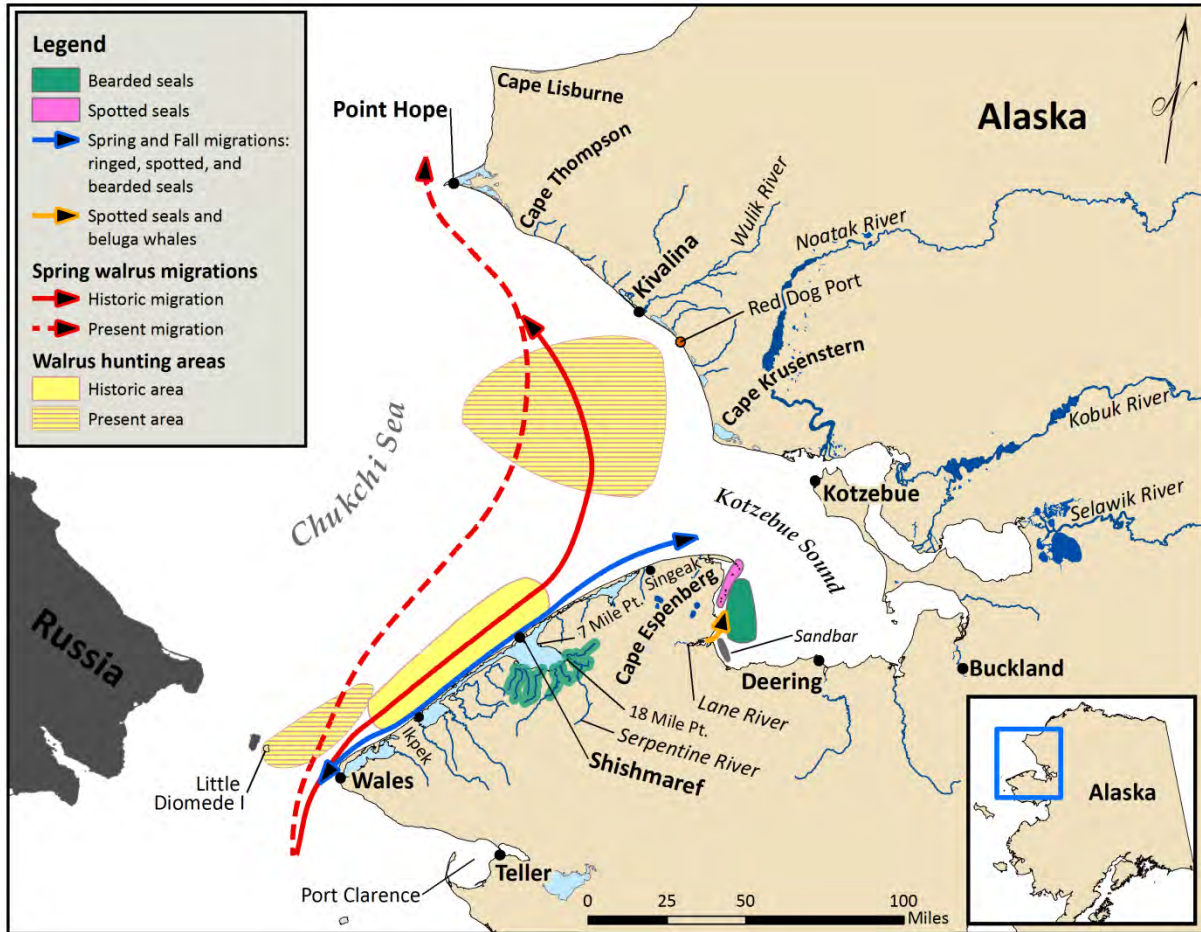
We appreciate the skill, expertise, and generosity of the 87 hunters who participated in the interviews, and the communities and Tribal Councils of Kaktovik, Barrow, Wainwright, Point Lay, Point Hope, Elim, Stebbins, St. Michael, Shishmaref, Kotzebue, and Kivalina that facilitated this work. We also thank the Alaska Eskimo Whaling Commission, the Eskimo Walrus Commission, and the Ice Seal Committee for their support and guidance. We are grateful to the Bureau of Ocean Energy Management, the Minerals Management Service, ConocoPhillips, and the Coastal Marine Institute for funding.

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# Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near Shishmaref, Alaska



# **Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near Shishmaref, Alaska**

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Huntington, H.P., M. Nelson, and L.T. Quakenbush. 2016. Traditional knowledge regarding ringed seals, bearded seals, and walrus near Shishmaref, Alaska. Final report to the Eskimo Walrus Commission, the Ice Seal Committee, and the Bureau of Ocean Energy Management for contract #M13PC00015. 9pp.

## **Introduction**

Bearded seals, spotted seals, and ringed seals are important species for subsistence harvests by Iñupiat hunters from Shishmaref (population 579), on the northern coast of the Seward Peninsula, in the Chukchi Sea coast, just north of Bering Strait in Alaska. Walrus are found and hunted in this area, too. These Arctic marine mammal populations are at potential risk from climate change, increasing industrial activity, coastal development, and shipping through Bering. Scientific studies of distribution, behavior, movements, and habitat use of seals and walrus have made important contributions to understanding the effects of a changing environment and the potential effects from industrial activity. For example, placing satellite transmitters on seals and walrus provides detailed information about the movements and some behaviors of individual animals. Documenting traditional knowledge about seals and walrus, through interviews with residents of coastal communities, however, provides valuable complementary current and historical information about the general patterns of each species.

This report summarizes information gathered from interviews with hunters and other knowledgeable residents in Shishmaref, Alaska, in January 2016. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## **Methods**

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting his/her knowledge, the associations made between walrus and other parts of the environment, and so on. The interviewers use their list of topics to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In Shishmaref, we interviewed five people, three in one group and two individually. Those interviewed were Glenn Nayokpuk, William Olanna, Bert Iyatunguk, Fred Weyiouanna, and Morris Kiyutelluk. The interviews were conducted on January 4 and 5, in the homes of the interviewees and at the Shishmaref IRA Council office.

The topics identified by the research team in advance of the interviews were:

- Haulouts on land
- Overwintering areas and behavior
- Use of lagoons and rivers
- Feeding patterns and prey
- Differences between ringed and bearded seals
- Impacts from climate change
- Parts of seals that people eat

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to

all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### ***General Observations***

In spring, bearded seals come first, followed by walrus, and then spotted seals. When the spotted seals are plentiful near Shishmaref, hunters know the bearded seal season is over, unless they go most of the way to Kotzebue to catch up to them. Today, the changing climate is shortening the time separating the migrations and they are blending together such that bearded seals and walrus may arrive at the same time.

Animals are arriving earlier in spring than they used to, and the spring season is over sooner. It used to be that duck hunting came before bearded seal hunting, but now bearded seal hunting takes place at the same time as duck hunting. Eggs and berries also come earlier than they used to.

Seals are not common around Shishmaref in summer, from about July to September. They are at Cape Espenberg and in Kotzebue Sound.

In fall, there are more seals in the Shishmaref area than there used to be.

Sea ice breaks up earlier than it used to and freezes much later. This winter (2015-16), there was open water on the ocean until Christmas, when it usually freezes by November. The ice is thin and dangerous much of the time, not solid and reliable as it once was in winter. There are no large pressure ridges to hold the ice in place, so in spring the ice will break up quickly and be dangerous to travel on.

Seals feed on herring and salmon, which are plentiful in the Shishmaref area.

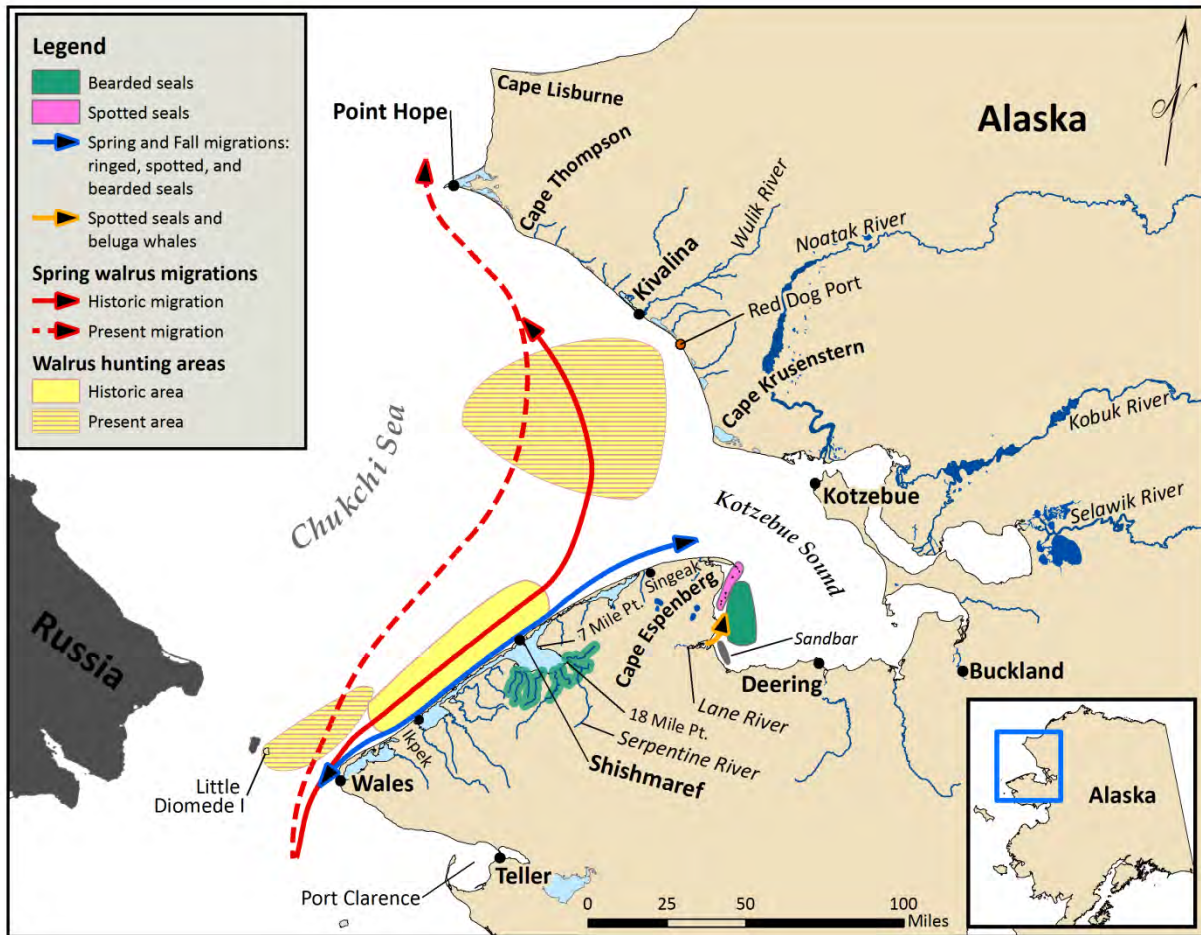


Figure 1. Movements and behavior of bearded seals, spotted seals, ringed seals, walrus, and beluga whales as described during traditional knowledge interviews, January 2016.

***Bearded Seals***

Bearded seals are the main source of food for Shishmaref residents. Bearded seal oil and meat are a typical winter meal. Bearded seals are hunted mainly in spring, from the shorefast ice or in the pack ice when boating is possible.

In spring, bearded seals migrate closer to the shore and the village than they used to. Hunters do not have to travel as far, unless they are held on shore because the sea ice is piled up against the land. In those years, hunters may have to travel very far, sometimes to northern Kotzebue Sound, in pursuit of bearded seals.

Young bearded seals (unmiaq) migrate north with the adults, but migrate back south slightly ahead of the adults. Unmiaq’s are also found up rivers in summer, especially the Serpentine River and occasionally in smaller rivers and tributaries. They are likely feeding on salmon.

Bearded seals return to the Shishmaref area in late fall, when slush ice starts to form on the ocean. In spring, the bearded seals surface often as they migrate past the village. In fall, they travel differently, surfacing infrequently and moving fast.



One fall during the slush ice period, one hunter saw one pan of sea ice full of spotted seals and another pan nearby that was full of bearded seals.

In recent years, since the Fukushima nuclear reactor breach in 2011, hunters have seen many diseased animals, with sores around their flippers and back end, with white livers, and with bald spots or even with no hair at all. The hair can feel like sandpaper instead of being smooth, and in fall it may come out easily when it should be firmly attached to the skin. In 2015, there were more sick seals than in 2014.

Hunters once found a worm in a bearded seal's liver, most likely a liver fluke. The animal appeared healthy otherwise, though its blubber was yellow-orange.

In spring 2015, after the sea ice broke up, hunters caught a young bearded seals (*unmiaq*) but found that it was covered with white spots. This was something different from the hair loss hunters were familiar with. Hunters do not like to eat diseased animals. One hunter's grandmother told him not to eat seals that have no hair where they are supposed to have hair. Many hunters do not even want to touch animals that appear severely ill.

Bearded seals in fall also showed signs of disease. Diseased seals of all species are typically thin, with little blubber, and do not dive right away or stay down for long. One seal did not dive until three shots were fired at it. Healthy seals dive right away and can stay down for a long time.

People in Shishmaref eat the oil, meat, liver, intestines, kidneys, heart, and lungs of bearded seals. The blubber is rendered into oil. Meat is dried and stored in oil. Liver is cooked and then stored in oil. Intestines are dried, cooked, and stored in oil. Lungs are half-dried and then eaten. They can become hard as wood if left too long. Flippers are hung up with the drying meat until they become tasty. In the old days, seal oil and meat would be stored in sealskin pokes, in shallow holes in the ground, covered with wood. In fall, the ground would freeze and water in the hole would freeze, helping protect the pokes from bears and foxes. The quality of seal meat, seal oil, and seal hides does not appear to have changed.

Some bearded seals have claw marks, probably from polar bears as the seals are hunted in spring.

Albino bearded seals are seen, though rarely.

### ***Spotted Seals***

Spotted seals are typically hunted in fall when they return to the Shishmaref area from Cape Espenberg and Kotzebue Sound. They are the first seals seen in early fall before the ice starts to form.

Spotted seals haul out in large numbers on small islands south of Cape Espenberg on the Kotzebue Sound side. They are also seen in large numbers in the mouth of the Lane River, farther south of Cape Espenberg on the same side, particularly in the deep water channel on the north side of the Lane estuary.

In fall 2015, hundreds of spotted seals were seen on top of ice in Shishmaref Lagoon near the mouth of the Serpentine River. During open water, spotted seals are abundant near the entrances to Shishmaref Lagoon likely eating fish because the fishing is poor. The fish arrive in higher numbers once the ice forms and the seals leave.

Spotted seals in recent years have been larger than they used to be. The spotted seals found near Cape Espenberg, at Singeak, and at Ikpek (southwest of Shishmaref) are all big. The spotted seals in Shishmaref Lagoon are only 4-5 feet long, not the big ones.

Spotted seals also suffer from the disease that afflicts bearded seals, the one that causes hair loss.

### ***Ringed Seals***

Ringed seals, referred to as common seals, are typically hunted in fall, but can be hunted year round if they are available.

Ringed seals return to the Shishmaref area in late fall, like bearded seals, when slush ice starts to form on the ocean.

The harvest of ringed seals has declined due to the disease that has been seen on so many bearded, spotted, and ringed seals in the past five or so years. People do not want to hunt animals that may be sick. Some ringed seals and ringed seal pups are seen on the beach in summer, but people do not want to harvest them or touch them or even feed them to dogs because of the risk of disease.

### ***Walrus***

Walrus are hunted in spring as they migrate northwards with the retreating ice. Walrus migrate farther off shore now because the pack ice is less dense and more broken than in the past.

Walrus are occasionally seen in fall, as lone animals swimming past. One was seen in Shishmaref Lagoon. Some individuals are seen hauled out on the beach, by themselves.

Walrus can be seen sometimes on very small ice floes, instead of in larger groups on larger ice pans the way they used to haul out. Sometimes only the small floes are available.

In the 1970s and early 1980s, some hunters went over 50 miles offshore on the ice by snowmachine to hunt walrus. In those days, the weather was cold and the sea ice was solid.

Today, walrus are sometimes hunted from the ice edge in May. They used to be hunted along the shore north and south of Shishmaref. In some years, hunters have to go as far as Kotzebue Sound and even close to Kivalina to pursue walrus as they migrate northwards. When they do

so, hunters may go to Cape Espenberg and wait for good weather for traveling across Kotzebue Sound. Hunters have also gone as far south as Wales and Diomedes to pursue animals.

Walrus appear healthy, with no sign of the disease afflicting seals. Some walrus are skinny, perhaps due to retreating sea ice and having to swim farther from their resting places atop the ice to their feeding areas.

### ***Other Information***

Ribbon seals are very skittish, diving off ice floes at the slightest sound or smell of people.

It is harder to find polar bears than it was 20 years ago. They are typically seen in spring when they go out with the sea ice. Nowadays, some get stranded on land. Some are seen swimming straight out to sea, presumably in search of sea ice. Hunters in Shishmaref do not believe the polar bears survive this attempt. Polar bears are seen more often inland than they used to be, usually in early spring before the ice goes out.

Steller sea lions are occasionally seen in the Shishmaref area. This is a relatively new phenomenon, but is still rare.

The Lane River area is a good place to hunt belugas in late summer and fall.

In spring 2015, killer whales kept a gray whale cow and calf close to shore near Shishmaref. The killer whales may have taken the calf.

Hunters can push whales in the direction they want them to go by slapping the water with their paddles. This imitates the behavior of killer whales, which slap their tails and dorsal fin on the water to scare the whales and push them in the direction the killer whales want them to go. Whales have occasionally come into Shishmaref Lagoon, but this has not happened in recent years. The bones of a whale can be found a short distance upstream from the mouth of the Serpentine River, where hunters pursued it many years ago. It is not known what species of whale it was.

Shishmaref hunters took a bowhead whale once, when it came closer to the shorefast ice than usual.

Many more gray whale carcasses are seen along the coast near Shishmaref than there used to be. Bowhead whale carcasses remain rare.

Fish arrive in spring after the ice goes out.

There are more seabirds in the Shishmaref area now than there used to be. There are also different birds

There are different crabs in the Shishmaref area in recent years.

Some hunters will print satellite images of sea ice before going out on the shorefast ice in spring.

The channels into Shishmaref Lagoon formed relatively recently. The one to the north of the village, for example, opened within the past two generations. The grandmother of one Shishmaref resident described jumping over the narrow channel when she was young, as it was forming.

Caribou are found closer to the village recently than they have been for many years. The warmer weather may be an influence. The elders said the caribou would return to this area. They can be seen on the mainland not far from Shishmaref. It used to be that only a few caribou might be seen, but now there are hundreds if not thousands. Predators are closer, too, including wolves, wolverine, and brown bears.

It used to be possible to predict good weather for a couple of days, so that hunters could cross Kotzebue Sound for example. Now, the winds and bad weather can come up very quickly.

### **Acknowledgements**

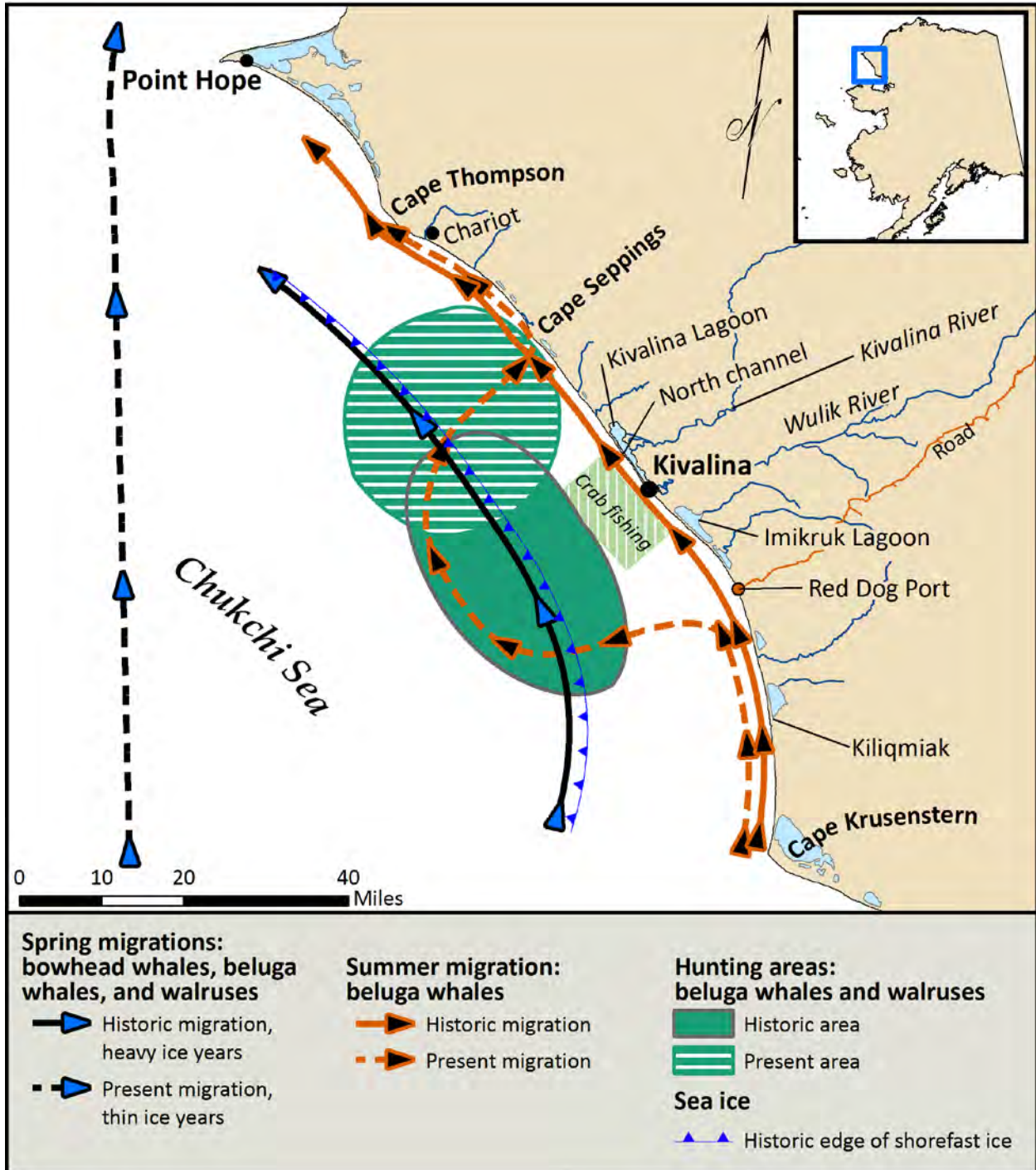
We are grateful for the skill, expertise, and generosity of the five hunters who participated in the interviews. We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to Jane Kakoona, Karen Olanna, and Renee Kuzuguk from the Shishmaref IRA Council office for helping to set up the interviews. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract Nos. M09PC00027 and M13PC00015 and we appreciate the support of Charles Monnett, Catherine Coon, Dan Holiday, and Carol Fairfield. Justin Crawford prepared the maps used during the interviews and the figure in this report.

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# Traditional Knowledge Regarding Ringed Seals, Bearded Seals, Walrus, and Bowhead Whales near Kivalina, Alaska





# **Traditional Knowledge Regarding Ringed Seals, Bearded Seals, Walrus, and Bowhead Whales near Kivalina, Alaska**

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## **Introduction**

Ringed and bearded seals are important species for subsistence harvests by Iñupiat hunters from Kivalina (population 384), on the Chukchi Sea coast of northwestern Alaska. Walrus are found and hunted in this area, too. These Arctic marine mammal populations are at potential risk from climate change, increasing industrial activity, coastal development, and shipping through Bering Strait. Scientific studies of distribution, behavior, movements, and habitat use of seals and walrus have made important contributions to understanding the effects of a changing environment and the potential effects from industrial activity. For example, placing satellite transmitters on seals and walrus provides detailed information about the movements and some behaviors of individual animals. Documenting traditional knowledge about seals and walrus, through interviews with residents of coastal communities, however, provides valuable complementary current and historical information about the general patterns of each species.

This report summarizes information gathered from interviews with hunters and other knowledgeable residents in Kivalina, Alaska, in January 2016. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## **Methods**

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting his/her knowledge, the associations made between walrus and other parts of the environment, and so on. The interviewers use their list of topics to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In Kivalina, we interviewed five people. Those interviewed were Leonard Knox, Allen Knox, Replogle Swan, Dolly Swan, and Enoch Adams Jr. The interviews were conducted on January 7, 2016, at the Kivalina Tribal (IRA) Council office and in the homes of interviewees.

The topics identified by the research team in advance of the interviews were:

- Haulouts on land
- Overwintering areas and behavior
- Use of lagoons and rivers
- Feeding patterns and prey
- Differences between ringed and bearded seals
- Impacts from climate change
- Parts of seals that people eat

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### ***General Information***

Marine mammals continue to be abundant in the Kivalina area. The migratory patterns remain largely the same, with variation in timing from year to year. The big change for hunters is that the ice is no longer a reliable platform for hunting, but is instead a dangerous place that prevents hunters from reaching marine mammals or limits the length of the hunting period.

The number of marine mammals coming past Kivalina has decreased considerably since construction of the Red Dog Mine Port Site in the late 1980s. The noise from that facility deflects marine mammals migrating up the coast, pushing them offshore and out of reach of Kivalina hunters. For example, beluga whales used to be seen every summer, but after the construction of the Port Site, they do not come to Kivalina from the south any more. As a consequence, hunters from Kivalina now often travel northwest of the community towards Cape Thompson to go hunting. It is expensive to travel far to go hunting. Many hunters also go to the area of the north channel into the lagoon, where it is quieter.

A great deal has changed in recent years, but hunters are adjusting to these changes. What used to take place is not what happens now. The availability of high-powered outboards and high-powered rifles has helped hunters adjust in ways that would not have been possible 50 or 100 years ago. A boat trip to Point Hope now takes two hours, instead of all day. Hunters can make day trips from the village instead of having to camp out on the land or ice. People need to be thinking in new ways a lot now.

Kivalina hunters do not pursue marine mammals in fall. They are hunting caribou at that time of year. Not many seals are seen in fall.

Bearded seals, caribou, and fish are the primary subsistence resources that sustain Kivalina. Other species, such as bowhead whales, beluga whales, and walrus are appreciated when they are available, but not essential to the community's well-being.

People eat the blubber (oil) and meat of bearded and ringed seals. They also eat many of the organs of both seals. Elders enjoy small seals of either species. Seals are fat in spring, and their blubber is good for seal oil. Fall seals are not as good for oil. In late spring, male ringed seals are darker and have a different taste "like kerosene" in the words of one hunter. Spotted seal meat is not eaten because it does not taste good, but spotted seal blubber may be used for oil if necessary. There has been no real change in the quality of seal meat or oil.

Sharing of seals and other animals is very important for Kivalina hunters. Hunters will take animals for their families, their relatives, elders, and others in the community. The first animal of the season is typically shared, so many people are excited when a hunter gets his or her first animal, knowing it will be distributed to others. People say that if you give first, more will come, so they do not like to keep their first catch. This practice applies to caribou and to marine mammals.

Shorefast ice does not stay as long as it used to. In some years, it starts to melt as early as March. The ice used to be thicker than it is now, and seems to be getting thinner. This year, in early January, there is open water to the beach. Last winter, 2015, the ice did not stay for good

until March. This winter may be similar. Shorefast ice used to form in early fall and stay until June, but this is no longer the case.

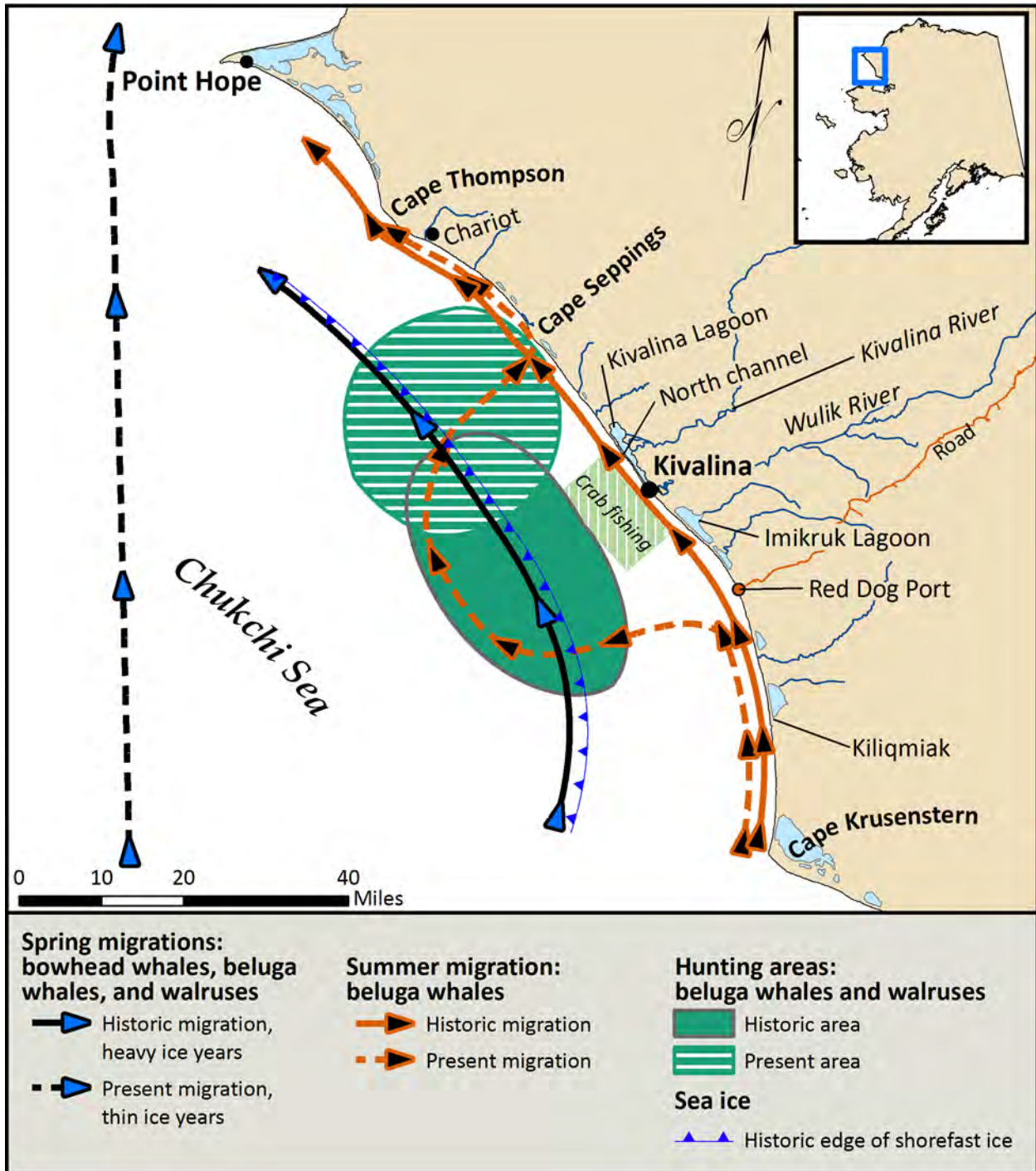


Figure 1. Movements and behavior of bearded seals, spotted seals, ringed seals, walrus, beluga whales, and bowhead whales as described during traditional knowledge interviews, January 2016.

### ***Bearded Seals***

Bearded seals start to haul out on the ice in spring when the days get longer. Many seals are seen at this time of year.

They are usually not hunted until the bowhead and beluga hunt is over, so as not to scare off the whales. Bearded seal hunting takes place before it is too warm, so that the meat will not spoil or be affected by insects as it is drying on racks.

In recent years, the thin ice has made it dangerous to go hunting for bearded seals on top of the ice. In 2015, the ice disappeared very quickly after break-up, so the opportunity for hunting bearded seals by boat was very short. In the late 1990s, hunters were caught by surprise one year when the hunting period was only a week long instead of several weeks. After that, they made sure to take advantage of the opportunity as soon as it came. That worked, until last year. In 2015, however, the season was much shorter, again catching hunters by surprise. Offshore winds carried the ice out, but the ice did not come back in after the winds died, as it used to do. This happened once before, in the 1980s. Now hunters fear it will be the new pattern.

A few bearded seals remain in the area after the ice goes out. Bearded seals come through the channel into the lagoon in summer, following fish. Young bearded seals go up rivers in fall. Bearded seals start returning to the area in fall.

A few sick bearded seals have been seen in recent years, with large hairless areas. One young bearded seal taken last October in open water had about half its hair missing. It did not have sores on its skin, but it was skinny. Most seals are healthy, but it used to be very rare to encounter a sick seal.

### ***Ringed Seals***

Some ringed seals stay all winter in the Kivalina area. In mid-winter, ringed seals are fat and in their prime. Hunters cannot get them now because the ice is thin or there is open water. Whereas hunting used to start in December or January, it is often not possible to hunt ringed seals until February or March.

It is important to take ringed seal in winter to make bleached sealskin leather, which requires cold weather to cure properly. Bleached ringed sealskin is becoming a rare commodity in Kivalina.

Small, sickly ringed seals have been seen on the beach in the past few years. They do not move off when people approach. They are not common, only a few each year, but this is a new phenomenon. One hunter said the previous time he saw a sick seal was at least 30 years ago, in contrast to seeing at least one each year now.

### ***Spotted Seals***

Spotted seals arrive after the ice leaves. Some pups can be seen on the beach all summer, going out to feed and coming back to rest and avoid danger. Spotted seals are seen all summer. Few people hunt spotted seals. Their skins are beautiful and warm, if tanned properly, but the meat is not wanted and the blubber is usually thin. People could get more spotted seals than ringed or



bearded seals these days. Spotted seals do not seem to be affected as much by changes in ice, as they come for the fish rather than the ice.

### ***Walrus***

Walrus come northwards past Kivalina in spring when the ice starts to break up, at the end of the bearded seal season. Walrus used to follow a path that brought them past Kivalina, but now seem to go straight from Shishmaref to Point Hope or Cape Thompson, which takes them 50 miles away from Kivalina, too far to go in a boat in broken ice.

Occasionally a walrus will be seen hauled out on the beach. They prefer ice, but will haul out on land if there is no ice.

Walrus are seen going south in fall. A few stray walrus are seen in summer, heading south.

One hunter took a female walrus each of the past two summers, in July, but the blubber was thin and the meat was very dark and red and stinky. They were excited about getting a walrus, because that has become rare for Kivalina hunters, but they could not eat it.

Women are not allowed to go walrus hunting because of stories from long ago of walrus chasing boats and even turning boats over.

### ***Bowhead and Beluga Whales***

Bowhead and beluga whales are normally hunted in spring as they migrate north through the leads in the ice. The whales continue to follow this pattern, but with more open water they can take a more direct route from Wales to Point Hope, bypassing Kivalina. When the ice is thick offshore, then bowheads and belugas are more likely to follow the leads along the shore in the Kivalina area. The whales that do come past Kivalina are typically 20 miles offshore. When there was stable shorefast ice in spring, hunters could go 20 miles out and camp at the ice edge to hunt whales. Now, it is too dangerous, so hunters do not have access to the whales. With the thin ice, Kivalina hunters would not be able to pull a large bowhead whale out of the water. There is still an opportunity, but it is shorter than it used to be.

A few belugas will be seen in summer, usually coming from the north. They may be deflected offshore near the Red Dog Port Site, then return to the coast near Cape Seppings. Some come south to feed in the river mouths along the coast, which is why they stay close to shore at this time. Last summer (2015), killer whales kept the belugas in the shallow water close to shore, where hunters could get them. Hunters did not see the killer whales, but heard reports of killer whales from people in Point Hope. The belugas stayed in shallow water, avoiding killer whales even though it made them vulnerable to human hunters. This happens from time to time, but not consistently. Killer whales are doing what they have always done.

### ***Other Information***

Gray whales come into the area at the end of summer.

Humpback whales were seen in front of Kivalina in July 2015, a time when there were lots of herring in the area. Humpbacks are seen every few years, usually in July when there are many chum salmon coming up the coast.

There are porpoises (harbor porpoises, *Phocoena phocoena*) in the Kivalina area in summer, but hunters do not pursue them.

Polar bears still come to the Kivalina area, but would usually be encountered by hunters at the ice edge during whaling season. Now that hunters cannot go as far out on the shorefast ice, they see fewer polar bears. Two polar bears have made dens in the hills behind Kivalina this winter.

One hunter found an eight-foot shark on the beach at the end of July one year.

Crabbing is good at Kivalina, especially in fall. The crabs are plentiful in deeper water about five miles from shore.

Some shrimp wash up on the beach after fall storms, along with small fish known as *akaluaq*. Squid and unusual fishes have been washing up on the beach in recent years, which is odd. The squid, which are black and a few inches long, have not been seen before. Some people have also seen swimming worms in the ocean, up to a foot long, the thickness of a pencil. Smaller worms were seen last summer, in a school towards Cape Thompson, at a time when there were also three gray whales nearby. Someone saw a swimming octopus in one recent year.

### **Acknowledgements**

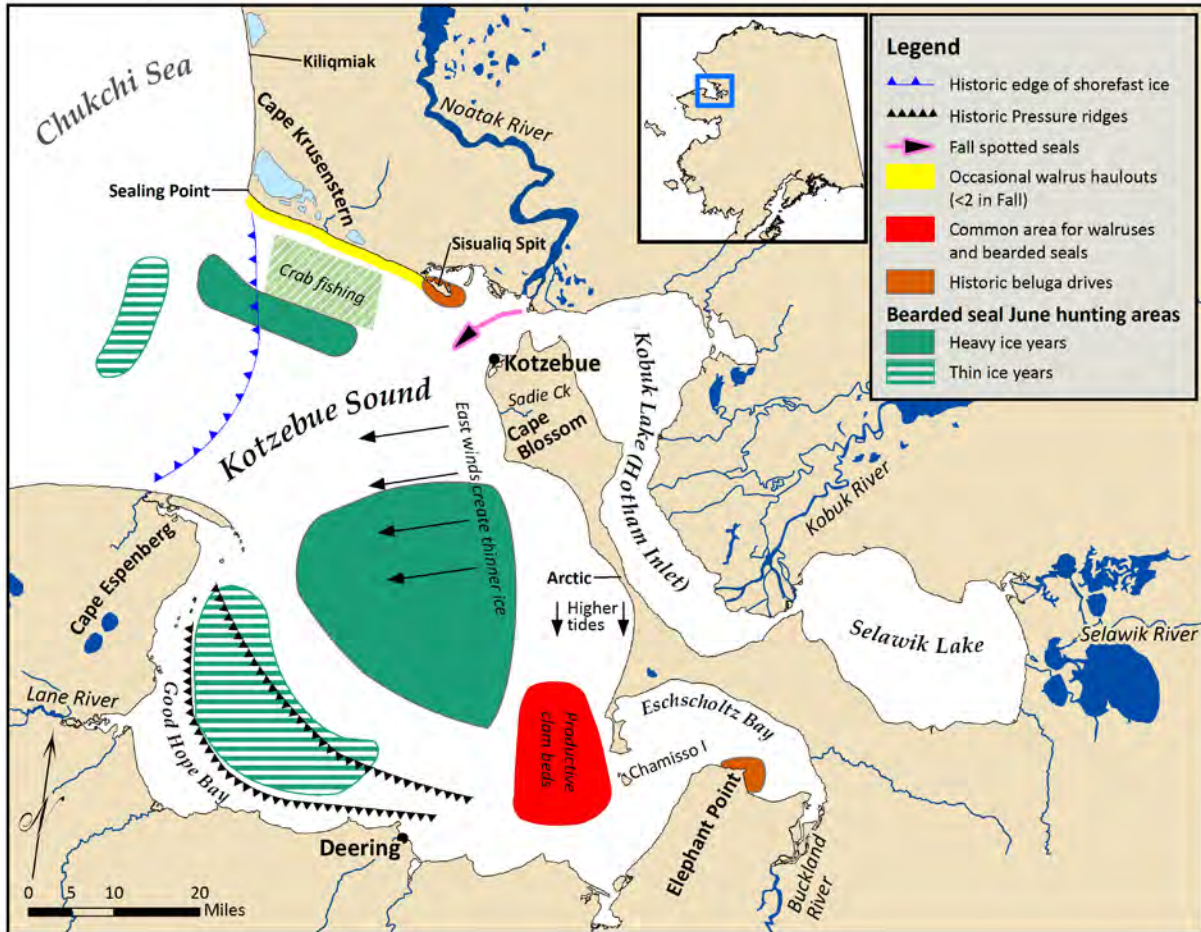
We are grateful for the skill, expertise, and generosity of the five people who participated in the interviews. We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to Enoch Adams Jr. for helping to set up the interviews and to Stanley Hawley and the Kivalina IRA Council for use of their office space. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract Nos. M09PC00027 and M13PC00015 and we appreciate the support of Charles Monnett, Catherine Coon, Dan Holiday, and Carol Fairfield. Justin Crawford prepared the maps used during the interviews and the figures in this report.

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# Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near Kotzebue, Alaska



# **Traditional Knowledge Regarding Ringed Seals, Bearded Seals, and Walrus near Kotzebue, Alaska**

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## **Introduction**

Ringed seals and bearded seals are important species for subsistence harvests by Iñupiat hunters from Kotzebue (population 3,284), in northwestern Alaska. Walrus are found and hunted in this area, too. These Arctic marine mammal populations are at potential risk from climate change, increasing industrial activity, coastal development, and shipping through Bering Strait.

Scientific studies of distribution, behavior, movements, and habitat use of seals and walrus have made important contributions to understanding the effects of a changing environment and the potential effects from industrial activity. For example, placing satellite transmitters on seals and walrus provides detailed information about the movements and some behaviors of individual animals. Documenting traditional knowledge about seals and walrus, through interviews with residents of coastal communities, however, provides valuable complementary current and historical information about the general patterns of each species.

This report summarizes information gathered from interviews with hunters and other knowledgeable residents in Kotzebue, Alaska, in January 2016. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## **Methods**

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting his/her knowledge, the associations made between walrus and other parts of the environment, and so on. The interviewers use their list of topics to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In Kotzebue, we interviewed six people individually. Those interviewed were John Goodwin, Cyrus Harris, Willie Goodwin, Enoch (Atamuk) Sheidt, Henry (Boyuk) Goodwin, and Lance Kramer. The interviews were conducted on January 6 and 7, 2016, in the home of one interviewee, at the Kotzebue IRA Council office, at the Nullagvik Hotel, and, in one case, beginning at the Bering Air terminal, en route to Kivalina, at the Kivalina community center, and concluding at the Kivalina IRA Council office.

The topics identified by the research team in advance of the interviews were:

- Haulouts on land
- Overwintering areas and behavior
- Use of lagoons and rivers
- Feeding patterns and prey
- Differences between ringed and bearded seals
- Impacts from climate change
- Parts of seals that people eat

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to



all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### ***General Observations about Seals***

Hunters on the coast would take seals for their own families and also for families that could not hunt for themselves, such as elders and widows. They would also take seals to trade with people from upriver, getting dried fish and furs in return.

People eat seal oil, meat, heart, kidneys, intestine, and liver of seals. Bearded seals are preferred, though all seals can be eaten. From spotted seals, hunters usually take the hide and blubber, as the meat is not regarded as tasty. Bearded seal flippers would be aged underground and eaten after a few weeks. In the old days, people would store seal and other foods in sealskin pokes in ice cellars. Today, they typically use electric freezers and modern containers.

Elders like young bearded seals, which produce nice, clear oil. Older male bearded seals yield oil that is yellow and less preferred.

By May, seals are making holes in the ice and coming out to lie on top of the ice. Historically, hunters would start hunting when the seals started hauling out atop the ice. Most of the seals seen at this time are adult seals, but hunters would also take young seals when they came out of their lairs. The skins were very desirable at that stage, soft and good for liners. The best hunting for pups was in years with little snow in early spring, which did not happen every year.

Soon after break-up, only bearded and ringed seals are around. Later on, while the ice is still there, spotted seals arrive and the bearded seals and most ringed seals leave. Spotted seals are aggressive and scare off the other seals. Once spotted seals are there, hunters either stop looking for bearded seals or look elsewhere for bearded seals. This is usually in June or July.

There are seals year round in Kotzebue Sound and along the coast. From satellite tagging, hunters now know that the juveniles travel far, even into the Bering Sea, whereas older seals tend to stay closer to Kotzebue Sound.

Hunters can get bearded, ringed, and spotted seals in fall, though the bearded seals are almost all juveniles.

The quality of seal and walrus meat, blubber, other foods, oil and hides has not changed. Seal behavior has not changed, either, despite changes to the ice.

This past year, seals were fat and healthy, and there were many pups, despite the poor ice conditions for hunters. Hundreds if not thousands of seals were seen in Eschscholtz Bay in 2015. Lots of seals were seen between Kotzebue and the Chamisso Islands, including seals sleeping on the water surface. The only big change is the loss of hunting opportunity due to poor ice and rapid disappearance of ice after break-up starts.

When the snow melts early, there is no protection for seal pups from predators such as jaegers and ravens and foxes. The roof of the den collapses and the pup is exposed. Under the snow, seals move around and make escape routes from their dens.

The smallest pups do not go into the water.

There are as many or more seals now as there were in the past. There has never been a shortage of seals compared with people's needs. There is not as much hunting, largely because there are fewer dogs to feed. Hunters also used to get seals to make sealskin pokes for storing oil and meat, but today there are other containers so no need to hunt seals for this purpose.

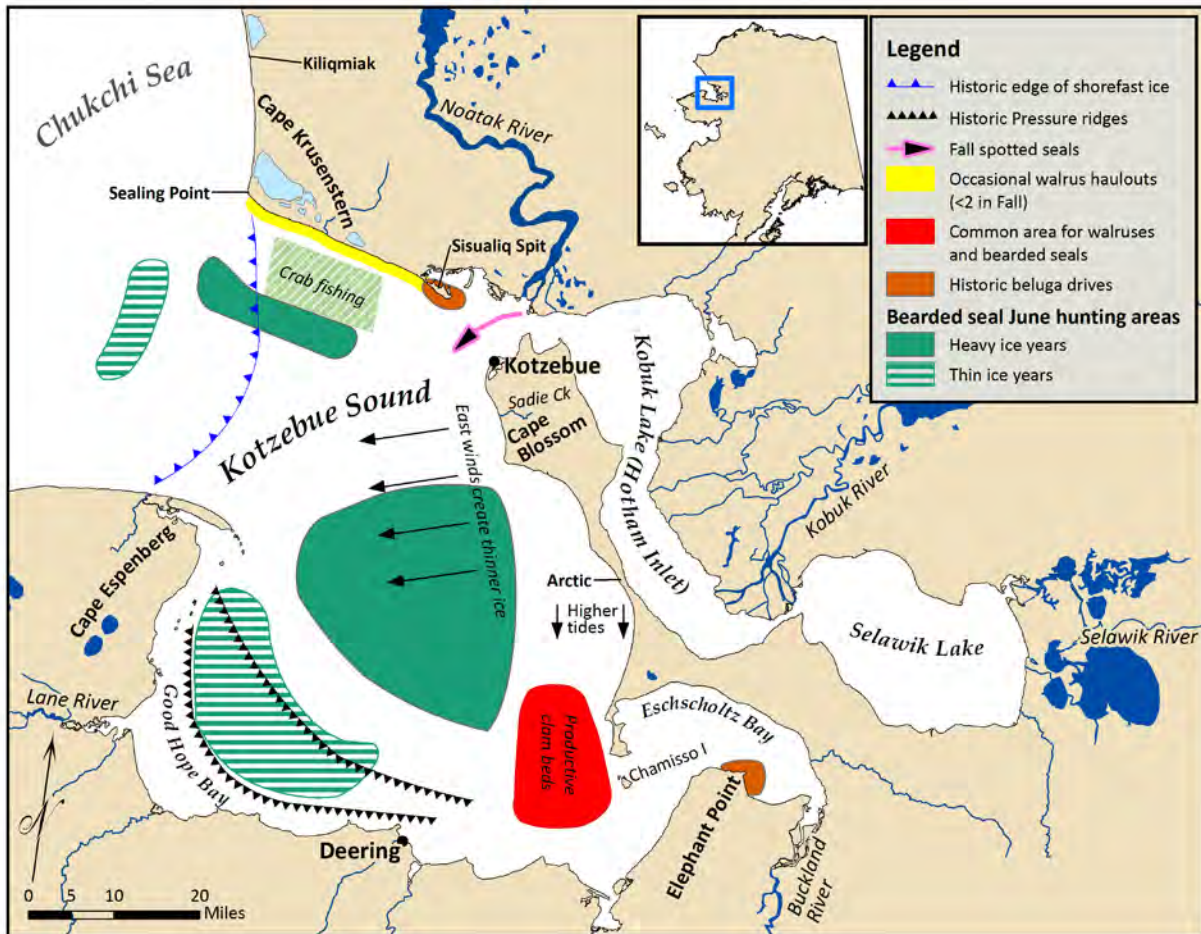


Figure 1. Movements and behavior of bearded seals, spotted seals, ringed seals, walrus, and beluga whales as described during traditional knowledge interviews, January 2016.

### Seals and Disease

It seems there may even be an overpopulation of seals, which could cause starvation if there is not enough food for all the seals. When animals starve, they can develop many different kinds of disease, which may help explain the skin sores and other problems hunters saw a few years ago.

Hair loss is normal in seals, and can be seen on bearded, ringed, and spotted seals. When seals were taken, hunters' wives would pull on the hair to see if the hair was firmly attached or if the seal was in the middle of the molt. Seals that are molting or have lost hair are good for making leather, for ropes and mukluk soles and other purposes. Hairless seals would be fed to dogs, or if they seemed fat and healthy otherwise would be eaten by people. One hunter took a hairless ringed seal in winter, and his grandmother said he should burn it, so he did. People would say the seals did not spend enough time on top of the ice to molt fully. The hair loss may also have come from rubbing against the seabed. The loss of ice in recent years may mean the seals cannot spend as much time hauled out as they used to, which could affect the molt. Seals may have to learn to adapt, for example by hauling out on land instead of ice.

The recent hair loss, accompanied by skin sores and other signs of ill health, is a new phenomenon. Hunters do not want to handle, much less eat, seals that show signs of poor health. In addition to the sores, the seals appear lethargic. Ringed seals hauled out on the beach do not flee, so would be easy to catch, but hunters do not want to approach them once they see they are sick. This illness occurred first in 2011, but seems mostly to have disappeared. Some hunters see it as nature's way of dealing with overpopulation of seals.

### ***Bearded Seals***

In spring, bearded seals are the focus for hunting, getting food for spring and for the following winter. When the ice started to break up, hunters would go to Sealing Point (near Cape Krusenstern) to hunt bearded seals. In the days before outboard motors, hunters would use kayaks to go between floes and in the cracks in the ice to pursue bearded seals.

The ice edge off Cape Krusenstern is a good place to hunt bearded seals, though the seals move around. Many may be seen one day, and none the next day, in the same spot. The waters about 10 miles west of Cape Blossom are also rich with seals, but this is farther from shore and more dangerous to travel to. The waters north of Cape Krusenstern are also good for hunting, at Kiliqmiak, just south of Rabbit Creek. There are many creeks and other places on either side of Cape Krusenstern where hunters can find refuge in case of bad weather. There are fewer places to find refuge in southern Kotzebue Sound.

It used to be that there were two or three weeks of good hunting conditions for bearded seals, as the ice broke up but before it was gone entirely. In spring 2015, there was only a week or less, because the ice disappeared very quickly after break-up. This is due in part to more east wind, blowing the ice out, and in part to thinner ice during the winter, making it easier to melt and move. The lack of ice also meant that waves could build up more in Kotzebue Sound, increasing the risk for hunters. Some ice remained towards Goodhope Bay, but it was dangerous to go that far in open water. Still, if hunters can find an ice floe, there are often bearded seals nearby, so the hunting can be good. With so little ice, the bearded seals have few options left, so are concentrated near the floes that remain. The risk of exposure to wind and waves is still higher for hunters with so little ice.

Bearded seals come in earlier than they used to, but often stay on thin ice where hunters cannot reach them. Thinner ice also makes it harder to hunt for bearded seals, as travel on top of the ice is more dangerous for hunters. Bearded seals can be hunted while they are swimming in open

water, but hunters prefer to get them on the ice since hauling them in and out of the boat is difficult. The adult bearded seals come in earlier because the ice breaks up earlier, but they do not stay as long because the ice goes away quickly, leaving only swimming seals.

Bearded seals need white ice (thicker ice), but there is more and more black ice (thinner, younger ice) in Kotzebue Sound these days, which produces fewer pressure ridges and thus less denning habitat. The ice is no longer suitable for camping during the spring hunt. The ice that is left moves very quickly in the currents and can break up quickly, making it dangerous for camping. Adult bearded seals in spring have thinner blubber than they did in the past, only an inch or an inch-and-a-half thick as opposed to three to four inches.

Yearling bearded seals (*ugruchiaq*) return in September, before the ice starts to form. Many of these seals spend time up rivers, including the Ugrugvik Lakes, just north of the mouth of the Kobuk River. A bearded seal was seen close to Ambler on the Kobuk River in September 2015. There are often bearded and ringed seals up the Kobuk, and seemed to be even more this past fall (2015), well over a dozen. Some bearded and ringed seals also go up the Noatak River. There were more yearling bearded seals last fall (2015) than ever before. They appeared very healthy.

One hunter has checked the stomachs of three bearded seals in his lifetime. All were full of shrimp. The seals will feed throughout Kotzebue Sound, but a prime feeding area is off the Chamisso Islands.

### ***Ringed Seals***

Some ringed seals will stay in Kotzebue Sound during summer, but most move away because they do not like to be around spotted seals. Ringed seals return in late summer. The juveniles come first, and the adults later in fall after the spotted seals have started to leave. Adult ringed seals will stay in Kotzebue Sound all winter. They make their dens in the pressure ridges. Large ridges used to form in the middle of Kotzebue Sound, but the ice today is thinner. Merging currents at Cape Blossom also created pressure ridges close to shore, but today this area is often open water even into winter, reducing denning habitat for ringed seals. In mid-winter, ringed seals are fat and healthy, at their most prime condition. They float very well at this time of year.

### ***Spotted Seals***

After the ice is gone in summer, spotted seals are the ones seen in the area until fall. They come to feed on the fish in Kotzebue Sound and in the rivers. Spotted seals are molting when they arrive. That is the time of year when everything is molting. Many spotted seals go up the Noatak River, to just below the hatchery, though they are generally in the lower part of the river. They also go into Hotham Inlet, Kobuk Lake, and Selawik Lake. They feed on fish in the freshwater areas.

After the ice floes start to form in fall, spotted seals will haul out in the hundreds and ride the ice to the southwest when the wind blows from the northeast. In fall 2015, thousands of spotted seals were seen in front of Kotzebue. Buckland hunters took many spotted seals in Eschschooltz Bay, including by the mouth of the Buckland River.

Spotted seals may be arriving a little later than they used to, and are staying a lot longer in fall.

### ***Walrus***

Walrus come into Kotzebue Sound in spring, and feed in the waters off the Chamisso Islands in southern Kotzebue Sound. They may have young there, too. They stay while there is still ice in the area.

In fall, one or two walrus may haul out on the beach to the east of Cape Krusenstern. There are never many that do this.

When there are walrus around, seals will not be seen. The seals stay away from walrus.

A walrus taken last summer had shrimp in its stomach.

### ***Beluga Whales***

Beluga whales will come into Kotzebue Sound when the ice starts to break up, coming in the cracks that form from Cape Espenberg and Cape Krusenstern.

There has been a huge change in beluga whales in Kotzebue Sound. It is not even clear that there is a Kotzebue Sound population any more. People used to get them every year. Sisualiq is named for beluga whales (*sisuaq*), and there used to be drive hunts there every summer. The drive hunt used to be well organized and coordinated, but now people tend to go for themselves rather than as a group. Belugas do not go into Eschscholtz Bay the way they used to, either. The few sightings in recent years have been around the mouth of the Noatak River, with a few in Eschscholtz Bay, and one juvenile beluga as far upriver as Selawik Lake. One beluga was seen in the shallows between Kotzebue and Sisualiq, in only a few feet of water, during the tomcod run in October, which is very late for a beluga to be seen near Kotzebue.

There is a lot of boat traffic these days, especially hunters from Kotzebue going after bearded seals towards Cape Krusenstern or putting in crab pots north of Kotzebue. The noise may deter belugas from coming into the Sound. Elders said the belugas came in because it was quiet. When air traffic increased at Kotzebue, the belugas started to decline. The noise of jet planes can be heard even at Sisualiq. The conflict between Buckland and Kotzebue hunters over hunting in Eschscholtz Bay (Elephant Point), which was the last place belugas were plentiful in Kotzebue Sound, may also have contributed to the decline. The custom is to let the first animals pass, but these days there are no animals to follow the first ones. Today, though, hunters may pursue the first animals. Hunters no longer coordinate the hunt the way they used to. Most beluga hunting today is with nets.

The ice entrapment of belugas in Russia in the mid-1980s seems the most likely explanation for their disappearance. There was a lot of harvest prior to that, but it seems hard to believe that overharvest is the explanation for the nearly complete disappearance of belugas from Kotzebue Sound.

The belugas that came into Kotzebue Sound in large numbers in one year in the 1990s were thinner than the belugas Kotzebue hunters are used to taking.



A group of belugas came to the Sadie Creek area a few years ago. Hunters think killer whales chased them in, because the belugas nearly beached themselves in the shallows.

One year, hunters found a king salmon in the stomach of a beluga whale. Two other belugas taken at the same time had only tomcod in their stomachs. A beluga taken in summer 2015 had a stomach full of crabs. Crabs are sometimes seen in beluga stomachs, but usually the stomachs are mostly full of fish.

### ***Killer whales***

There are more killer whales than there used to be in the Kotzebue Sound area. This is known from observations and also from the results of acoustic monitoring done by the Kotzebue IRA Council. When they follow belugas, the belugas will stay very close to shore and even go into very shallow water. Killer whales stay where the water is deep. One hunter saw a killer whale kill a large male beluga by holding it under water until it died. After that, the killer whales tore the beluga apart.

### ***Other Information***

Fewer ribbon seals are seen now than in the past. Hunters used to encounter them now and then, but hardly seem them now. People never ate them, but took the hides and fed the meat and blubber to dogs. One hunter saw many ribbon seals a few years ago, between Point Hope and Cape Lisburne.

A fur seal was once seen in Kotzebue Sound, many years ago.

The waters between Cape Espenberg and Cape Krusenstern are very dynamic, with open water and moving ice in winter and spring, and an abundance of marine mammals.

The southern end of Kotzebue Sound, including Eschscholtz Bay, has tides of about four feet. Boats hauled up at Cape Espenberg can be left high and dry at low tide if hunters are not paying attention. The northern end, including Kotzebue, does not.

The water level in northern Kotzebue Sound, Hotham Inlet, Kobuk Lake, and Selawik Lake is controlled by wind. North and east winds cause the water level to drop; west and south winds cause it to rise, with the highest water coming from south winds. Fish movements are determined by the currents caused by the wind. There used to be little south wind in summer, but September would bring south winds, causing the water to rise. The prevailing wind in winter is from the east, lowering the water and preventing flooding. Today, there is more flooding due to changing wind patterns.

An east wind opens the ice to the west of a line between Cape Espenberg and Cape Krusenstern. In the old days, hunters would travel to the ice edge by dog team when there was an east wind so they could hunt seals there. They would wait for the wind to calm down, so that the risk of being blown out to sea was less, and then have a day or two of seal hunting before the open water froze over again. Today, east winds may open the ice may well within Kotzebue Sound. While new ice may form on the open water, the ice still remains thin and does not have time to become thick. It seems that the east winds are stronger than they used to be.

In those days, the ice in Kotzebue Sound was five to six feet thick, and there was no moving ice inside of the Espenberg-Krusenstern line. There were more pressure ridges in Kotzebue Sound, including very large ones in the middle of the sound. Seals make their lairs in the pressure ridges, where the ice and snow provide good habitat. Today, the ice is thinner and flatter, though there are still some smaller pressure ridges, closer to shore, so there is still denning habitat for seals. The thinner ice is more dangerous for traveling, as it can open up or form cracks well into Kotzebue Sound. No longer can hunters travel straight from Kotzebue to Cape Espenberg—the ice is too unreliable. There is much less shorefast ice, since there are not large pressure ridges to hold the ice in place. There are fewer strong west winds to push the ice into Kotzebue Sound and build up those pressure ridges, and the ice is thinner. Hunters used to be able to camp on the ice past Cape Krusenstern, but today the ice is not reliable.

While ice and weather conditions have always varied from year to year, the changes have really taken effect over the past fifteen years or so. In the 1980s, there was still ice for hunting bearded seals into July, but now the ice is gone in June.

When the ice goes out in spring, Kotzebue Sound opens up a week or two after Kobuk and Selawik Lakes. The elders have always said it is dangerous to go out while there is still ice in Kobuk Lake and Hotham Inlet. In some years, the ice goes out quickly, and in other years it goes back and forth in Kotzebue Sound for some weeks.

A strong current carries spring pack ice from Cape Espenberg northwards towards Cape Krusenstern. A current along the coast from Shishmaref merges with a current coming from Goodhope Bay and southern Kotzebue Sound to produce a stronger current going north. This current does not go into northern Kotzebue Sound, but goes north past Cape Krusenstern.

There used to be more snow, on the ice and in town.

The weather used to be easier to predict. Now it is hard to read. Clouds forming on the tops of mountains are a good indicator that winds are coming, as are the ways high clouds form or disappear in the sky.

Hunters use satellite imagery of sea ice to plan boat travel in Kotzebue Sound, to help improve safety and efficiency as they will know where to find ice for hunting bearded seals.

### ***Concerns***

Continued climate change, and subsequent changes, like more commercial shipping, remain a concern. If the ship traffic starts to occur when marine mammals are migrating, it could be a major conflict or impact. The Arctic Waterways Safety Committee is a good forum for discussing shipping. Having a shipping lane from Bering Strait to Canada would be a good way to reduce impacts and risks to hunters.

The reports of dying murrelets and poor salmon returns from around the state raise concern about how much the ocean is changing and what that is likely to mean for people in Kotzebue, even if seals in Kotzebue Sound appear to be doing well so far.

### **Acknowledgements**

We are grateful for the skill, expertise, and generosity of the six hunters who participated in the interviews. We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to John Goodwin and Alex Whiting for helping to set up the interviews and to the Kotzebue IRA Council for providing space for interviews. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract Nos. M09PC00027 and M13PC00015 and we appreciate the support of Charles Monnett, Catherine Coon, Dan Holiday, and Carol Fairfield. Justin Crawford prepared the maps used during the interviews and the figure in this report.

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## **Update of hunter-assisted seal tagging and traditional knowledge studies of Pacific Arctic seals, 2016 and beyond.**

Justin A. Crawford<sup>1\*</sup>, Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, Andrew L. Von Duyke<sup>2</sup>, Merlin Henry<sup>3</sup>, Alexander Niksik<sup>4</sup>, Albert Simon<sup>5</sup>, John Goodwin<sup>6</sup>, Alex Whiting<sup>7</sup>, Kathy Frost<sup>8</sup>, Josh London<sup>9</sup>, and Peter Boveng<sup>9</sup>

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<sup>2</sup> North Slope Borough, Department of Wildlife Management, Barrow, AK;

<sup>3</sup> Seal hunter and resident of Koyuk, AK;

<sup>4</sup> Seal hunter and resident of St. Michael, AK;

<sup>5</sup> Seal hunter and resident of Hooper Bay, AK;

<sup>6</sup> Seal hunter and resident of Kotzebue, AK and Ice Seal Committee Chairman;

<sup>7</sup> Native Village of Kotzebue, AK;

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*Alaska Marine Science Symposium, 23–27 January 2017, Anchorage AK*

Ringed (*Pusa hispida*), bearded (*Erignathus barbatus*), and spotted (*Phoca largha*) seals use sea ice for pupping, nursing, molting, and resting. Decreases in the extent of sea ice and lengthening of the open water season have eased access to the Arctic, expediting the need to plan development activities to minimize effects on seals. Our understanding of seal habitats, behavior, and timing of movements by all species, age, and sex classes, however, is limited. We expanded upon a cooperative satellite telemetry study of Pacific Arctic seals with hunter-taggers and biologists in Kotzebue Sound, first through a National Marine Fisheries Service (NMFS) funded project, and currently through the merger of two studies, funded separately by the Bureau of Ocean Energy Management and Office of Naval Research, further fostering collaborations among the Alaska Department of Fish and Game, North Slope Borough, NMFS, Ice Seal Committee, and subsistence seal hunters. We worked with hunter-taggers from five villages along the Bering, Chukchi, and Beaufort seas to deploy transmitters on seals to study habitat use, timing of movements, seasonal site fidelity, and association and use of sea ice and oceanographic features. By tagging seals in multiple locations and seasons, we minimize the biases from deploying all of the tags at the same location during the same season. In 2016, four bearded and one ringed seal tagged in 2014 and 2015 wintered in the Bering Sea and Norton Sound. Seven bearded, three ringed, and seven spotted seals were tagged near Barrow, Koyuk, and St. Michael. Seals tracked during 2016 ranged in all three Arctic seas from Bristol Bay in the Bering Sea, to the north and west (near Wrangel Island, Russia) in the Chukchi Sea, and east to Kaktovik, Alaska in the Beaufort Sea. Local and traditional knowledge enhances our understanding of how seals and hunters may respond to changing sea ice conditions. Reports generated from interviews of subsistence users in Barrow, Elim, St. Michael, Stebbins, Kivalina, Kotzebue, Shishmaref, Pt. Lay, and Wainwright were summarized in a publication in 2016. Future plans include training more hunter-taggers and tagging additional seals from coastal villages.

# Update of hunter-assisted seal tagging and traditional knowledge studies of Pacific Arctic seals, 2016 and beyond

Appendix K.



Justin A. Crawford<sup>1</sup>, Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, Andrew L. Von Duyke<sup>2</sup>, Merlin Henry<sup>3</sup>, Alexander Niksik<sup>4</sup>, Albert Simon<sup>5</sup>, John Goodwin<sup>6</sup>, Alex Whiting<sup>7</sup>, Kathy Frost<sup>8</sup>, Josh London<sup>9</sup>, and Peter Boveng<sup>9</sup>

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<sup>4</sup>Seal hunter and resident of St. Michael, AK, <sup>5</sup>Seal hunter and resident of Hooper Bay, AK,

<sup>6</sup>Seal hunter and resident of Kotzebue, AK and Ice Seal Committee Chairman, <sup>7</sup>Native Village of Kotzebue, AK

<sup>8</sup>School of Fish and Ocean Science, UAF, Fairbanks, AK, <sup>9</sup>Polar Ecosystems Program, Alaska Fisheries Science Center, MML-NOAA, Seattle, WA



## INTRODUCTION

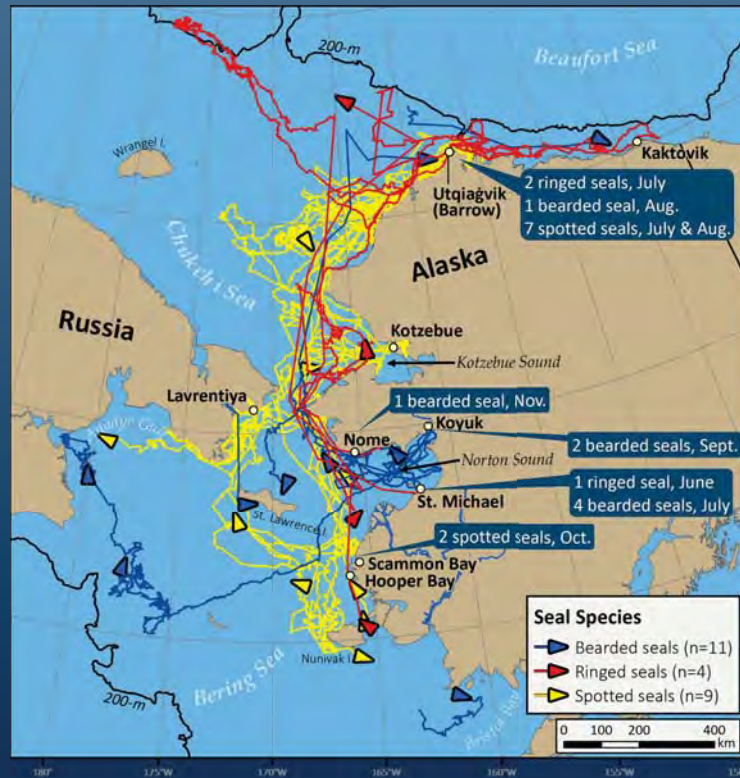
Ringed (*Pusa hispida*), bearded (*Erignathus barbatus*), and spotted (*Phoca largha*) seals are called “ice seals” because they use sea ice for pupping, nursing, molting, and resting. In Alaska, these seals are located in the Bering, Chukchi, and Beaufort seas. They are important subsistence species used by Alaska Natives for food, oil, clothing, and handicrafts. Decreases in the extent of sea ice and lengthening of the open water season have eased industrial access to the Arctic, expediting the need to develop mitigation measures to minimize anthropogenic effects on seals, but our understanding of how changes in sea ice will affect ice seals and their habitat is not clear.

Cooperative satellite telemetry studies among hunters and biologists are increasing our understanding of important habitats, seasonal movements, use of sea ice including haul-out behavior, and seasonal site fidelity. This project expands on past studies by tagging seals at several widely-spaced locations through two studies, funded separately by the Bureau of Ocean Energy Management (BOEM) and Office of Naval Research (ONR), and further fostering collaborations among the Alaska Department of Fish and Game (ADFG), North Slope Borough Department of Wildlife Management (NSB), Marine Mammal Laboratory-NOAA (MML), Ice Seal Committee, and subsistence seal hunters. Traditional knowledge is incorporated into our findings to further explain seal movements in response to changing sea ice.

## OBJECTIVES

Work with seal hunters to:

- Capture and tag ringed, bearded, and spotted seals.
- Document seal habitat use and movements:
  - **BOEM Study:** document seal movements and foraging using:
    - **SPLASH tags:** collect location and dive data (Wildlife Computers, USA).
    - **SPOT tags:** collect location and haul-out data (Wildlife Computers, USA).
  - **ONR Study:** document seal movements and ocean conditions using:
    - **CTD tags:** collect location, dive, and water conductivity, temperature, and depth data (Sea Mammal Research Unit, Scotland).
- When possible, we tagged each seal with either a SPLASH or CTD tag epoxied to their back or head and a SPOT tag attached to their flipper.
- Gather and document local and traditional knowledge.



**Figure 2.** Movements of 4 ringed, 11 bearded, and 9 spotted seals during 2016. Seals were tagged with satellite-linked transmitters during 2014, 2015, and 2016 in Kotzebue Sound and near Hooper Bay, Scammon Bay, St. Michael, Koyuk, Nome, and Utqiagvik (Barrow). Balloons contain number of seals tagged by species and month in 2016.

**Table 1.** Number of ringed, bearded, and spotted seals tagged with SPLASH, CTD, and SPOT tags in 2016. As part of a collaborative effort to deploy tags, multiple agencies provided seal tags. The agency that provided the tag or the funding for the tag is listed in parenthesis and includes: BOEM, ONR, NSB, and MML.

Seal species	SPLASH (BOEM)	CTD (ONR)	SPOT (BOEM)	SPOT (NSB)	SPOT (MML)	No. tagged individuals
Ringed		2	1	2		3
Bearded	2	3	8			8
Spotted		9		2	3	9
<b>Total</b>	<b>2</b>	<b>14</b>	<b>9</b>	<b>4</b>	<b>3</b>	<b>20</b>



**Figure 1.** Attaching satellite-linked transmitters to captured bearded seals: a) Palsson Fitka, resident of St. Michael, on the St. Michael Canal, July 2016 and, b) Merlin Henry, resident of Koyuk, and Mark Nelson (ADFG), on the Inglutalik River, September 2016.

## ACTIVITIES IN 2016

- We deployed satellite-linked transmitters on **20 seals (3 ringed, 8 bearded, and 9 spotted seals)** (Table 1).
- We **tracked the movements of 24 seals**, including 3 bearded seals tagged in 2015 and 1 ringed seal tagged in 2014 (Fig. 2).
  - Maps of seal movements were distributed weekly and displayed on the following webpages:



ADFG



NSB



ANIMAL TELEMETRY NETWORK

- **Traditional knowledge interviews were conducted** in Shishmaref, Kivalina, and Kotzebue in January and finalized in separate reports in June.
- Traditional knowledge collected under several BOEM projects (bowhead, walrus, and seal) was published in August (Huntington *et al.* 2016).

## FUTURE WORK

- Continue to work with trained hunter-taggers and with new hunters and communities to tag seals.
- Conduct interviews to document local and traditional knowledge to better understand seal movements in response to changing sea ice.
- Continue to combine location data with traditional knowledge to better understand seal movements and habitat use in a changing environment.

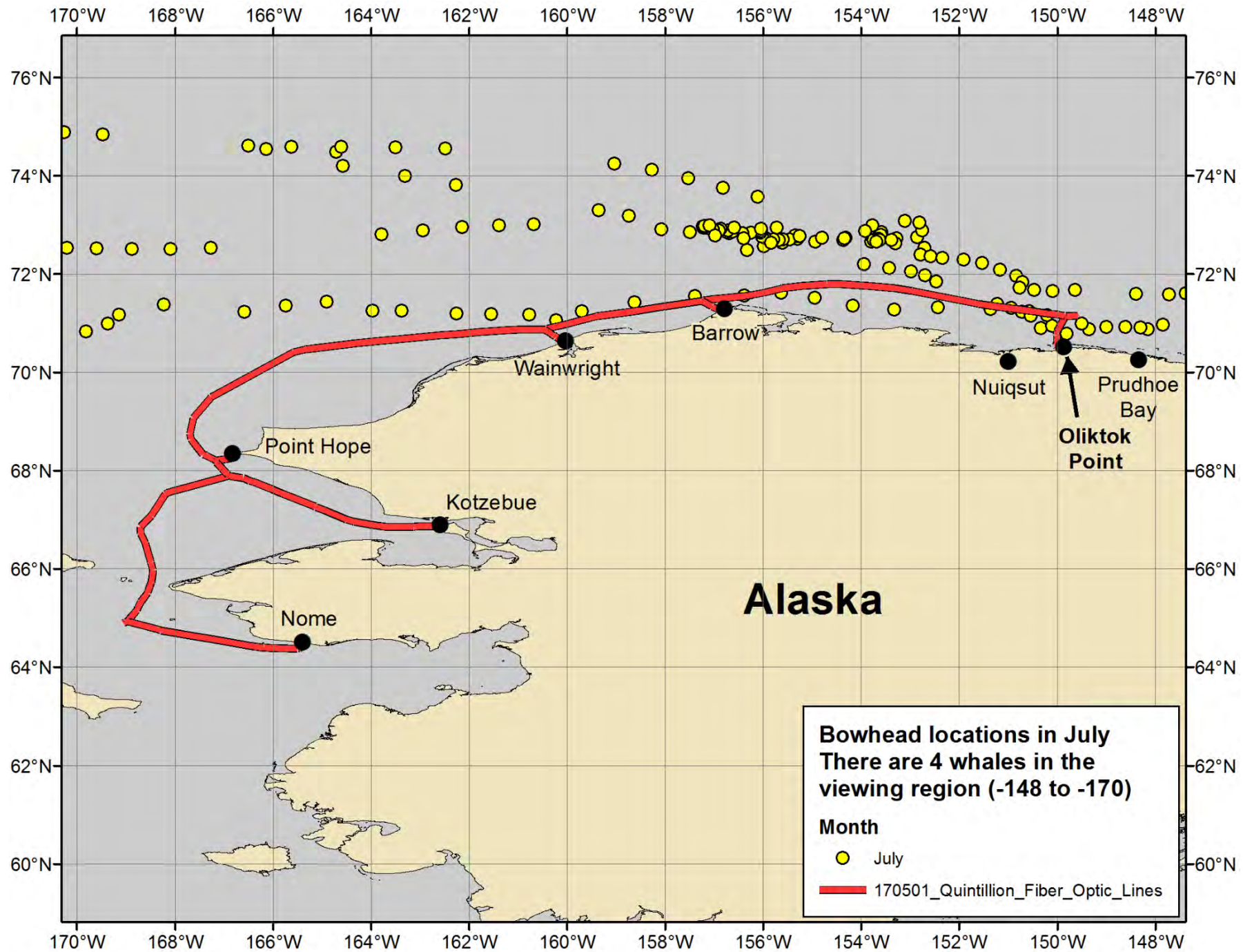
## ACKNOWLEDGEMENTS

Our projects are funded by BOEM and ONR, NSB support came from the Collaborative Alaskan Arctic Studies Program (formerly the Shell Baseline Studies Program). We appreciate the assistance of all the hunter-tagger crews; Albert Simon II, Palsson Fitka, Stephan Horn Jr., Tom Gray, Morgan Simon, Wybon Rivers, Denali Whiting, Edward Ahyakak, Edwin Kotangan Jr., Frank Garfield, Gordon Eakon, Henry “Boyuk” Goodwin, Allen Stone, and Pearl Goodwin. We also thank Anna Bryan, Aaron Morris, Joe Skin, and Isaac Leavitt for tagging assistance. Research on ice seals was conducted under permit #15324 issued to ADFG by the National Marine Fisheries Service and under an approved ADFG Animal Care and Use Committee Protocol #2014-03, 2015-25, and 2016-23.

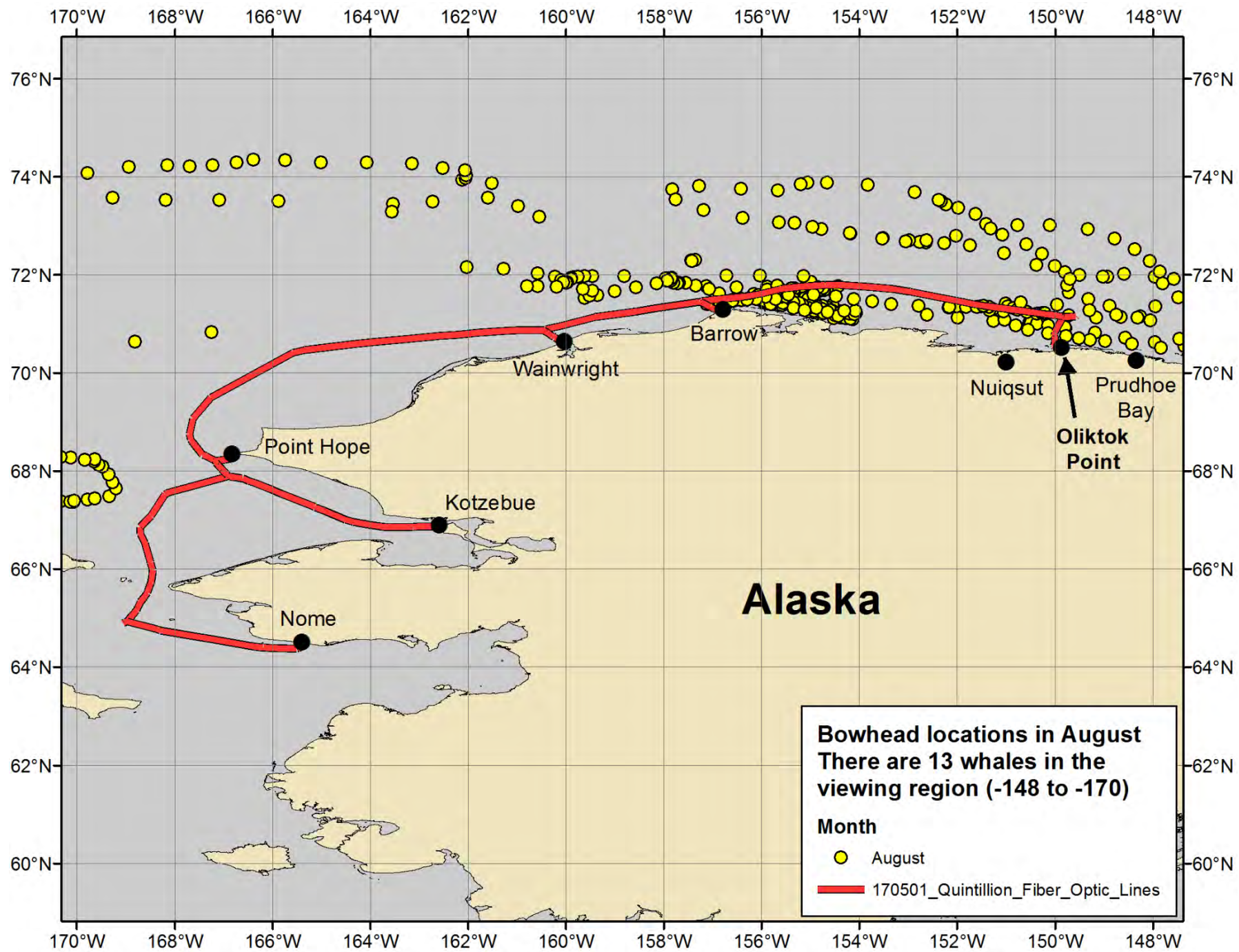
## LITERATURE

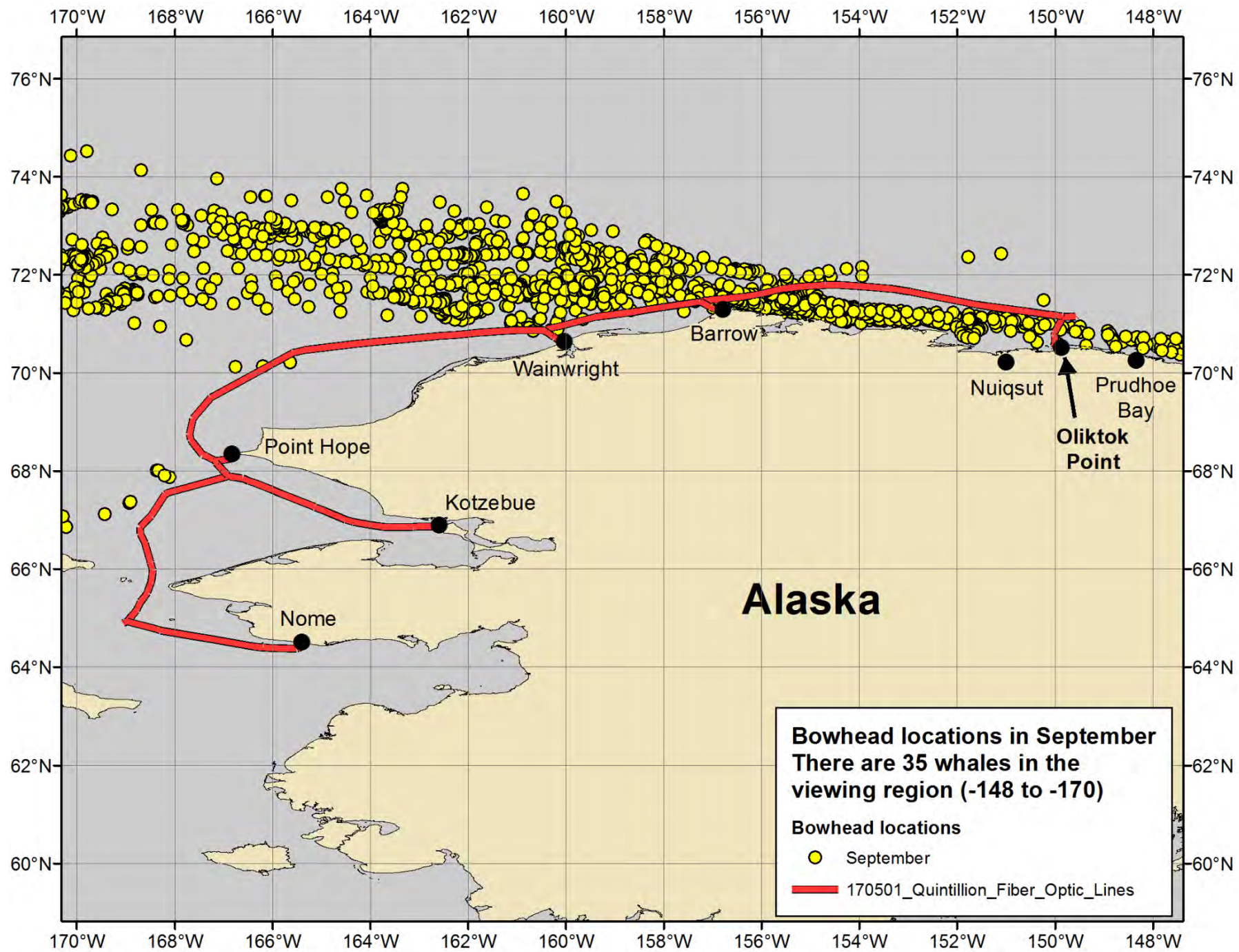
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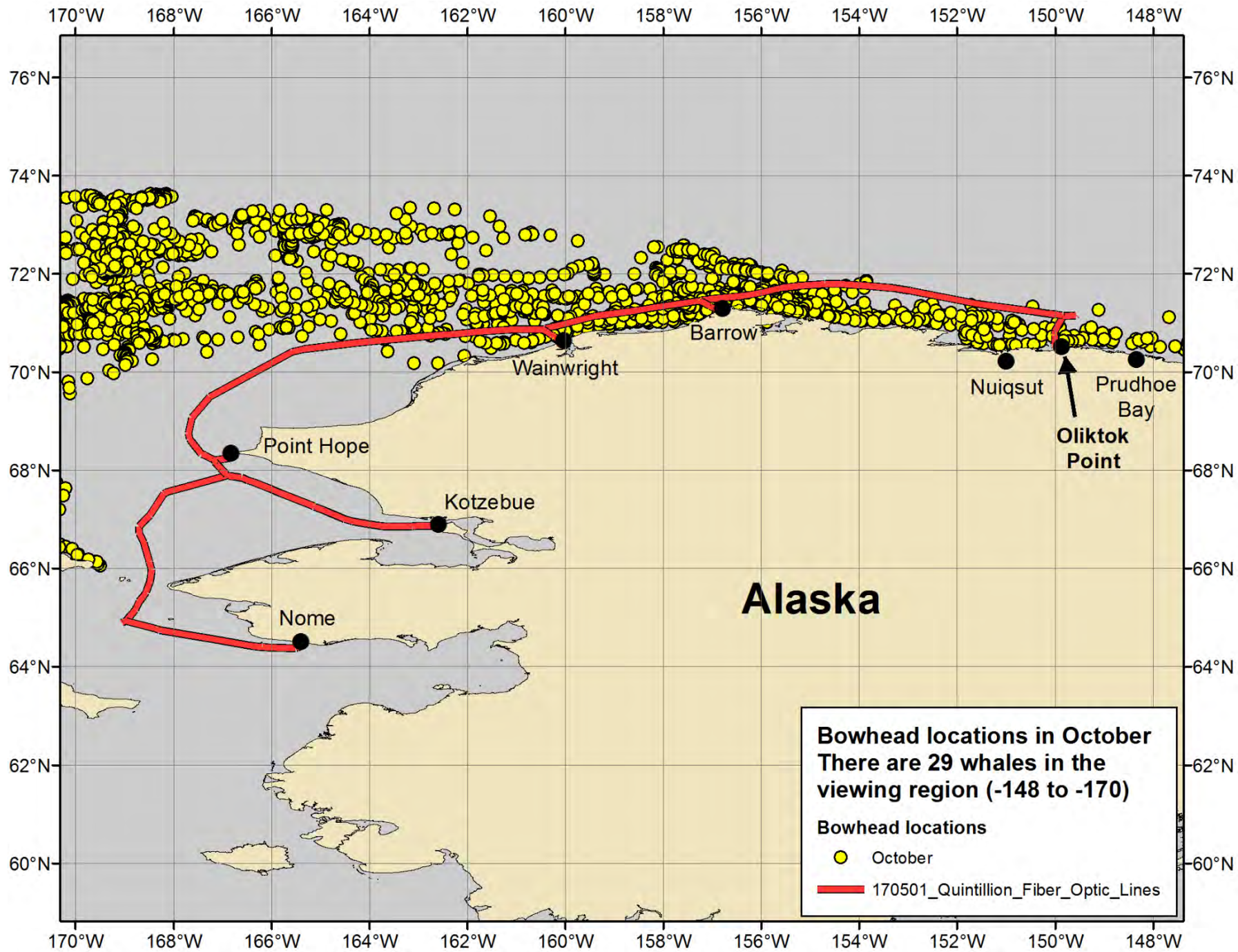


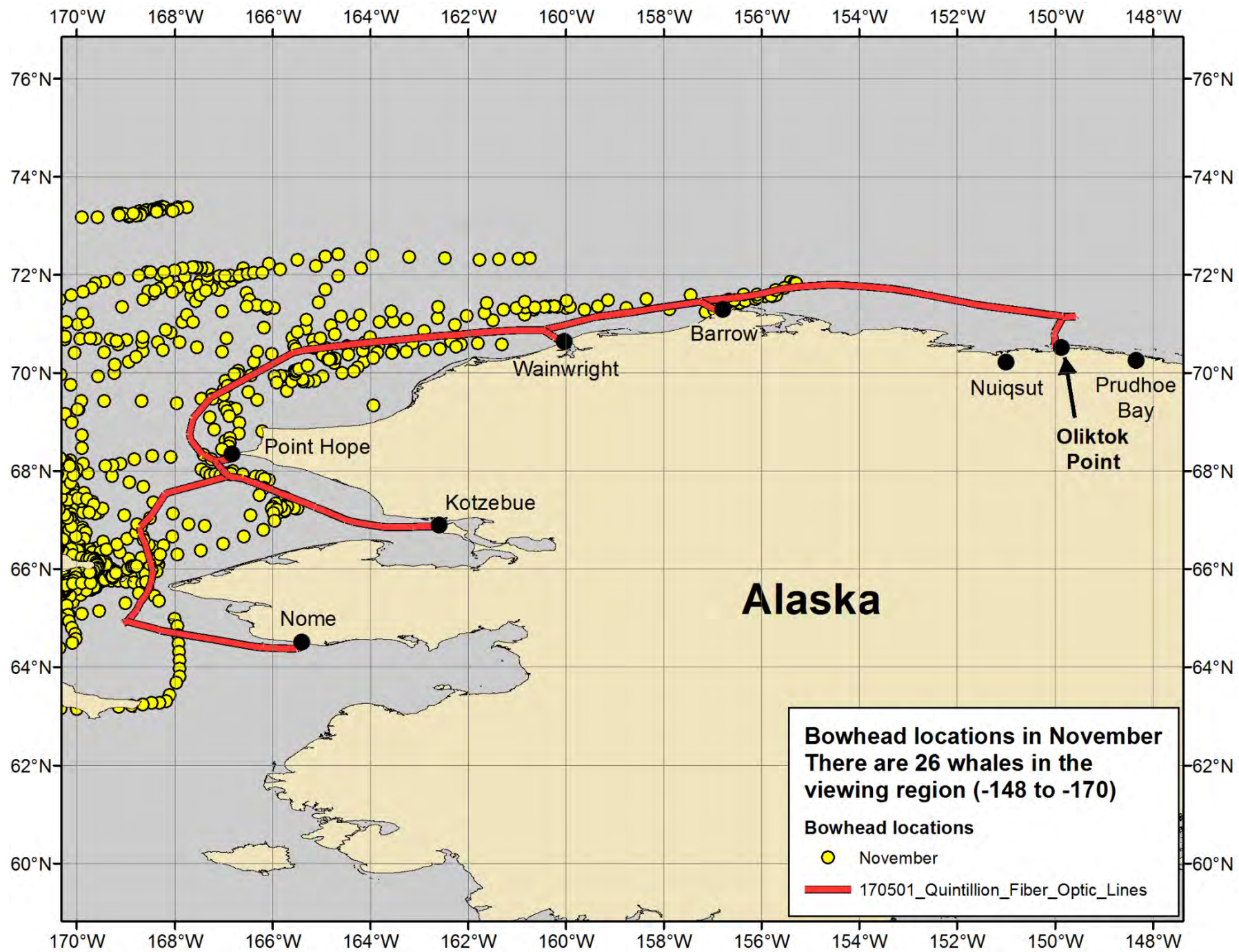




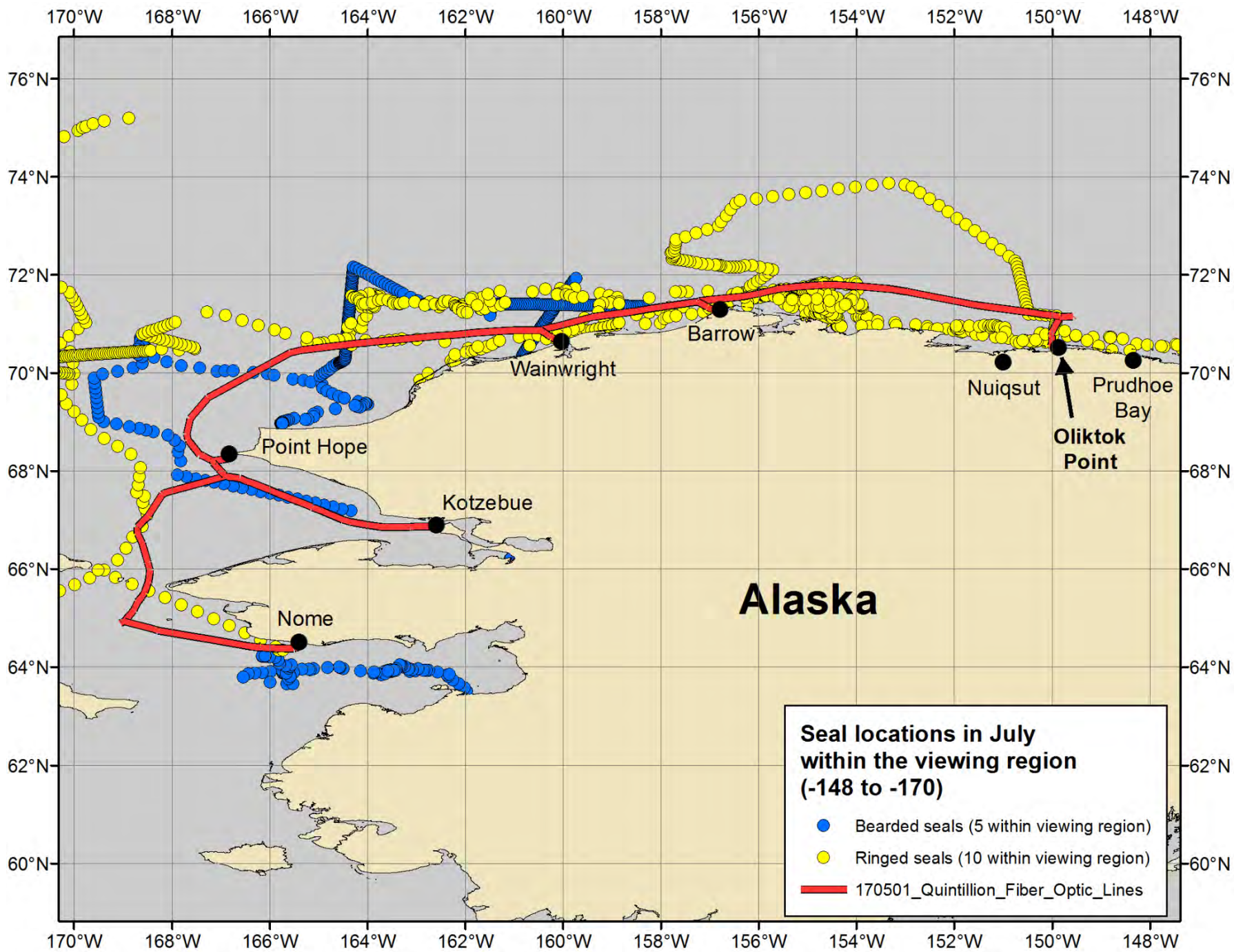


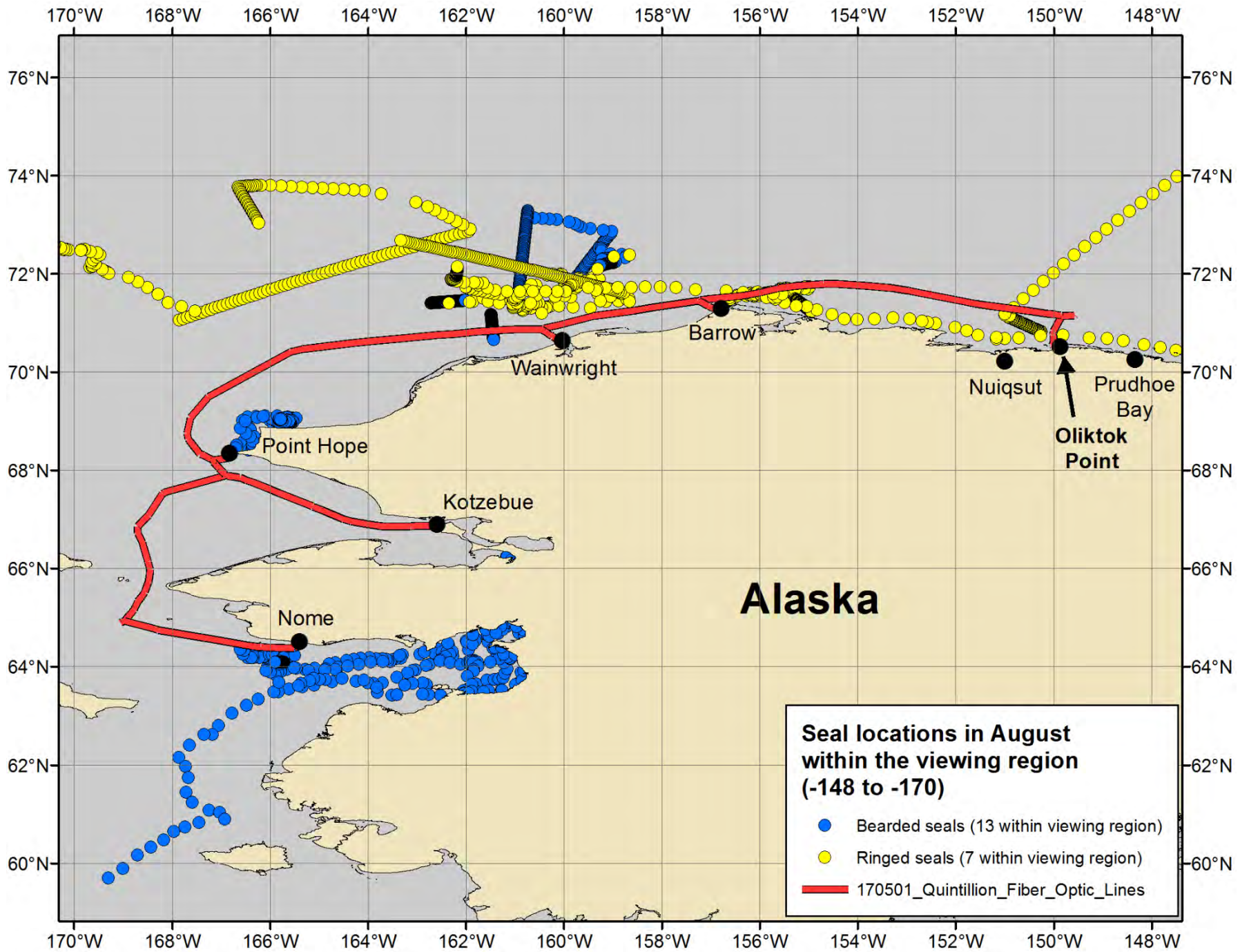




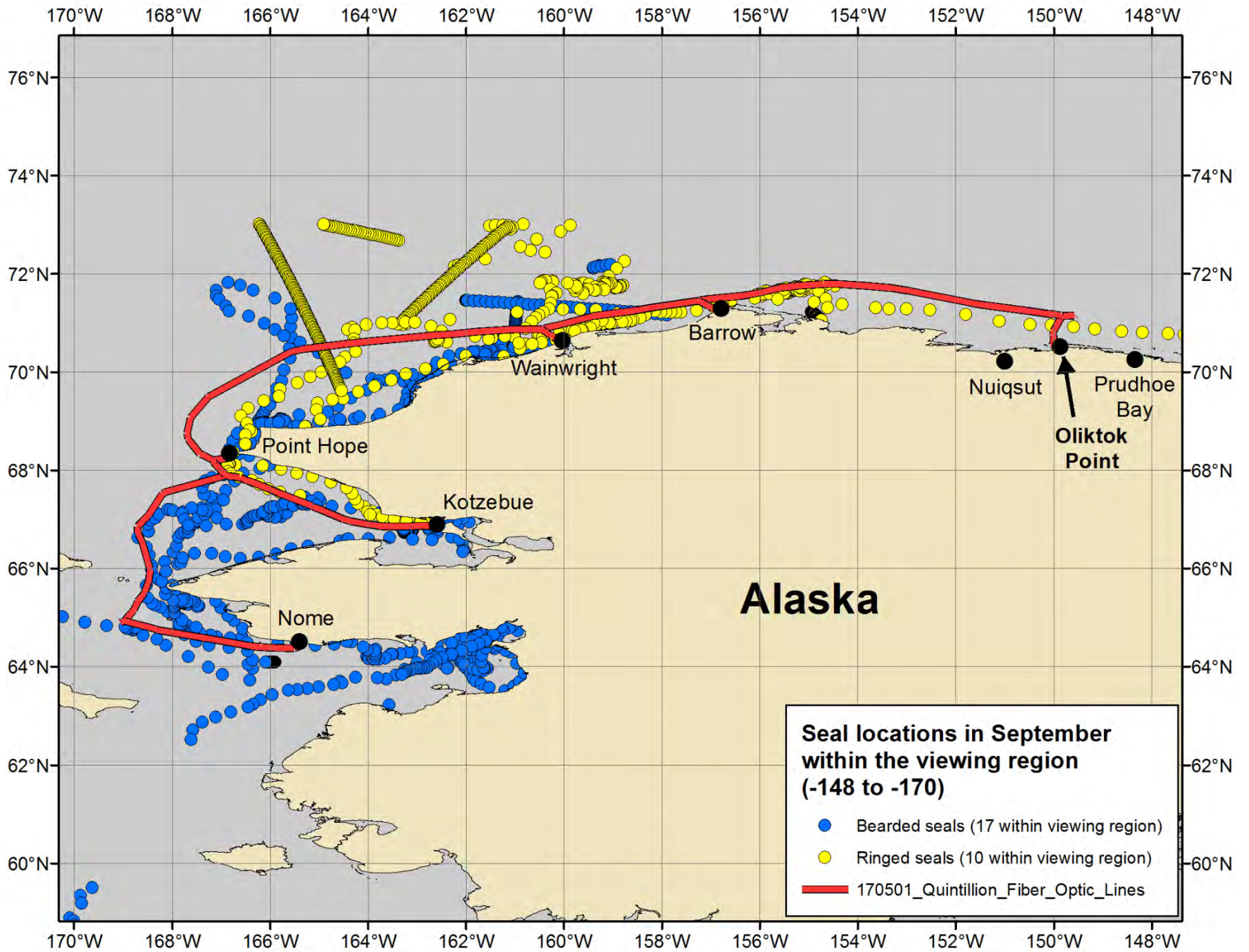


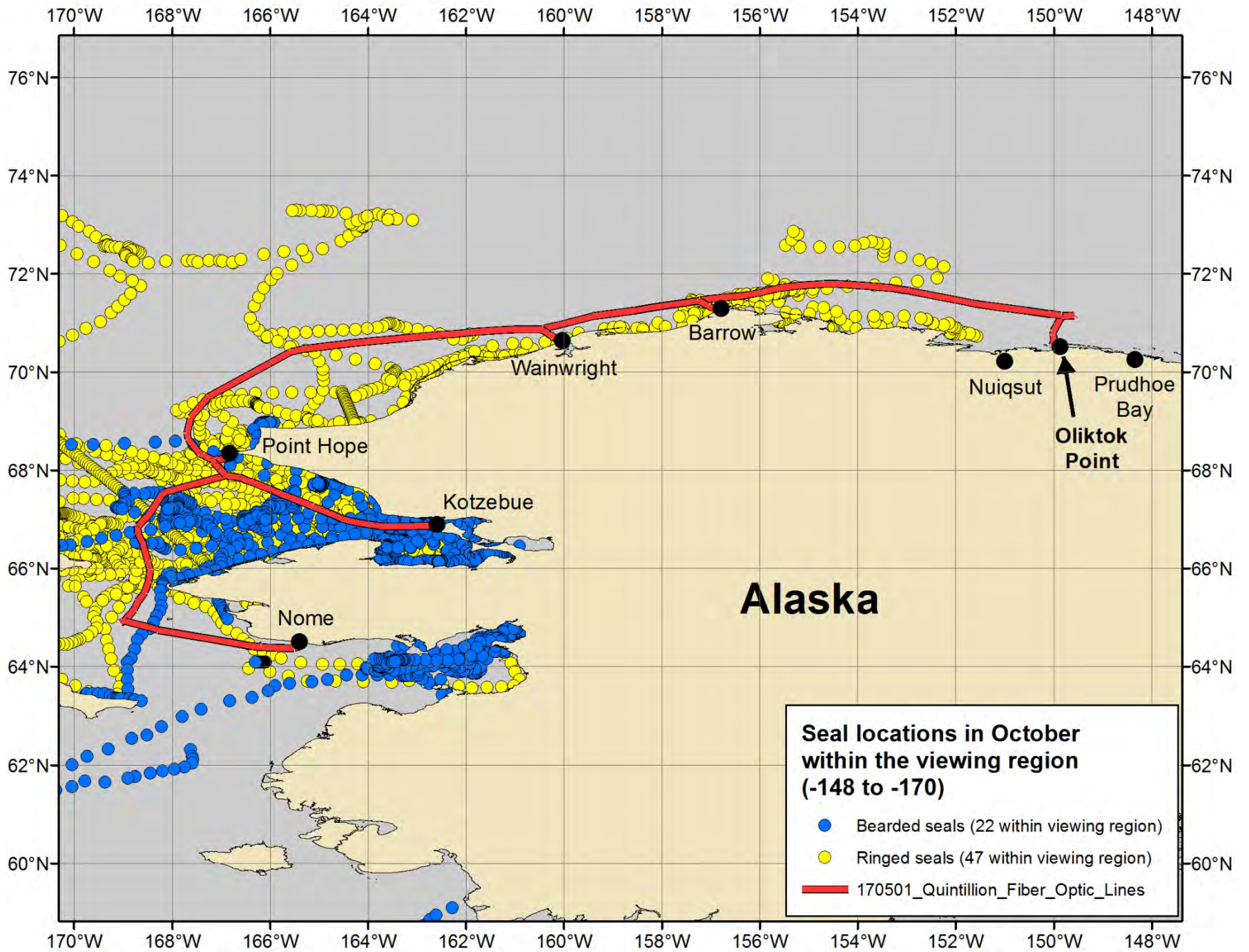




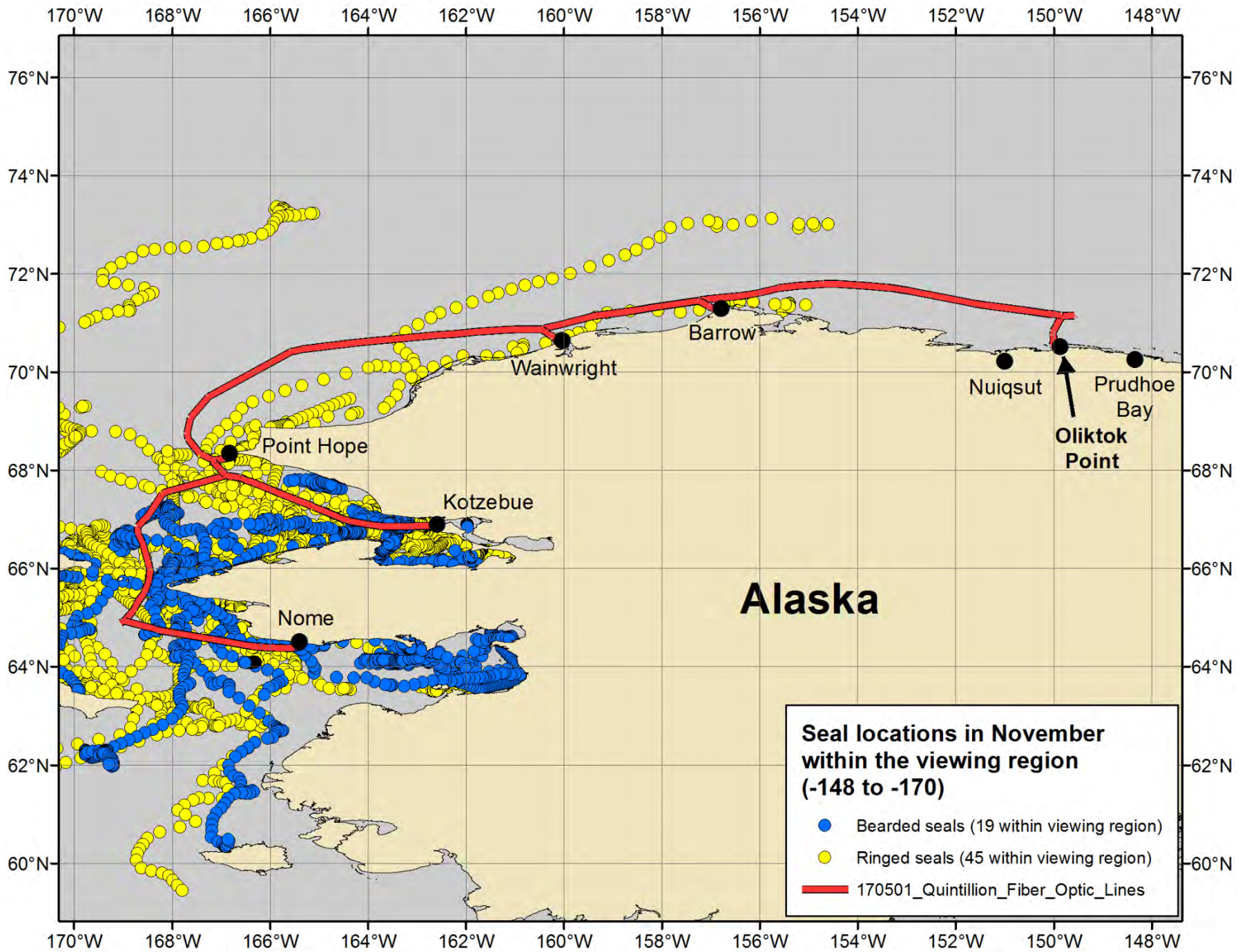




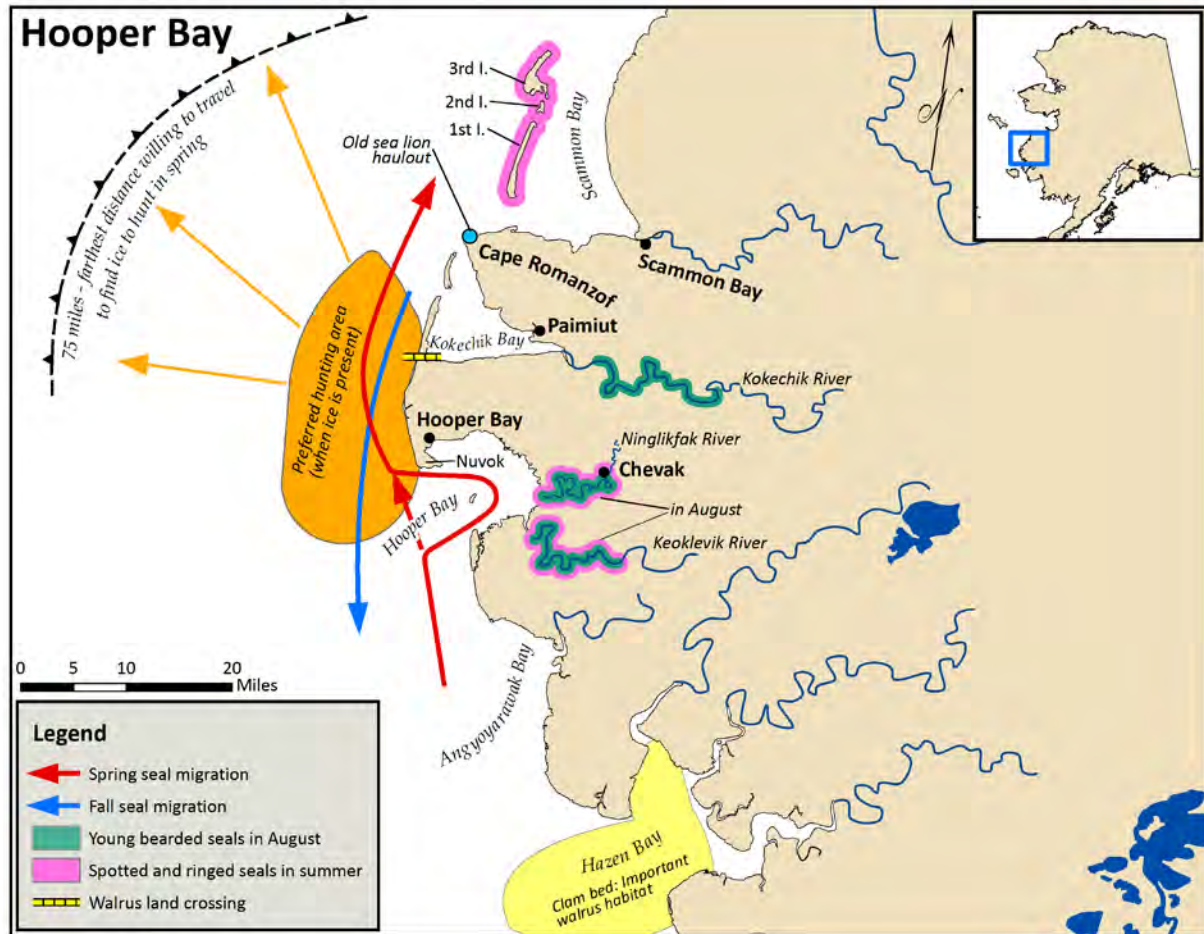








# Traditional Knowledge Regarding Marine Mammals near Hooper Bay, Alaska



# **Traditional Knowledge Regarding Marine Mammals near Hooper Bay, Alaska**

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Final Report  
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## Introduction

Seals, walrus, and beluga whales are important for subsistence harvests by Yup'ik hunters from Hooper Bay, Alaska. These animals are also iconic Arctic marine mammals at risk from climate change. Industrial activity in the Bering and Chukchi seas, coastal development in the Norton Sound region, and shipping through Bering Strait are additional potential stressors to these marine mammals. The study of the distribution, behavior, and movements of marine mammals is an important contribution to monitoring the effects of a changing environment and the potential effects of industrial activity. Placing satellite transmitters on seals, walrus, beluga whales, and other species provides detailed information about the movements, habitat use, and behavior of some individual animals. Satellite telemetry studies, however are limited in the number of individuals per species that can be instrumented, therefore it is difficult to know how well tagged animal movements and behavior represent the population as a whole. Documenting traditional knowledge about timing of migration, behavior, and the age classes of marine mammals at specific locations through interviews with residents of coastal communities provides important context in which to interpret the satellite telemetry studies as well as providing contemporaneous and historical information about general patterns in marine mammal distribution, movement, and behavior that complement the science greatly. The integration of these two different but equally important types of information provides a broader more comprehensive overview of how Arctic marine mammals and hunters operate in their environment and how changes in the environment are influential.

This report summarizes information gathered from interviews held in Hooper Bay with hunters and other knowledgeable residents in January 2017. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## Methods

We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting that person's knowledge, associations made between animals and the environment, and so on. The interviewers use a list of topics of interest to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.








In Hooper Bay, we interviewed 11 persons, five individually and six in one group. The interviewees were Albert Simon, Albert Simon II, John Lake, and eight others who wished to remain anonymous. The interviews were conducted on January 9, 2017 in the homes of interviewees and at the Sea Lion corporation apartments.



The topics of interest identified by the research team in advance of the interviews were:

- Seasonal patterns of distribution of ice seals, walruses, and beluga whales
- Haulouts on land
- Use of rivers
- Feeding patterns and prey
- Impacts from climate change and hunter responses to those changes
- Parts of marine mammals that people eat
- Information about other marine mammals
- Information about other aspects of the environment and people

Table 1. List of Yup'ik, English, and scientific names of marine mammals mentioned in this report.

	<b>Yup'ik name</b>	<b>English name</b>	<b>Scientific name</b>
	Maklak	bearded seal	<i>Erignathus barbatus</i>
	Maklagaq	young bearded seal	<i>Erignathus barbatus</i>
	Issuriq	spotted seal	<i>Phoca largha</i>
	Nayiq	ringed seal	<i>Phoca</i> or <i>Pusa hispida</i>
	Qaygulek	ribbon seal	<i>Histriophoca fasciata</i>
	Kaugpak	Pacific walrus	<i>Odobenus rosmarus</i>
	Uinaq	Steller sea lion	<i>Eumetopias jubatus</i>
	Cituaq	beluga whale	<i>Delphinapterus leucas</i>

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

## Ringed Seals

Ringed seals are found in the Hooper Bay area from fall to spring when sea ice is present. They are abundant in the area during this period. Today there seems to be fewer ringed seals in the Hooper Bay area, perhaps because of the changes in ice conditions, drawing the seals to the ice edge farther away. A few individuals may be found in the area in summer, sometimes these are young ringed seals in rivers, but the majority head north with the ice. Occasionally a ringed seal pup will be seen on the beach in summer. Ringed seals return when there is ice, the timing of which depends on the weather but may be in December or January. Even with changes in sea ice, seals of all kinds remain abundant. The coast is their highway.

One hunter once found a seal lying on an ice floe on its back, with its stomach open, perhaps killed by a polar bear.

Ringed seals eat herring in May. Their faces may be covered with herring eggs. Ringed and spotted seals seem to have similar diets.

Mostly it is hard to tell what ringed seals are doing just by watching them on the surface. They just pop up out of nowhere, with little indication of where they have been or what they have been doing.

Ringed seal skins can be blown up like a balloon and dried. They are used for the upper parts of mukluks (boots). There are several styles of mukluks, including ones for casual wear around the village, knee-high ones for going on the tundra, and thigh-high ones for cold weather. Ringed seal skins can also be used to make pokes, for storing fish and other foods. To store fish, the fish are put into the poke, and then seal oil is added to preserve the fish. After the fish are eaten and the oil is drained out, the skin can then be used to make watertight hip boots. Ringed seal skin is also used as rope, for lashing bearded seal skin boat covers to the boat frame, or making sleds or harpoons.

Seal meat can be dried on a rack outside and eaten like jerky. It is good when dipped in seal oil. Seal oil is also good to eat with vegetables gathered from the tundra in spring. The head, flippers, and tail of seals can be aged and eaten.

Male seals during the rut smell like gasoline. Their blubber can be used, but not the meat.

Sick seals have been seen occasionally, but most seals are healthy. Sick seals have boils on their skin and black fur. This is a relatively new phenomenon, seen in the past dozen or so years among ringed and spotted seals. One diseased seal, with pustules along its lungs and heart, was cut open and left on the beach, but even ravens and gulls would not eat it. Sometimes seals are seen with hair rubbed off, but this is thought to be caused by them hauling out and resting on ice.

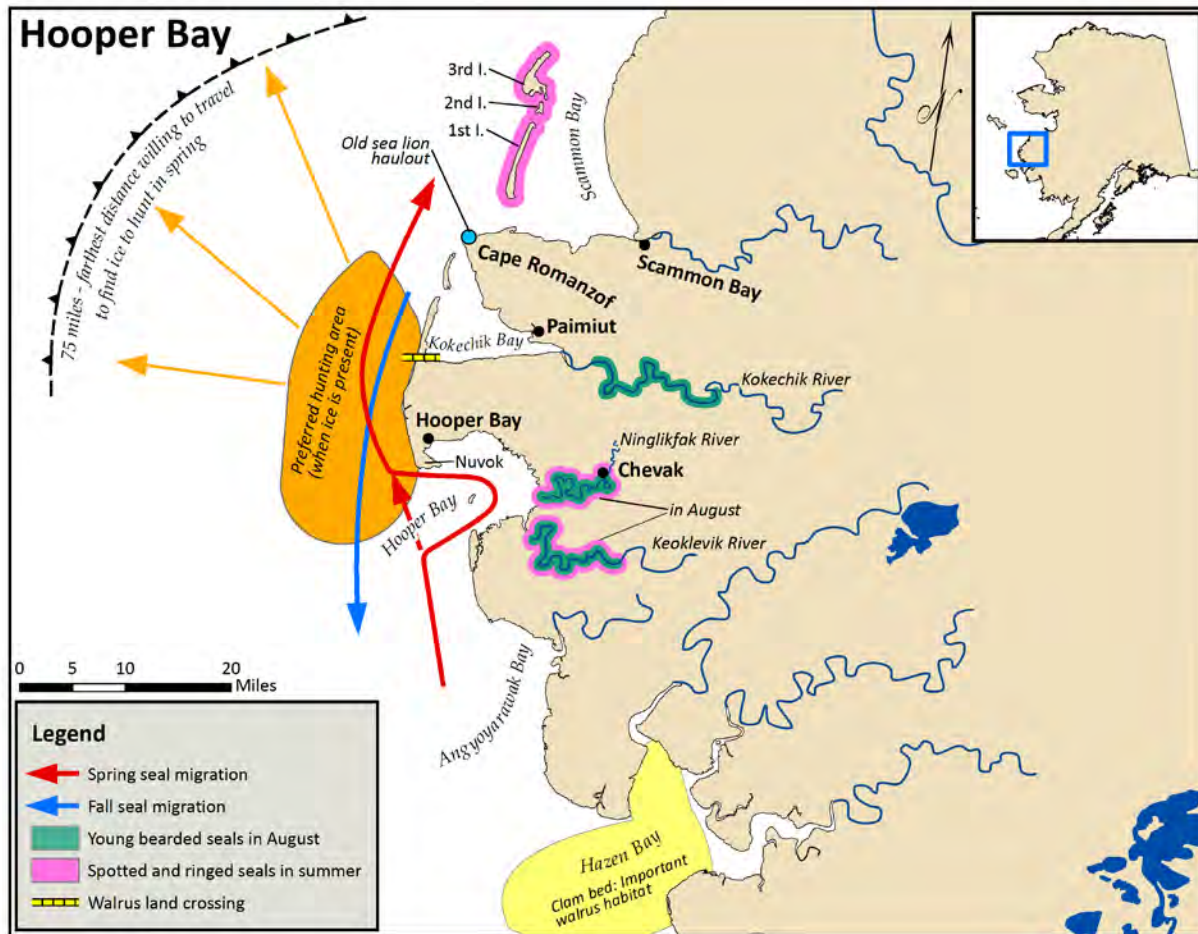


Figure 1. Movements and behavior of seals, walrus, and whales as described during traditional knowledge interviews, January 2017.

### Spotted Seals

Spotted seals used to arrive in abundance in April following the beach, going after fish, probably tomcod (i.e., saffron cod) on their way north, but now they are found all winter long, whenever there is open water. . Most spotted seals head north by early to mid-May, with the sea ice, but some stay into June, often in rivers. There are many spotted seals on the three islands off Scammon Bay in summer, so many that they can be smelled from a distance. In fall, most spotted seals in the Hooper Bay area are subadults.

Spotted seals eat tomcod and smelt in late winter and early spring. There are lots of seals when there are lots of fish. In May, they eat herring and their faces can be covered with herring eggs. Spotted seal stomachs can also have clams in them. Feeding seals stay in one area, whereas migrating seals are heading in the direction of migration. The surfacing behavior is the same, however. Winter spotted seals are tasty, but spring spotted seals have a strong smell and flavor. Spotted seal skins are used for making hats and gloves.



### Bearded Seals

Bearded seals typically arrive in large numbers in late March, remaining abundant through April and into May, as long as there is ice. In recent years, they have been arriving earlier, sometimes in February. Mothers with pups are slower when migrating. Some bearded seals may be found in the area all winter. Pregnant bearded seals have been taken in January. After the ice leaves, some juvenile bearded seals will stay in the area, going up rivers after fish such as whitefish, at times far up the rivers in late summer and are seen when people travel to pick berries (Figure 1). A few bearded seals stay in the area in summer, and are occasionally caught in salmon nets. In fall, most bearded seals in the Hooper Bay area are subadults or young of the year. One hunter took a pregnant bearded seal once in November.

Bearded seal stomachs have clams and shrimp and some small fish. In spring, bearded seal males will dive and call to the females. The calls can be heard by people on the surface of the water. Younger bearded seals are better than adults at hiding from hunters in broken ice, with only their nose out of water. Older seals are not afraid of hunters, don't hide as well, and are easier to find and hunt.

Bearded seal skins are used for the soles of mukluks (boots). These skins can also be used for kayak covers and skin boat covers. The skins are sewn together with sinew from beluga whales. Yellow moss is soaked in seal oil and used as caulk on the seams. A hole in a skin boat can be easily repaired at sea by using seal oil to join the skins back together. Bearded seal flippers, tail, and head can be aged in summer and eaten. Bearded seal intestines are rinsed, cooked, and eaten. The stomach can be dried out and inflated and used for storage, for seal oil or for berries and other things. The intestinal lining of bearded seals can be used to make raincoats or to make windows for old-style houses. People eat the kidneys, liver, heart, lungs, and other organs of bearded seals. These can be eaten raw or cooked. A bearded seal swimming in the sea is ready to eat as soon as it is harvested.

### Walrus

Walrus are typically seen in spring, often in Hazen Bay where clams are abundant (Figure 1). The clams can be seen by river mouths when the tide is out. Walrus can also be seen on thick sea ice when it is present in spring, but this is less common now than it used to be. When west or northwest winds would bring thick sea ice to Hooper Bay, up to 50 walrus might be seen on a single floe, depressing the ice low enough to make it appear the walrus were lying on the water. A walrus was once seen on the beach in May, but this was unusual. Adults are not seen on land, only on ice and in the water. Young walrus have been taken in fall and in December near Hooper Bay, but this was very unusual. These days, walrus can sometimes be seen even in mid-winter, which never used to happen.

The elders say walrus used to take a shortcut overland at the base of the spit going to Kokechik Bay (Figure 1). The sandbars across the mouth of the bay used to be larger and formed a more complete barrier.

### Beluga Whales

Beluga whales arrive in April and May, migrating north. They may pass by or come into the bay in the fall on their southern migration. They do not come into the bay as frequently as in the past,

but when fish are available they will come into Hooper Bay feeding. In the fall of 2016, belugas were seen approaching the bay but then turning away, likely due to the presence of barges and the commotion associated with construction on the runway, which is near the shore. Belugas are regarded as sensitive to noise and disturbance. Belugas were seen in the area in January 2016, a time of year when they never used to be seen here.

Belugas commonly had their young in Hooper Bay, but have switched to having young in Kokechik Bay to avoid the barge and other boat traffic. Lately, belugas seem to come by during times of high wind and waves, making it difficult to hunt them. Beluga meat, skin, and organs can be stored and prepared in various ways: dried, aged, fresh.

#### Other Marine Mammal Species

Ribbon seals are sometimes seen in fall and winter near Hooper Bay. They make good seal oil, but the meat is strong and bloody tasting.

Sea lions were common in the area until the 1970s and early 1980s. Hooper Bay's village corporation is named the Sea Lion Corporation. From the 1980s until recent years, however, sea lions were seen infrequently, usually by Cape Romanzof, where six or eight sea lions may haul out at a time, high on the rocks (Figure 1). In the past few years, sea lions seem to be returning in greater numbers, though they remain uncommon. They are typically seen in spring and summer, not so often in the fall. People would occasionally hunt sea lions in the 1970s—the meat is excellent—but they have not been hunted since the sea lion population declined.

Killer whales are seen in the Hooper Bay area. They have been seen hunting beluga whales, which swim close to shore to try to avoid the killer whales. Killer whales were once seen hunting a gray whale, which swam close to a hunter's boat in an apparent attempt to avoid the killer whales. Hunters know not to try to harm killer whales, because the killer whales will remember the individual who harmed them and seek them out, even years later.

Gray whales and occasionally bowhead whales are seen off Hooper Bay in spring, typically 15 or more miles offshore, migrating to the north. Minke whales have been seen in May near Hooper Bay. A humpback whale was seen in the area for the first time in the summer of 2016. Pilot whales were seen in the area for the first time a few years ago. Hooper Bay is along a whale migration path so many species are observed throughout the year.

#### Other Information

Sea ice is thinner and breaks up more quickly than it used to. There used to be solid ice for the middle months of winter, but now there is thin ice and there is more open water. It is hard to travel on the thin ice, whereas people used to go out by dog team or snowmachine to reach the ice edge. There is not much pack ice in the area any more. There is now little or no shorefast ice in winter, whereas there used to be extensive shorefast ice that hunters could use for traveling to the ice edge. Without the shorefast ice, launching boats directly from shore can be hazardous because of waves breaking in the nearshore shallows. In the deeper water at the edge of shorefast ice, the waves do not break in this way, so the hazard is much lower. There are fewer northwest winds, which used to bring the big, thick ice floes in along with the marine mammals. It is easier

to hunt when there is ice, and thick ice provides a place to cut up larger seals. There are still plenty of seals, but hunters have to travel farther and look harder to find them.

There used to be more snow in Hooper Bay, creating deep drifts. Winters used to be colder. There used to be no flooding in winter, but a lack of ice and strong winds have created high winter floods in recent years.

The weather has changed, making hunting harder and more dangerous. River mouths may be open during winter, and on the beach an ice ledge can form, making it difficult or impossible to get down to the beach in places. Even when there are plenty of seals on the ice, hunters may not be able to get to them.

Storms now are more persistent than they used to be, and there are more windy days and fewer calm days. More southeast winds bring more periods of high water and flooding. There is more east wind than there used to be, and less south wind.

There has been less driftwood in recent years, perhaps because the Yukon River does not flood as often in the Interior. Those floods carry many trees away down the river, bringing them to the coast.

The lakes where Hooper Bay residents get freshwater are drying out. Perhaps this is because of changing permafrost.

Moose are more common in the area than before, coming every summer. Black bears can be found in the mountains, in spring and especially in fall. One hunter said an elder had told him that strange animals would come to the area, and after that, there would be nothing, which is a scary prospect. There are sometimes swans in the area in November. Bees and ladybugs are now common in summer, and new insects such as hornets are arriving.

Salmon are coming in earlier. Fewer came in last summer than usual, but overall the salmon remain abundant. Even king salmon are plentiful, despite problems on the Kuskokwim and Yukon Rivers. In May, the north wind brings in the king salmon. There are more halibut, and also salmon sharks, which were not seen before. Someone found a small stingray (probably a skate) on the beach. Overall, the fish supply is abundant. Fishermen sometimes see fish that have been wounded by seals. Some smelt have been seen with boils, scars, and black spots, which appears to be new in the past 15 or so years.

The rapid retreat of sea ice in spring means hunters have a shorter period for hunting ice-associated marine mammals such as seals and walrus. It is important to take advantage of the opportunities to hunt when they happen, since they are so brief these days. Larger boats and more powerful motors mean they can go farther offshore to find ice and animals, as much as 60 miles from land, but this entails considerable risk and expense, as well as much disappointment if no marine mammals can be found. The problem is not a shortage of animals—there are still plenty of seals and other marine mammals and the animals are healthy. The problem is getting to them, either because they are far away or because ice conditions are not favorable for hunting or traveling.



The lessons of the elders are important ones, reflecting the skills and values that allowed people to survive and thrive in this region for countless generations. Hunting comes from necessity not recreation. Successful hunters should share with those in need, especially elders who can no longer hunt for themselves. While the connection to the land is weakening as people rely more and more on the store and other outside sources of the things they need, it is still essential to pass on to one's children the essential values of respect and sharing. Hunters used to prepare extensively before going out, to be ready for any situation. Ammunition was scarce and expensive, so hunters had to be sure of their shot and be sure they could retrieve an animal they shot. They were prepared to be patient, to wait all day for a seal. They were not greedy and did not get excited, but stayed calm and relaxed. They placed safety first. Today, many hunters go out without emergency gear and without making these kinds of physical and mental preparations.

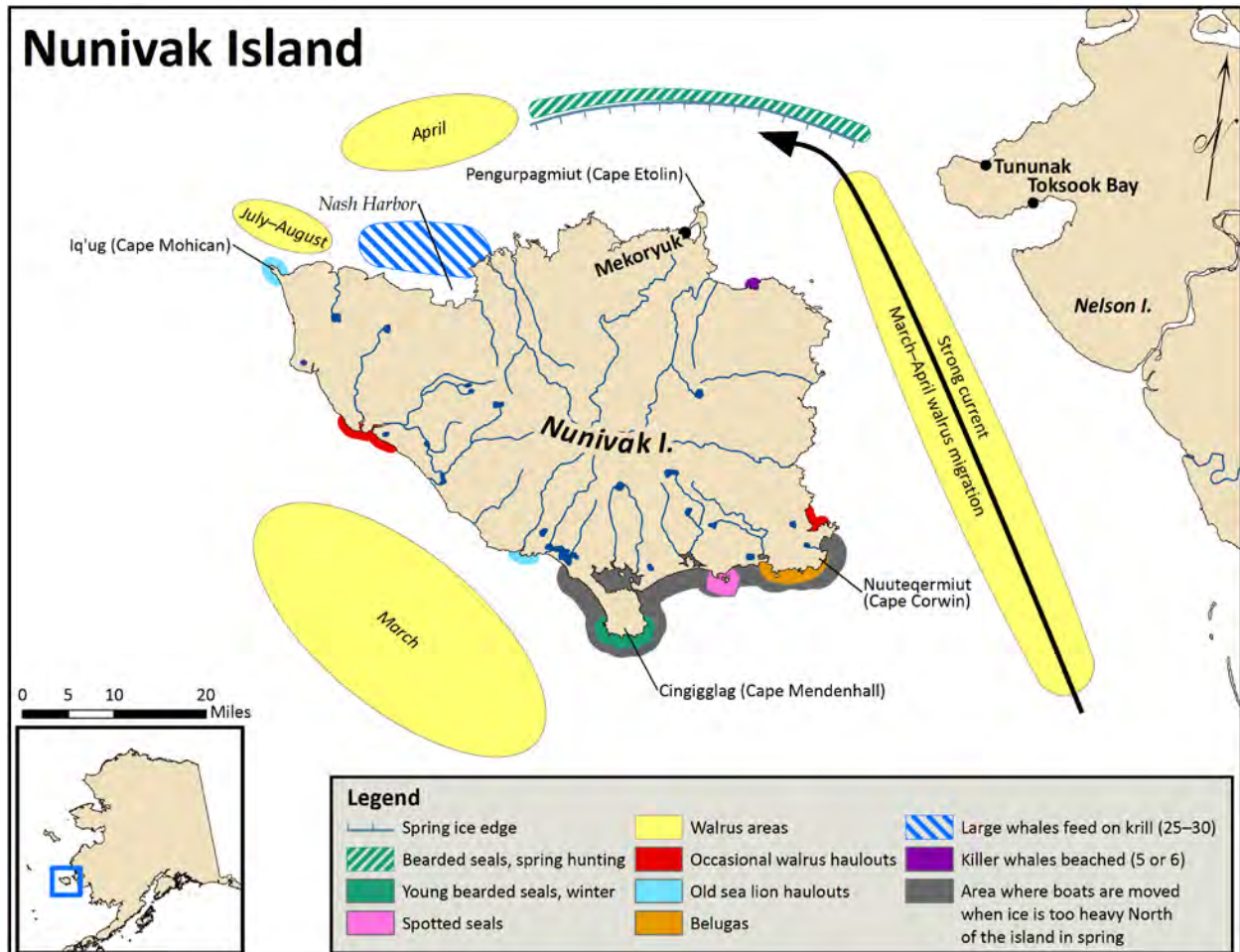
#### Acknowledgements

We are grateful for the skill, expertise, and generosity of the eleven hunters who participated in the interviews. We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to Albert Simon for helping to set up the interviews. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract No. M13PC00015 and we appreciate the support of Carol Fairfield and Catherine Coon. Justin Crawford prepared the maps used during the interviews and the figure in this report.

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- Huntington, H.P. 1998. Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic* 51(3):237–242.
- Noongwook, G., the Native Village of Gambell, the Native Village of Savoonga, H.P. Huntington, and J.C. George. 2007. Traditional knowledge of the bowhead whale (*Balaena mysticetus*) around St. Lawrence Island, Alaska. *Arctic* 60(1):47–54.

# Traditional Knowledge Regarding Marine Mammals near Mekoryuk, Alaska



# **Traditional Knowledge Regarding Marine Mammals near Mekoryuk, Alaska**

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## Introduction

Seals, walrus, and beluga whales are important for subsistence harvests by Cup'ig hunters from Mekoryuk, Alaska. These animals are also iconic Arctic marine mammals at risk from climate change. Industrial activity in the Bering and Chukchi seas, coastal development in the Norton Sound region, and shipping through Bering Strait are additional potential stressors to these marine mammals. The study of the distribution, behavior, and movements of marine mammals is an important contribution to monitoring the effects of a changing environment and the potential effects of industrial activity. Placing satellite transmitters on seals, walrus, beluga whales, and other species provides detailed information about the movements, habitat use, and behavior of some individual animals. Satellite telemetry studies, however are limited in the number of individuals per species that can be instrumented, therefore it is difficult to know how well tagged animal movements and behavior represent the population as a whole. Documenting traditional knowledge about timing of migration, behavior, and the age classes of marine mammals at specific locations through interviews with residents of coastal communities provides important context in which to interpret the satellite telemetry studies as well as providing contemporaneous and historical information about general patterns in marine mammal distribution, movement, and behavior that complement the science greatly. The integration of these two different but equally important types of information provides a broader more comprehensive overview of how Arctic marine mammals and hunters operate in their environment and how changes in the environment are influential.

This report summarizes information gathered from interviews held in Mekoryuk with hunters and other knowledgeable residents in January 2017. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## Methods












We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting that person's knowledge, associations made between animals and the environment, and so on. The interviewers use a list of topics of interest to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In Mekoryuk, we interviewed seven persons as a group. The interviewees were Albert Williams, Howard Amos, and five others who wished to remain anonymous. The interviews were conducted on January 13, 2017 at the Native Village of Mekoryuk office.

The topics identified by the research team in advance of the interviewers were:

- Seasonal patterns of distribution of ice seals, walruses, and beluga whales
- Haulouts on land
- Use of rivers
- Feeding patterns and prey
- Impacts from climate change and hunter responses to those changes
- Parts of marine mammals that people eat
- Information about other marine mammals
- Information about other aspects of the environment and people

Table 1. List of Cup'ig, English, and scientific names of marine mammals mentioned in this report.

	<b>Cup'ig name</b>	<b>English name</b>	<b>Scientific name</b>
	Maklag	bearded seal	<i>Erignathus barbatus</i>
	Amirkar (sometimes maklassugar)	young bearded seal	<i>Erignathus barbatus</i>
	Issuri (sometimes Issurir)	spotted seal	<i>Phoca largha</i>
	Nayir	ringed seal	<i>Phoca</i> or <i>Pusa hispida</i>
	Qasrul'eg or Qasrulek	ribbon seal	<i>Histiophoca fasciata</i>
	Kaugpag	Pacific walrus	<i>Odobenus rosmarus</i>
	Apakcuq or Apakcug	Steller sea lion	<i>Eumetopias jubatus</i>
	Cetuar	beluga whale	<i>Delphinapterus leucas</i>
	Aatagat	Northern fur seal	<i>Callorhinus ursinus</i>
	Mangaqcuar	harbor porpoise	<i>Phocoena phocoena</i>
	Mangaqcuar	Dall's porpoise	<i>Phocoenoides dalli</i>

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### Ringed Seals

Ringed seals are hunted in spring when the water starts to open up. Hunting is often right from the beach with a kayak. Ringed seals are around most of the year, but are more common when ice is close. Ringed seals used to be caught in nets in late fall, but nets are rarely used for catching seals now. They are hunted when bearded seals are not available and are preferred over spotted seals.

### Spotted Seals

Spotted seals are present year-round, in abundance and even over-abundance according to some hunters. They are especially abundant during the herring run in May. Spotted seals haul out on rocks on the southeast side of the island and also on rocks on the beach in all the bays on the island (Figure 1). Because they are not usually hunted, the spotted seals just stay where they are and go where they want to. Spotted seal pups are sometimes seen alone on a beach.

Spotted seal oil has a strong taste. Other seals are preferred. Spotted seals are considered “emergency food,” if a hunter does not get a bearded or ringed seal.



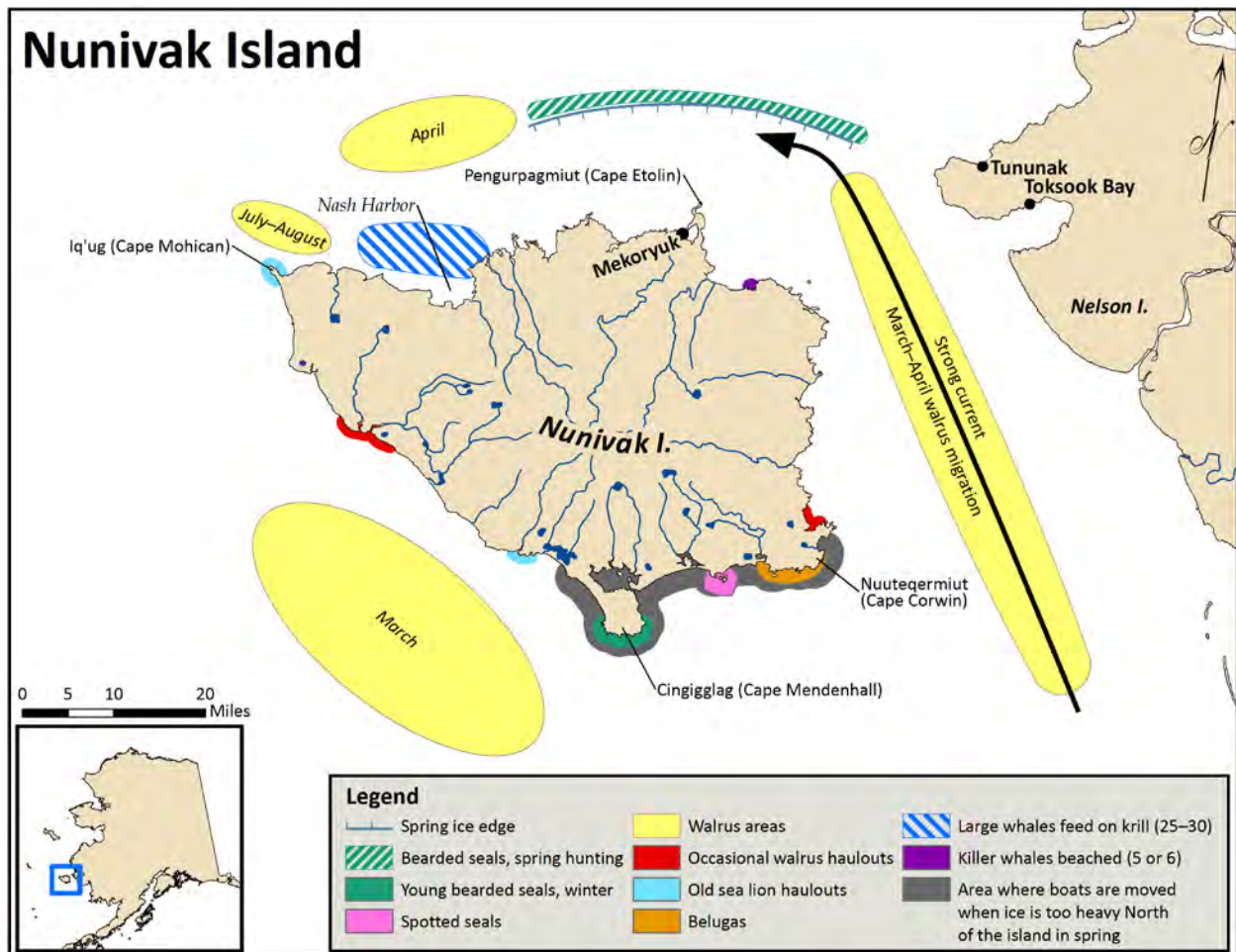


Figure 1. Movements and behavior of seals, walrus, and whales as described during traditional knowledge interviews, January 2017.

### Bearded Seals

Bearded seals are seen on the southern coast of Nunivak Island in winter, especially off Cape Mendenhall on the south side of the island (Figure 1). Most of the bearded seals seen in winter are yearlings. Older, larger bearded seals stay farther north.

Young bearded seals are occasionally seen in river mouths or up rivers on the island. Yearlings are also seen in the bay by the village, rarely but it does happen from time to time.

Mekoryuk hunters see fewer bearded seals now. They used to see them more often off the north coast, about 15 miles offshore (Figure 1), but this is not so common anymore.

Bearded seals eat shrimp, small shell and hair crabs, and some small fish such as flounder and rockfish. Hunters have not seen clams in bearded seal stomachs.

Blubber thickness has been decreasing. Seal oil is very important in the diet of Mekoryuk residents. People eat all parts of the seal, including kidneys and intestines. The meat can be dried or frozen.

Mekoryuk residents primarily hunt for bearded seal. After that, they will look for walrus or ringed seals. Bearded seals are large enough to feed a family for a year, and will be shared with relatives, elders, and those in need.

### Walrus

Walrus come in spring in herds that have males, females, and pups. In later spring, the herds may have more bulls. Lone walrus have been seen on the west side of the island in summer, hauled out on land. Long ago, in the wooden boat times, a herd of walrus was once seen hauled out on rocks on the east side of the island in June, after the ice had gone. A walrus was once taken off the south side of the island in June, after the ice had gone. In 2005 or 2006, a large group of male walrus came ashore on the beach near the village during halibut season in summer, early July (Figure 1). Walrus are occasionally seen in fall. In the fall of 2016, a herd of walrus came into the bay by the village.

A walrus was once seen well inland on the north side of the island, south of the village. Apparently the ice had come in and blocked access to the water. Perhaps the walrus was trying to reach open water on the other side of the island. Walrus have been known to get stranded in this way, when access back to the water is blocked by ice. Some walrus come on land in that situation.

Walrus eat clams. When hunters take a walrus east of Mekoryuk in April, the clams in its stomach are ready to eat. The clams are typically 2-4 inch butterclams. Hunters have not seen other prey in walrus stomachs.

People eat walrus heart and kidneys as well as meat and blubber. Some people age the flipper of the walrus.

### Beluga Whales

A group of beluga whales was seen in March off the shore near the airport. Beluga whales were seen nearshore at the southeast end of the island about four or five years ago in late April or early May, after the ice had gone. Belugas are not too common around Nunivak Island, though there are stories about beluga whales coming ashore and turning into wolves. Historically, Mekoryuk residents were not whale hunters, though they would take the flippers from whales that washed up on the beach. Beluga whales are encountered regularly in the Nuuteqermiut (Cape Corwin) area (Figure 1).

### Other Marine Mammal Species

Ribbon seals are seen and sometimes hunted in the area in fall, when the ice has begun coming in but boating is still possible. This is often in November. Ribbon seals are not seen in spring.

There are sea lions in the Mekoryuk area, but not as many as there used to be. Many sea lions used to haul out at Cape Mohican, but no longer (Figure 1). Once in a while, hunters will see a lone sea lion on the east side of the island. Sea lions have been seen on ice floes in a bay east of the village, on the northeast side of the island.

Killer whales are seen in late spring, when the ice goes out. They are not common. A few decades ago, a group of five or six killer whales beached themselves east of the village. No one knows why. Killer whales were once seen hunting a walrus that was on an ice floe.

There are many porpoise (most likely harbor porpoise, but could be Dall's porpoise) in the area. A group of 25-30 large whales of unknown species was once seen in the Nash Harbor area on the west end of the north side of the island, feeding in the bay (Figure 1). Many whales were seen one spring during egg season, off the southeast side of the island.

#### Other Information

Fishermen catch lots of skates now, while longlining for halibut. They never used to get skates and consider them a nuisance. Longlining for halibut was not done in the old days.

In winter, the north side of the island is typically blocked in by ice, so hunters have to go to the south side if they want to hunt. This means taking boats and other gear across the island, about a journey of about 45 miles.

The current is strong on the east side of the island, going north through Etolin Strait and then west along the north side of Nunivak Island. This current makes the north side dangerous, adding to the reasons for hunting off the south side in winter.

The ice has changed greatly in the past decade or two. Due to changes in ice conditions, the period of good hunting in spring is much shorter than it used to be. There used to be a few weeks of good hunting once the ice started breaking up. Now, hunters are lucky to have a week before the ice is gone, and the good hunting with it. If they miss the opportunity, they may be without seal oil.

Hunters also said the Cup'ig names of the months reflect what is happening in nature. The name for October means "when ponds freeze;" for November, "when sea ice covers the ocean." The timing of these events no longer follows the Cup'ig calendar. Freeze-up is coming later and later. Break-up comes earlier and is much faster than it used to be.

In early 2017, south winds created open water north of the island and the village, which used to be very unusual. Ice conditions are unpredictable now. The ice never used to move from the north side of the island in December, January, or February. It was rare to see open water at that time. Now, the ice can go away even in mid-winter. Even the bay in front of the village has had open water in wintertime in recent years. In the weeks prior to the interviews, people had been able to gather mussels from the beach, which was never possible in winter before.

Mekoryuk has seen rain in mid-winter, which never used to happen. In January 2017, there was little or no snow in the area, just hoarfrost covering the ground. This has made it hard to ride across the tundra to herd reindeer. In 2016, the snow was gone within a couple weeks of starting to melt.



In the old days, calm weather used to persist for a week or more. Nowadays, the winds will pick up again after a day or so. In old photos from Mekoryuk, people paddled kayaks across the bay in completely flat water.

#### Acknowledgements

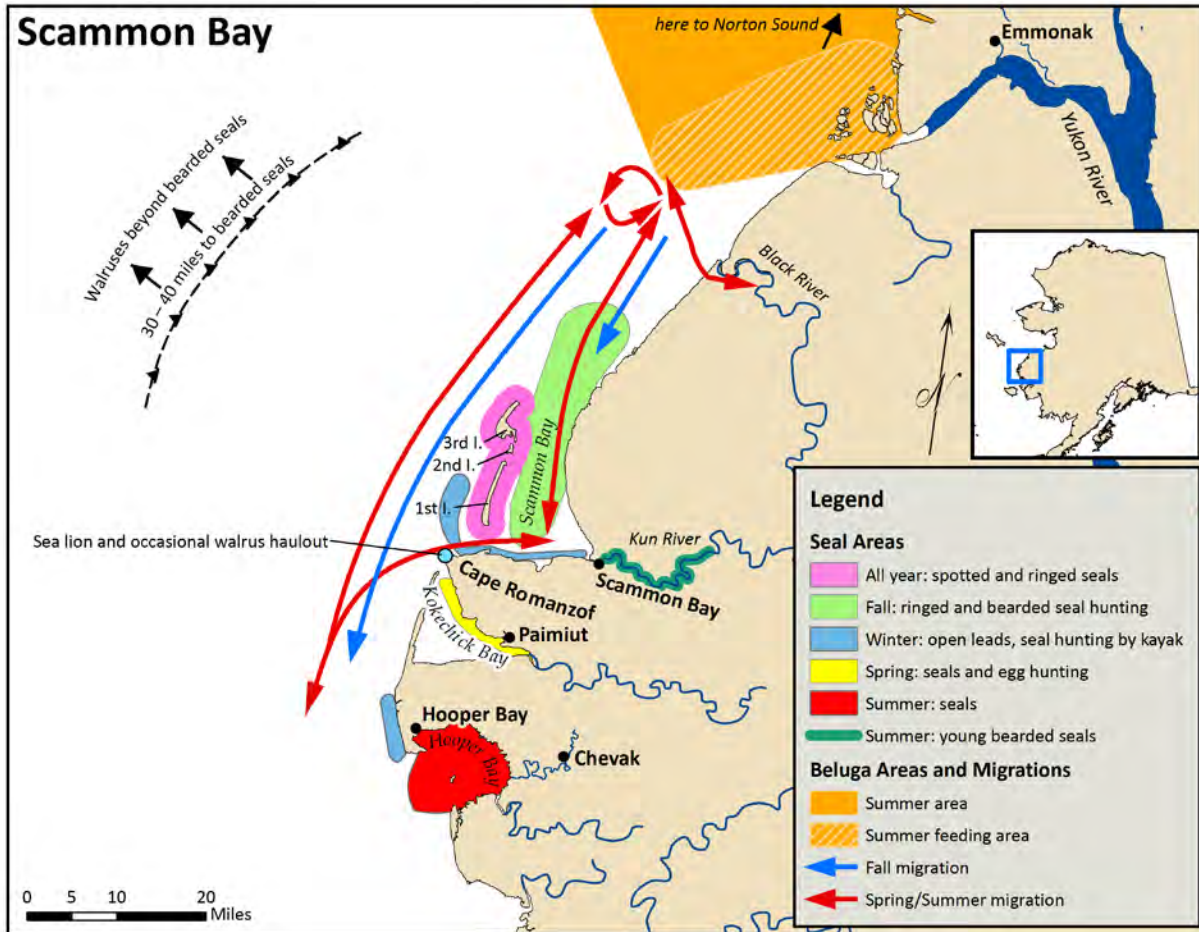
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Huntington, H.P. 1998. Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic* 51(3):237–242.

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# Traditional Knowledge Regarding Marine Mammals near Scammon Bay, Alaska



# **Traditional Knowledge Regarding Marine Mammals near Scammon Bay, Alaska**

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Final report  
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## Introduction

Seals, walrus, and beluga whales are important for subsistence harvests by Yup'ik hunters from Scammon Bay, Alaska. These animals are also iconic Arctic marine mammals at risk from climate change. Industrial activity in the Bering Sea, coastal development in the Norton Sound region, and shipping through Bering Strait are additional potential stressors to these marine mammals. The study of the distribution, behavior, and movements of marine mammals is an important contribution to monitoring the effects of a changing environment and the potential effects of industrial activity. Placing satellite transmitters on seals, walrus, beluga whales, and other species provides detailed information about the movements, habitat use, and behavior of some individual animals. Satellite telemetry studies, however are limited in the number of individuals per species that can be instrumented, therefore it is difficult to know how well tagged animal movements and behavior represent the population as a whole. Documenting traditional knowledge about timing of migration, behavior and the age classes of marine mammals at specific locations through interviews with residents of coastal communities, provides important context in which to interpret the satellite telemetry studies as well as providing contemporaneous and historical information about general patterns in marine mammal distribution, movement, and behavior that complement the science greatly. The integration of these two different but equally important types of information provides a broader more comprehensive overview of how Arctic marine mammals and hunters operate in their environment and how changes in the environment are influential.

This report summarizes information gathered from interviews held in Scammon Bay with hunters and other knowledgeable residents in January 2017. This traditional knowledge project used the same approach that the Native Village of Savoonga used when documenting traditional knowledge about bowhead whales on St. Lawrence Island (Noongwook et al. 2007).

## Methods








We used the semi-directive interview method, in which the interviewers raise a number of topics with the person being interviewed, but do not rely solely on a formal list of questions (Huntington 1998). Instead, the interview is closer to a discussion or conversation, proceeding in directions determined by the person being interviewed, reflecting that person's knowledge, associations made between animals and the environment, and so on. The interviewers use a list of topics of interest to raise additional points for discussion, but do not curtail discussion of additional topics introduced by the person being interviewed.

In Scammon Bay, we interviewed five persons individually. The interviewees were Morgan Simon, Jim Kaganak, Wybon Rivers, John Bell, and one other who wished to remain anonymous. The interviews were conducted on January 10 and 11, 2017 in the homes of three interviewees, at the office of one, and in the school library.

The topics of interest identified by the research team in advance of the interviews were:

- Seasonal patterns of distribution of ice seals, walruses, and beluga whales
- Haulouts on land
- Use of rivers
- Feeding patterns and prey
- Impacts from climate change and hunter responses to those changes
- Parts of marine mammals that people eat
- Information about other marine mammals
- Information about other aspects of the environment and people

Table 1. List of Yup'ik, English, and scientific names of marine mammals mentioned in this report.

	<b>Yup'ik name</b>	<b>English name</b>	<b>Scientific name</b>
	Maklak	bearded seal	<i>Erignathus barbatus</i>
	Maklagaq	young bearded seal	<i>Erignathus barbatus</i>
	Issuriq	spotted seal	<i>Phoca largha</i>
	Nayiq	ringed seal	<i>Phoca</i> or <i>Pusa hispida</i>
	Qaygulek	ribbon seal	<i>Histiophoca fasciata</i>
	Kaugpak	Pacific walrus	<i>Odobenus rosmarus</i>
	Uinaq	Steller sea lion	<i>Eumetopias jubatus</i>
	Cituaq	beluga whale	<i>Delphinapterus leucas</i>

The results are presented under different headings, reflecting the actual information collected and the fact that some of the subjects blend together, especially changes seen over time in regard to all of the topics. The interviewers were Henry Huntington and Mark Nelson. Lori Quakenbush is the project leader.

### Ringed Seals

A few ringed seals can be found in the Scammon Bay area year-round, but most arrive back in November or so, around the time the sea ice returns, when they can haul out on shorefast ice or

on pack ice. They stay through the winter and spring, becoming more plentiful or at least more visible in March as the ice opens and hunters begin to go out by kayak. Some ringed seals stay in the area as late as May or so and don't leave until after the herring run. Ringed seals usually have small fish in their stomachs, and sometimes some shrimp.

Ringed seals used to be hunted mainly in spring, but now can be hunted in December through February, due to thinner sea ice and more open water. In spring, they are hunted mainly for the meat and oil. The oil is used to preserve dried fish and other things. Hunters avoid larger ringed seals in March and April, because they may be in rut and not suitable for eating. Ringed seal skins are used for hats, gloves, and boot uppers.

Two or so years ago, ringed seals with boils on their neck and bellies were seen, acting fearless unlike how seals usually behave. Some hunters went for spotted seals instead, as these appeared to be healthy. Another hunter reported ringed seals with red skin and open sores, on their backs. He said some spotted seals had similar sores. Seals with bald patches have been seen from time to time for as long as some hunters can remember (>30 years), but they are not common. Some seals in the past were skinny too, perhaps ill.

In 2011, after the Japanese earthquake and tsunami, some seals were seen behaving sluggishly, not fleeing when hunters approached. Hunters avoided those seals and went instead for the ones that were energetic as usual. This behavior lasted only a year or two.



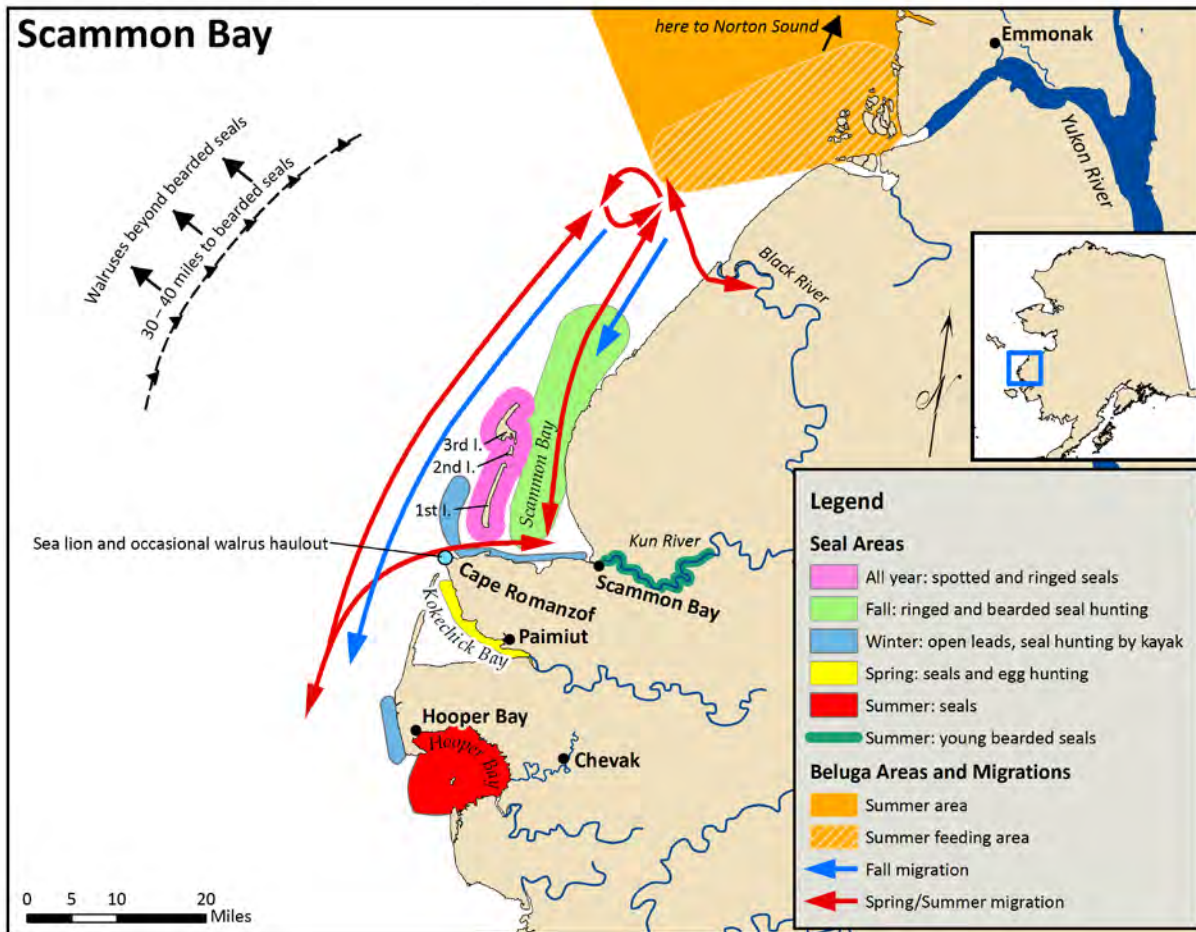


Figure 1. Movements and behavior of seals, walrus, and beluga whales as described during traditional knowledge interviews, January 2017.

### Spotted Seals

Spotted seals are abundant. They are found in the area year-round. In spring, spotted seals become more common in April, after ringed and bearded seals start heading north. Hundreds of spotted seals can be seen in the weeks before break-up, sometimes in large gatherings. Spotted seals remain plentiful in May. In summer, 400–500 spotted seals haul out on the second and third islands off Scammon Bay (Figure 1), but not elsewhere in the area. Some ringed seals may haul out there, too, but after the herring run nearly all the seals in the area are spotted seals. Spotted seals are occasionally seen in the channel by the first island in summer. Spotted seals are hunted for their skin and oil.

This winter, spotted seals are more abundant than usual in the area, due to the open water and thin ice so close to shore. In late December, hunters saw mainly spotted seals and only a few ringed seals. In colder winters, ringed seals are more common than spotted seals and are the usual seal to see in January and February.

Spotted seals eat tomcod (i.e., saffron cod) when they are abundant in the area, and herring during the herring run. Some can be seen with herring eggs on their faces at that time of year. A

spotted seal taken in late December 2016 had tomcod and smelt in its stomach. Hunters can tell if seals are feeding based on where the seals are and when, and on indicators like herring eggs on their faces. The surfacing behavior does not seem to change very much.

### Bearded Seals

Some bearded seals are present throughout the winter, but they are generally secretive and few are seen. Most bearded seals come in spring, when the ice opens up a bit and they have their young. They used to arrive in mid-March, but now some will come as early as February, showing up a few miles offshore. Most leave for the north in April or May, after the herring run, but some juveniles stay all summer, often going up rivers where they appear to be following tomcod and whitefish runs throughout the summer. At Black River, two or three bearded seals can be seen coming in with the fish on each tide (Figure 1). In fall, bearded seals return with the sea ice, but most of these are sub-adults.

Bearded seals are pregnant in spring. Mother bearded seals are very protective of their young; they can be approached easily as they will not flee and abandon their pups.

Bearded seals have many, often large, shrimp in their stomachs in spring and also sea cucumbers or spoon worms. In September and October, they will also have small, sardine-like fish.

Bearded seals are hunted in spring. The meat is often dried and can be frozen, too. The innards are used to make soup. Nearly all of the animal is used, with the exception of some parts such as the bile ducts near the liver. Bearded seal is used to make oil. Bearded seal skins are tough.

Bearded seal hunting in spring is getting harder, due to poor hunting conditions and fewer seals. Hunting in fall is also challenging due to fewer seals.

One hunter has found bearded seals with discolored livers on two occasions, including white patches on the liver. He discarded the livers but kept the rest of the seals. Another bearded seal had warts or a similar looking problem on the skin of its belly.

### Walrus

Walrus migrate past Scammon Bay 15–20 miles offshore from Cape Romanzof in April and May (Figure 1), with the large ice floes, though the timing is shifting earlier in the spring so now a few are seen in March and even February. The walrus may come closer if the ice brings them in. Walrus are in the area for a few weeks, but by May when the bay ice breaks up, hunters cannot travel offshore so may not see walrus after that. Walrus are rarely seen in the fall in this area.

In the spring of 2016, the ice left early and some small groups of bull walrus were seen swimming north in the open water, about 20 miles offshore by people who were halibut fishing. The hunter who saw this is unsure where they rested without ice to haul out on. Without big, thick ice floes, it can be hard to find walrus and other marine mammals.

One or two walrus may be found hauled out at Cape Romanzof at any time during summer (Figure 1). Walrus eat clams, no other diet items were identified.

### Beluga Whales

Belugas come from the south in May and June, following the herring and the salmon. Scammon Bay itself may still be frozen over, but the water is opening beyond the barrier islands. In summer, belugas stay near the mouths of the Black and Yukon rivers, going in and out with the tide as they feed on fish (Figure 1). They can also be seen along the coast between Scammon Bay and Black River. In fall, belugas head south around the time of freeze-up, though not as many are seen in fall as in spring. They may be following whitefish and tomcod in fall. The latest one hunter caught a beluga whale was late November. No belugas were seen in the fall of 2016. In other years, belugas have gotten tangled in fish nets in fall. Belugas are not seen in winter, but hunters are also rarely out on the ocean in winter. One hunter once caught a young beluga whale up a river, where he had gone to pick berries with his wife.

When killer whales are nearby, belugas will move to the nearshore shallows or into a river. Once belugas were seen by the hundreds in the river in front of the village.

### Other Marine Mammal Species

Ribbon seals are seen in the area in fall when the sea ice returns and the seals can haul out. The farther offshore, the more ribbon seals can be seen.

Sea lions are seen in spring, when the herring run occurs. They stay as long as the fish are in the area, about six weeks or so, and then they leave. A few will haul out at a time high on the rocks at Cape Romanzof (Figure 1). Sea lions are occasionally seen in rivers, chasing salmon. People leave sea lions alone, though they were occasionally hunted several decades ago.

Killer whales are seen more frequently in the area over the past 10 years or so. Last summer, a killer whale carcass was found for the first time in the area, on a beach. Halibut fishermen see killer whales offshore and they are seen during salmon season, too. People tend to stay away from killer whales. Killer whales have been seen chasing beluga whales in spring. Killer whales are seen occasionally in fall.

Large whales are sometimes seen in the area in summer, by halibut fishermen. These were not seen 10 years or more ago.

Porpoises (i.e., harbor porpoises) are increasingly common now, seen every time fishermen go out. The porpoises are small and their Yupik name means animals that herd fish, which benefits killer whales.

Sea otters are seen once in a great while here. This is not a new phenomenon, and typically happens in spring when it happens.

Unknown animals are seen from time to time and are known from stories. One seal-like animal washed up on shore but no one knew what it was.

### Other Information

Hunters need to be ready to take advantage of opportunities when they arise, especially in times of change as is the case at present. Waiting for the usual hunting times may not work well.



Instead, hunters have to be ready to go at times that are not customary, but when seals and other animals may nonetheless be available and accessible. In spring, the good hunting period used to last two to three weeks, when it was possible to go boating in the ice but the ice was still close to Scammon Bay. Now, the ice goes away quickly and hunters may have less than a week of good conditions before the ice is a long way out. Hunters have to be ready to go when the conditions are good, which tends to be earlier in spring than it used to be. Some hunters have begun avoiding spring hunting, being wary of dangerous conditions, seeking instead to get seals in fall. That strategy appears to be working so far for the hunters who are using it.

It is important to take what you can, when you can, so long as it is done respectfully and without waste. Sharing with elders and others who cannot hunt is important. In the old days, if Scammon Bay hunters had a successful season, they would load kayaks with meat and other foods and take them to Hooper Bay and other communities to share.

Chum and pink salmon runs have been strong in recent years. In 2016, fish of both species were large. The pink salmon that fall were as large as the chum salmon had been two years previously. King salmon returns are down and there are strict regulations restricting fishing. Fishermen have made chum salmon strips instead of king salmon strips. They are not as tasty, but they are still smoked salmon. Salmon can also be salted and frozen. People use the heads and fins, too.

Halibut fishing in July is a relatively new activity, and a good way of getting additional food. Halibut seem to be declining, though, while pollock and cod (Pacific cod) have been caught for the first time in recent years. One year, fishermen caught many skates. Salmon sharks are also seen while halibut fishing, which is a newly found species to the area.

Herring come in spring when the ice goes out from the bay. This used to happen in late May and early June, but recently has been happening in mid-May. The herring nonetheless arrive as the ice goes out.

Puffins, cormorants, and other birds nest at Cape Romanzof. Some new birds are being seen in the area, which hunters do not recognize. One looks like a small version of an arctic tern, with a wingspan of 6-8 inches. In one year, a storm blew little black birds into the village.

Sea ice has changed a lot. There is less shorefast ice and the ice is often thin, breaking easily and floating away. The ice is not strong, and breaks up and melts quickly in spring. There are few big icebergs any more. The ice does not extend as far out into Scammon Bay. There used to be thick ice all the way to Cape Romanzof, over which people would travel while gathering driftwood. This is no longer possible. Hunting is best in March and April. By late April, it is now too warm and the ice goes away.

Snow and ice melt earlier in the spring than they used to, which can make traveling harder over land and when trying to cross rivers during May when people hunt black brant. Some people now use boats to go brant hunting.

There has been little snow in recent winters, which is unusual. March is usually the snowy month, but has not seen much snowfall in recent years. The lack of snow also means fewer drifts on the ice that seals can use to make lairs for giving birth.

The weather has been more violent in recent years. Fall storms come early, even in summer, causing flooding and driving fish away until the waters settle again. Winds are stronger now and the weather is warmer. Flooding has been getting worse in the Scammon Bay area due to a lack of ice and strong winds during the winter.

Lack of snow in the Interior means less flooding on the Yukon River, so fewer trees are washed down the river and driftwood is scarce in the Scammon Bay area. This has been the case the past three years or so. People who gather driftwood have to go farther and have had to use cottonwood instead of the preferred spruce.

#### Acknowledgements

We are grateful for the skill, expertise, and generosity of the five hunters who participated in the interviews. We appreciate the support of the Eskimo Walrus Commission and the Ice Seal Committee for this project and are grateful to Morgan Simon for helping to set up the interviews. The Bureau of Ocean Energy Management (BOEM) funded the work as part of Contract No. M13PC00015 and we appreciate the support of Carol Fairfield and Catherine Coon. Justin Crawford prepared the maps used during the interviews and the figure in this report.

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Noongwook, G., the Native Village of Gambell, the Native Village of Savoonga, H.P. Huntington, and J.C. George. 2007. Traditional knowledge of the bowhead whale (*Balaena mysticetus*) around St. Lawrence Island, Alaska. *Arctic* 60(1):47–54.

## Seasonal movements, habitat use, and dive behavior of pup and yearling bearded seals in the Pacific Arctic.

Justin A. Crawford<sup>1\*</sup>, Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, John Goodwin<sup>2</sup>, Kathy Frost<sup>3</sup>, Alex Whiting<sup>4</sup>, and Matthew Druckenmiller<sup>5</sup>

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Society of Marine Mammalogy, 22–27 October 2017, Halifax, Nova Scotia, Canada

Bearded seals (*Erignathus barbatus*) are benthic foragers that use sea ice for pupping, nursing, molting, and resting. Changes in sea ice and water temperature associated with climate change may affect fish and invertebrate prey of bearded seals, and therefore their habitat use. Our understanding of foraging habitats, behavior, and timing of movements, however, is limited. We worked with Alaska Native hunter-taggers along the Bering and Chukchi coasts to deploy satellite-linked dive recorders on 20 young (< 2 years old) bearded seals from June through November 2014–2017. Seals were tracked 10–457 days. During the open-water period seals were located in the Chukchi and Bering seas. As sea ice advanced in December seals moved toward the Alaskan or Russian coast or the southern ice edge. By mid-December, 11 of 13 seals were in the Bering Sea, however one remained in the Beaufort Sea and another in the Chukchi Sea. We analyzed habitat use and dive behavior August–February. Seals were generally located 20 km closer to the coast during August, October, and December–February than during September and November ( $P < 0.01$ ) and in waters averaging 25–30 m deep August–January before moving to deeper waters in February (45 m;  $P < 0.01$ ). All seals made fewer benthic and more mid-water and surface dives during December than other months ( $P < 0.01$ ). Further, a higher proportion of benthic dives occurred during morning and afternoon (0700–1400; 90–93%) than at night (1900–0000; 72–78%;  $P < 0.01$ ). The durations of benthic dives were similar from August to November (5:30 min) but increased from December (6:45 min) through February (9:50 min;  $P < 0.01$ ). The presence and concentration of sea ice may influence habitat use and dive behavior and will be analyzed.





# Seasonal movements, habitat use, and dive behavior of pup and yearling bearded seals in the Pacific Arctic



Justin A. Crawford<sup>1</sup>, Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>,

John Goodwin<sup>2</sup>, Kathy Frost<sup>3</sup>, Alex Whiting<sup>4</sup>, and Matthew Druckenmiller<sup>5</sup>

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<sup>5</sup>National Snow and Ice Data Center, University of Colorado, Boulder, Colorado, USA

## BACKGROUND

Bearded seals (*Erignathus barbatus*) are benthic foragers that use sea ice for pupping, nursing, molting, and resting. Observed and predicted decreases in the extent of sea ice and lengthening of the open water season associated with climate change may affect fish and invertebrate prey of bearded seals, and therefore affect seal foraging behavior. Our understanding of important habitats, foraging behavior, and timing of movements, is limited; however, cooperative satellite telemetry studies among hunters and biologists are increasing our understanding of seal behavior and how these behaviors may change with future decreases in sea ice.

This project expands on past studies by tagging seals at several widely-spaced locations along the Alaskan coast. We worked with Alaska Native hunter-taggers along the Beaufort, Bering and Chukchi sea coasts to deploy satellite-linked transmitters on young (< 2 years old) bearded seals from June through November 2014–2017. We used satellite telemetry to describe bearded seal movements and diving behavior in relation to sea ice and other environmental variables.

## METHODS

- We worked with seal hunters to capture bearded seals in entanglement nets. Satellite-linked transmitters were glued to the hair on their mid-dorsum and included:

- SPLASH and SPOT tags** (Wildlife Computers, Redmond, WA, USA) and
- CTD tags** (Sea Mammal Research Unit, St. Andrews, Scotland).

### MOVEMENTS AND HABITAT ASSOCIATIONS:

- We estimated daily locations using a continuous-time Correlated Random Walk (CRW) model (package *crawl* in R).
- We **evaluated habitat associations** from August–February, including: bathymetry, distance to coast, and ice zone.

### DIVE BEHAVIOR:

- For 13 seals instrumented with SPLASH tags, we used the CRW model to predict dive locations to match dive dates and times.
- Dives were classified as benthic if they were <5 m from the ocean floor.
- We used a repeated-measures mixed model to test for differences in:

- Proportion of benthic dives**
- Dive duration of benthic dives**

- Variables of interest included:

- Seal variable:** Sex
- Time variables:** Month and time of day
- Habitat variables:** Ice zone, bathymetry, and distance to coast

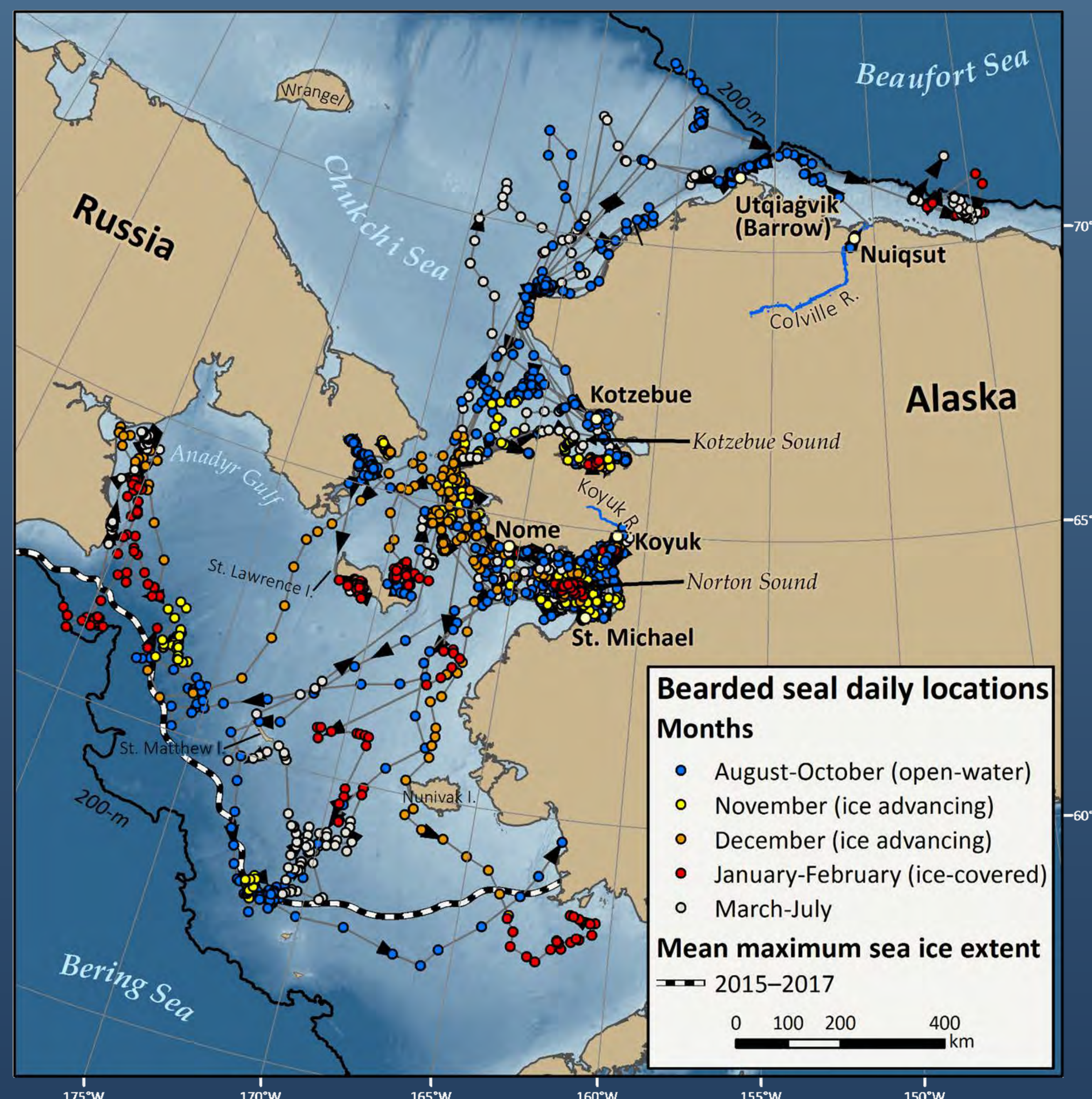
- Models were fit using SAS software (PROC GLIMMIX and MIXED) and the best model was selected using AICc.

## ACKNOWLEDGEMENTS

Seal tagging projects were funded by the Bureau of Ocean Energy Management, USA and Office of Naval Research, USA. We appreciate the support of the Ice Seal Committee and assistance from the hunter-tagger crews; Morgan Henry, Alex Niksik Jr., Palsson Fitka, Stephan Horn Jr., Tom Gray, Denali Whiting, Edward Ahyakak, Frank Garfield, Henry "Boyuk" Goodwin, and Pearl Goodwin. We also thank Anna Bryan, Ryan Adam, Aaron Morris, Joe Skin, Isaac Leavitt, and Andrew von Duyke for tagging assistance. Research on ice seals was conducted under permit #15324 issued to ADFG by the National Marine Fisheries Service and under an approved ADFG Animal Care and Use Committee Protocol #2014-03, 2015-25, and 2016-23.

## RESULTS

- We deployed satellite-linked transmitters on **24 young bearded seals** from 2014–2017.
- Seals were **tracked 10–457 days**.



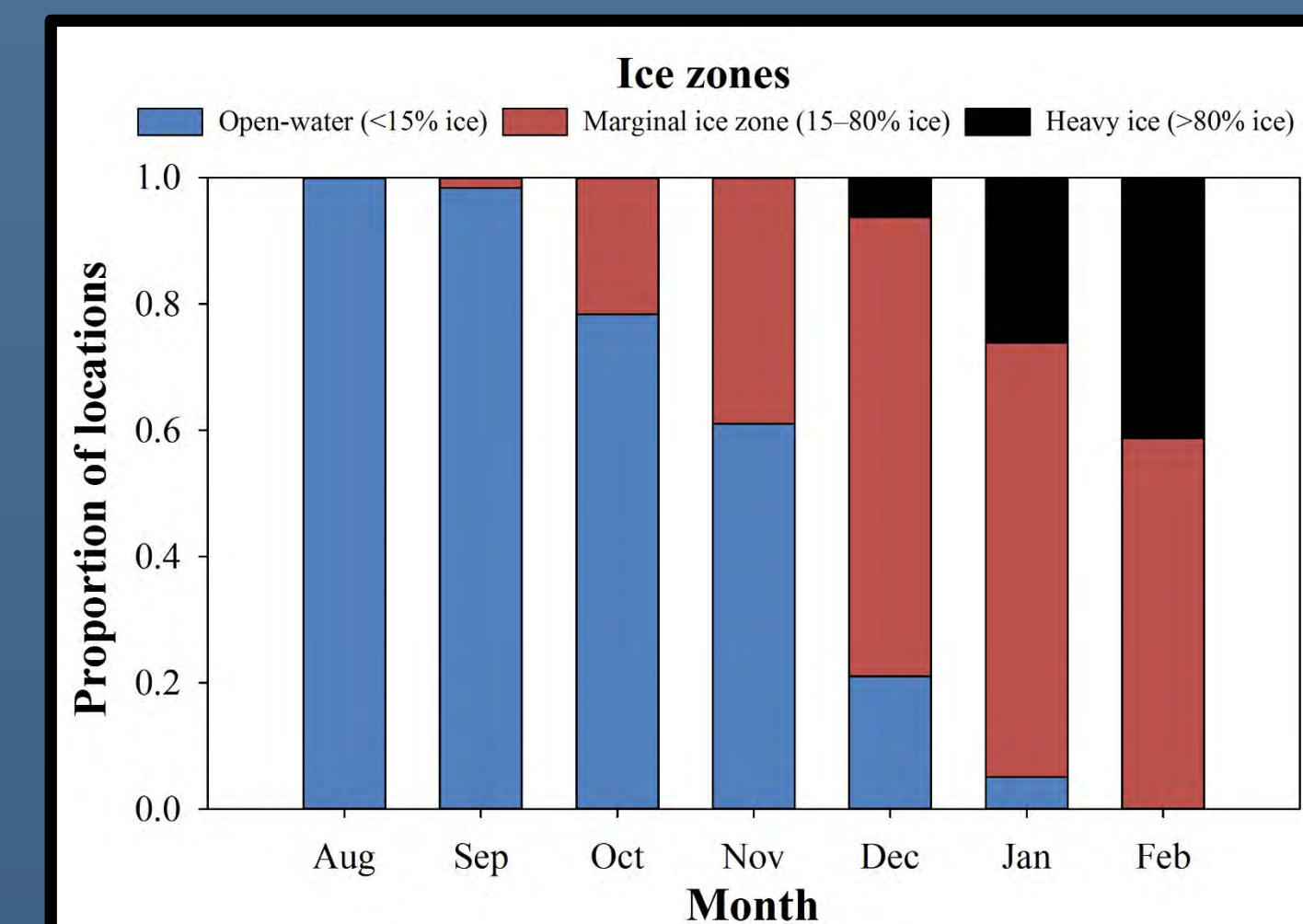
**Figure 2.** Movements of 24 bearded seals from 2014 to 2017. Seals were tagged with satellite-linked transmitters near St. Michael, Koyuk, Nome, Kotzebue, and Utqiagvik (Barrow), Alaska. Daily locations were estimated using a CRW model.



**Figure 1.** Attaching satellite-linked transmitters to captured bearded seals: a) Palsson Fitka, July 2016 and, b) Merlin Henry, and Mark Nelson (ADFG), September 2016.

## MOVEMENTS AND HABITAT ASSOCIATIONS

- As sea ice advanced south (September–February),
  - Seals moved toward coastal waters or the southern ice edge (Fig. 2).
  - Seals were **located in progressively heavier ice** (by concentration) with each successive month ( $P < 0.01$ ).
- During August–February, seals were located in waters ~25–45 m deep.

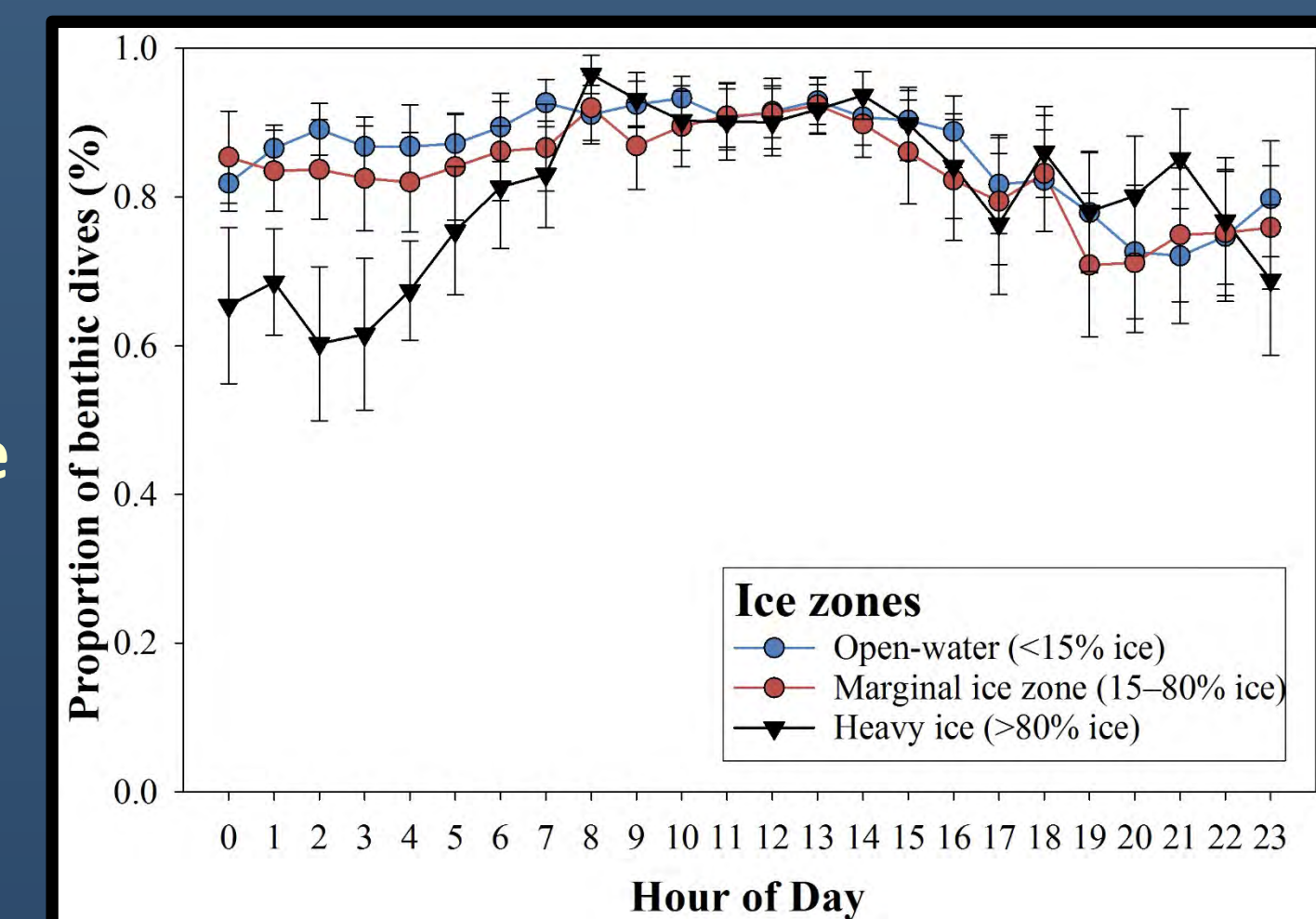


**Figure 3.** Proportion of estimated daily locations located in each ice zone by month.

## DIVE BEHAVIOR

### PROPORTION OF BENTHIC DIVES

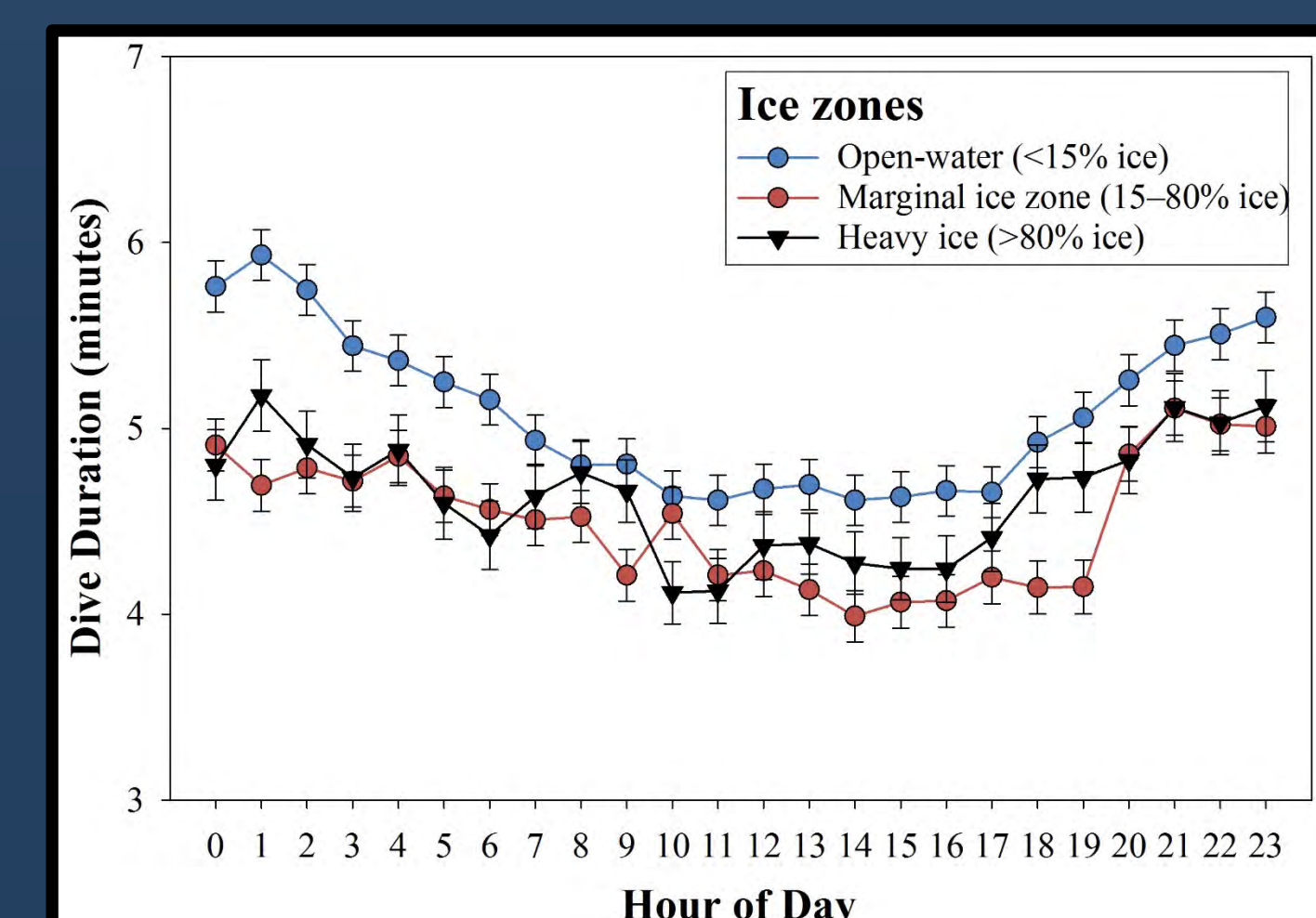
- Best model: **Ice zone X Hour + Bathymetry**
- Seal made proportionally **fewer benthic dives** from 0000–0400 when in heavy ice vs. marginal ice or open water ( $P < 0.01$ ).
- Overall, seals made proportionally fewer benthic dives from 1900–0000 than from 0700–1400 ( $P < 0.01$ ).
- Seals made proportionally fewer benthic dives in deep (50–70m; 60%) vs. shallow (0–40m; 87%) water ( $P < 0.01$ ).



**Figure 4.** Proportion of benthic dives made in each ice zone by hour of day.

### DURATION OF BENTHIC DIVES

- Best model: **Ice zone X Hour**
- Seals made **shorter benthic dives** when in heavy and marginal ice vs. open water ( $P < 0.01$ ).
- Dives were longer from 2100–0200 than from 0900–1800 ( $P < 0.01$ ).



**Figure 5.** Dive duration of benthic dives made in each ice zone by hour of day.

## SUMMARY

- In heavy ice, seals made proportionally fewer benthic dives and durations were shorter in heavy and marginal ice than in open water.
- Seals made proportionally fewer benthic dives at night, possibly in response to the vertical migration of their prey; however, durations were longer at night than the rest of the day.
- The presence and concentration of sea ice appears associated with reduced benthic foraging.
- Continued studies of bearded seal foraging behavior are necessary to monitor for changes in behavior with continued changes in sea ice.





## **Evaluating impacts of climate change on indigenous marine mammal hunting in northern and western Alaska using traditional knowledge**

Mark Nelson<sup>1\*</sup>, Henry Huntington<sup>2</sup>, Lori Quakenbush<sup>1</sup>

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*Society of Marine Mammalogy, 22-27 October 2017, Halifax, Nova Scotia, Canada*

Indigenous residents of western and northern Alaska rely on marine mammals for food. Climate-related changes in sea ice conditions and weather are expected to affect behavior of animals and hunter access to them. Documenting traditional knowledge of Iñupiaq, Yup'ik, and Cup'ik hunters concerning marine mammals, the environment, and hunter success provides information relevant to ecology, conservation, and subsistence communities. We interviewed 110 hunters in 14 communities on the Bering, Chukchi, and Beaufort Sea coasts about these topics. A few changes were reported in marine mammal abundance, distribution, body condition, prey, and disease, however, most changes were environmental including sea ice conditions, weather, and timing of hunting seasons. Sea ice conditions are a major driver for hunting Arctic marine mammals, as most are associated with the ice and therefore more abundant or accessible when ice is present. The spring hunt, typically the most productive, has shortened from several weeks to one week or less depending on when the pack ice retreats and if it returns during summer. Hunters have had to adjust to harvest enough for food, which requires that they compare what they know against new observations. Traditional knowledge is a system in which existing information is interpreted and shared and new knowledge is acquired through observation and assimilated with what is already known. It is “traditional” because the system has long been used, not because the knowledge is only from the past. While traditional ways of preparing for the hunt, cooperation, patience, and sharing the harvest remain relatively constant, the acquisition and sharing of new information for hunting under new conditions is an important adaptive strategy. Alaska Native marine mammal hunters have demonstrated their ability to overcome changes in the past, are doing so in the present, and will likely continue to do so in the future.



# Evaluating the Effects of Climate Change on Indigenous Marine Mammal Hunting in Northern and Western Alaska Using Traditional Knowledge

Appendix Q.



Mark Nelson<sup>1</sup>, Henry P. Huntington<sup>2</sup>, and Lori Quakenbush<sup>1</sup>  
<sup>1</sup>Alaska Department of Fish and Game, Fairbanks, Alaska, USA [Mark.Nelson@alaska.gov](mailto:Mark.Nelson@alaska.gov),  
<sup>2</sup>Huntington Consulting, Eagle River, Alaska, USA



## Overview

Indigenous residents of western and northern Alaska rely on marine mammals for subsistence including for food, materials, and culture. Documenting traditional knowledge of Iñupiaq, Yup'ik, and Cup'ik hunters concerning marine mammals, the environment, and hunter success provides information relevant to ecology, conservation, and subsistence communities. This compilation of traditional and local knowledge depicts changes in marine mammals including hunting seasons (dictated by weather and sea ice), distribution, health and body condition, and concerns of human activities.

## Methods

- We used the semi-directive interview method to collect traditional knowledge from subsistence hunters and community members (Huntington 1998).
- We interviewed 110 people from 14 communities between 2007 and 2017 (Table 1, Figure 1).
- After the interviews, we prepared a draft report that was reviewed and approved by all the participants.
- A final report was prepared for each community that included a map detailing specific observations (e.g., maps on left side of Figure 1).
- Community specific observations were compared with other communities and similar observations were grouped together in Figure 1 (represented by colored and numbered boxes).

Table 1. Summary of interviews. Table is modified from Huntington et al. (2017).

Community	Year	Species focus	No. of Participants
Kaktovik	2007	Bowhead whales	6
Barrow	2007	Bowhead whales	6
Wainwright	2008	Bowhead whales	7
Point Lay	2011	Walrus	5
Wainwright	2011	Walrus	13
Point Hope	2013	Walrus	8
Barrow	2015	Walrus and ice seals	10
Elim	2015	Ice seals and walrus	8
St. Michael & Stebbins	2015	Ice seals and walrus	8
Kivalina	2016	Ice seals, walrus, bowhead whales	5
Kotzebue	2016	Ice seals	6
Shishmaref	2016	Ice seals and walrus	5
Hooper Bay	2017	Ice seals, walrus, beluga whales	11
Scammon Bay	2017	Ice seals, walrus, beluga whales	5
Mekoryuk	2017	Ice seals, walrus	7
Total 14 communities, 15 research visits	7 years over 11 year period	Focus on 7 species	110 participants

## Discussion

- All communities reported extensive changes in the physical environment including sea ice, snow, and weather.
- All communities reported changes in marine mammal distribution, migration timing, health, and behavior.
- The largest changes to hunting are reportedly the result of changes to the physical environment (i.e., marine mammal populations appear to remain healthy and stable, but more difficult to access and hunt).
- Hunters acknowledge that traditional knowledge of active hunters must be updated more rapidly now to adapt to a rapidly changing physical environment.

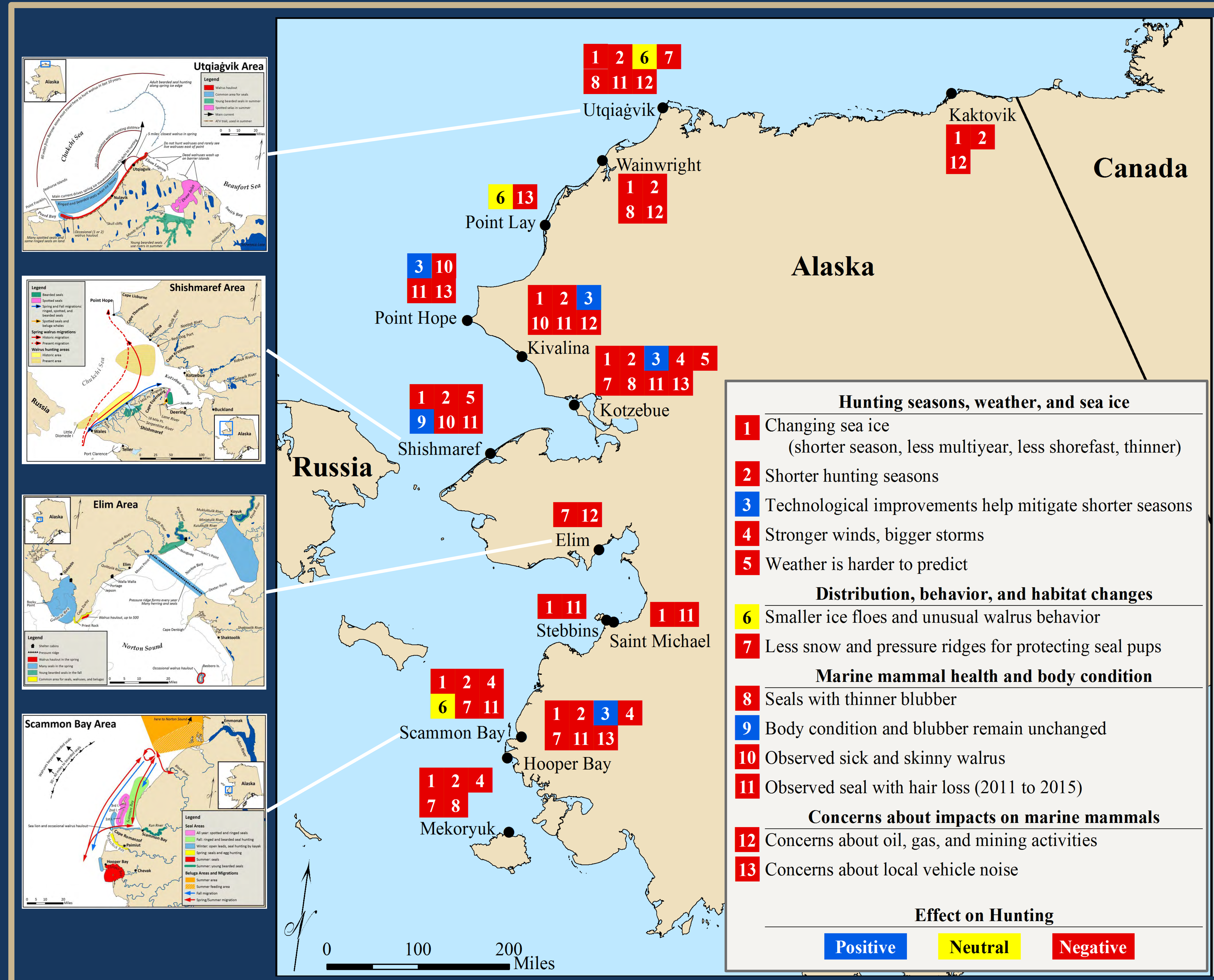


Figure 1. Map of study area and participating communities. Numbered boxes correspond to detailed observations about walruses, ice seals, and beluga and bowhead whales. Community maps at left represent the types of detailed information collected through traditional knowledge interviews. Figure is modified from Huntington et al. (2017).

## Acknowledgements

We appreciate the skill, expertise, and generosity of the 110 hunters who participated in the interviews, and the communities and Tribal Councils of Kaktovik, Barrow, Wainwright, Point Lay, Point Hope, Elim, Stebbins, St. Michael, Shishmaref, Kotzebue, Kivalina, Scammon Bay, Hooper Bay, and Mekoryuk that facilitated this work. We also thank the Alaska Eskimo Whaling Commission, the Eskimo Walrus Commission, and the Ice Seal Committee for their support and guidance. We are grateful to Justin Crawford for producing Figure 1 and to the Bureau of Ocean Energy Management, the Minerals Management Service, ConocoPhillips, and the Coastal Marine Institute for funding.

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- Huntington, H.P., Quakenbush, L.T., Nelson, M. 2017. Evaluating the effects of climate change on Indigenous marine mammal hunting in northern and western Alaska using traditional knowledge. *Frontiers in Marine Science* 4:319



## **Movements and dive behavior of young bearded seals as related to sea ice in the Pacific Arctic**

Justin A. Crawford<sup>1\*</sup>, Mark A. Nelson<sup>1</sup>, Lori Quakenbush<sup>1</sup>, Anna Bryan<sup>1</sup>, Andrew L. Von Duyke<sup>2</sup>, Merlin Henry<sup>3</sup>, Alexander Niksik<sup>4</sup>, John Goodwin<sup>5</sup>, Alex Whiting<sup>6</sup>, and Matthew Druckenmiller<sup>7</sup>

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<sup>2</sup> North Slope Borough, Department of Wildlife Management, Barrow, Alaska, 99723;

<sup>3</sup> Alaska Native seal hunter and resident of Koyuk, Alaska, 99753;

<sup>4</sup> Alaska Native seal hunter and resident of St. Michael, Alaska, 99659;

<sup>5</sup> Alaska Native seal hunter and resident of Kotzebue, Alaska, 99752;

<sup>6</sup> Native Village of Kotzebue, Alaska 99752;

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Alaska Marine Science Symposium, 22–26 January 2018, Anchorage, Alaska, USA

Bearded seals (*Erignathus barbatus*) are benthic foragers that use sea ice for pupping, nursing, molting, and resting. Decreasing sea ice associated with climate change may affect fish and invertebrate prey of bearded seals, and therefore affect seal foraging behavior. Our understanding of foraging habitats, dive behavior, and timing of movements, however, is limited. We worked with Alaska Native hunter-taggers along the Beaufort, Bering and Chukchi sea coasts to deploy satellite-linked dive recorders on 24 young (< 2 years old) bearded seals from June through November 2014–2017. Seals were tracked 10–457 days. During the open-water period seals were located in the Beaufort, Chukchi and Bering seas. As sea ice advanced in December seals moved shoreward (toward the Alaskan or Russian coast) or toward the southern ice edge in the Bering Sea. By mid-December, 11 of 13 seals were in the Bering Sea; one remained in the Beaufort Sea and one in the Chukchi Sea. During August–February seals were generally located in waters averaging 25–45 m deep. We analyzed dive behavior for 13 of the 24 seals during August–February. As sea ice advanced south (September–February), seals were located in progressively heavier ice (by concentration) with each successive month, as expected for a pagophilic seal species. When located in heavy ice (>80% concentration), all seals made proportionally fewer benthic dives (80% benthic dives) than when in marginal ice (15–80% concentration; 85%) or open water (87%;  $P<0.01$ ), and benthic dive durations were shorter in heavy (4:35 min) and marginal (4:30 min) ice than in open water (5:00 min;  $P<0.01$ ). Dive behavior also differed by time of day with proportionally fewer benthic dives at night (1900–0000; 72–78%) than during morning and afternoon (0700–1400; 90–93%;  $P<0.01$ ), however, benthic dive durations were longer at night (2100–0200; 5:30 min) than morning and afternoon (0900–1800; 4:30 min;  $P<0.01$ ). The presence and concentration of sea ice appears associated with reduced benthic foraging. Continued studies of bearded seal foraging behavior are necessary to monitor for changes in behavior with continued changes in sea ice.





# Seasonal movements, habitat use, and dive behavior of pup and yearling bearded seals in the Pacific Arctic



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<sup>1</sup>Alaska Department of Fish and Game, Fairbanks, Alaska, USA, [Justin.Crawford@alaska.gov](mailto:Justin.Crawford@alaska.gov);

<sup>2</sup>Seal hunter and resident of Kotzebue, Alaska, USA; <sup>3</sup>73-4388 Pal'iaha Street, Kailua Kona, Hawaii, USA; <sup>4</sup>Native Village of Kotzebue, Alaska, USA;

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## BACKGROUND

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## METHODS

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### MOVEMENTS AND HABITAT ASSOCIATIONS:

- We estimated daily locations using a continuous-time Correlated Random Walk (CRW) model (package *crawl* in R).
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### DIVE BEHAVIOR:

- For 13 seals instrumented with SPLASH tags, we used the CRW model to predict dive locations to match dive dates and times.
- Dives were classified as benthic if they were <5 m from the ocean floor.
- We used a repeated-measures mixed model to test for differences in:

- **Proportion of benthic dives**
- **Dive duration of benthic dives**

Variables of interest included:

- **Seal variable:** Sex
- **Time variables:** Month and time of day
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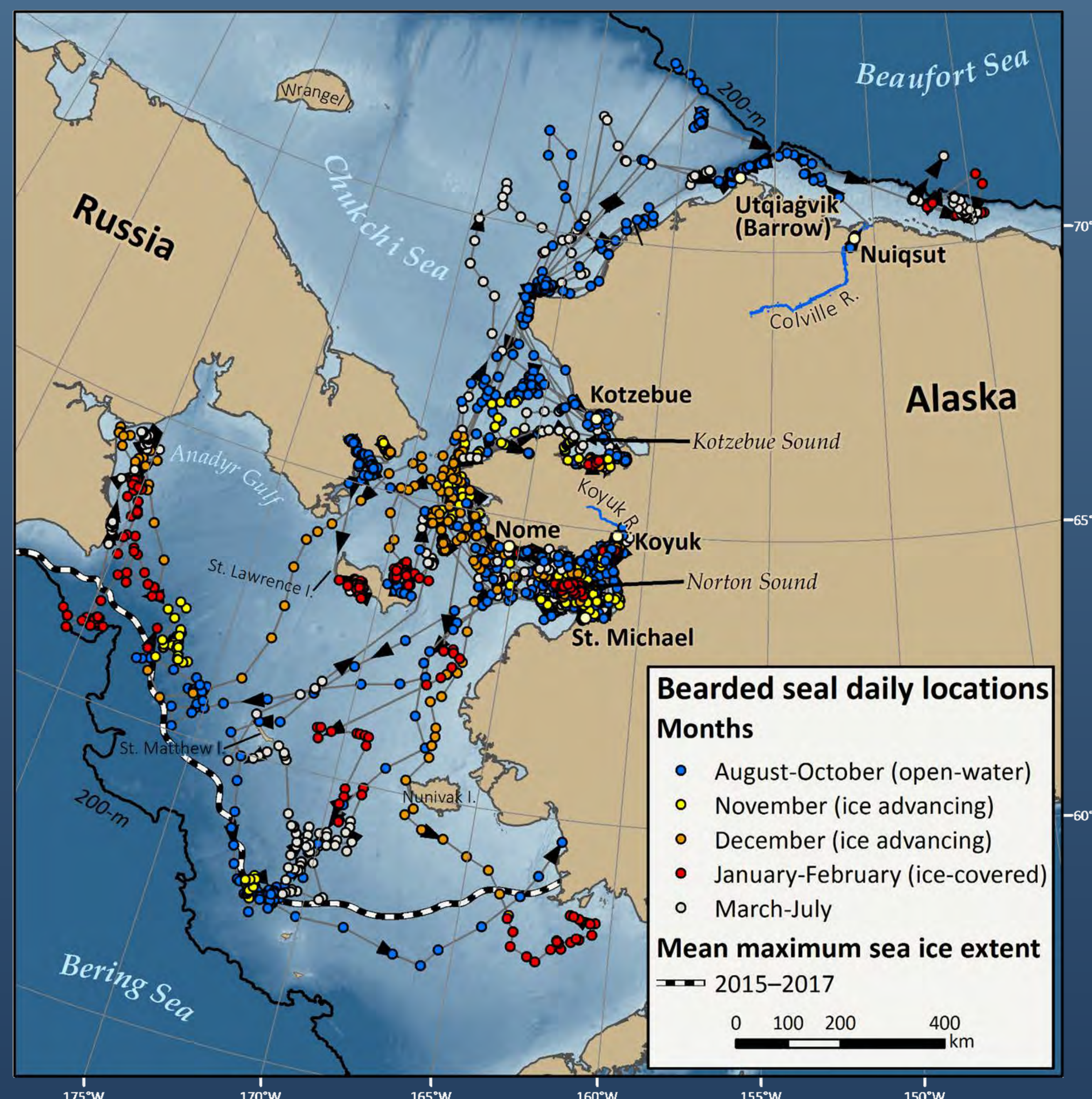
Models were fit using SAS software (PROC GLIMMIX and MIXED) and the best model was selected using AICc.

## ACKNOWLEDGEMENTS

Seal tagging projects were funded by the Bureau of Ocean Energy Management, USA and Office of Naval Research, USA. We appreciate the support of the Ice Seal Committee and assistance from the hunter-tagger crews; Morgan Henry, Alex Niksik Jr., Palsson Fitka, Stephan Horn Jr., Tom Gray, Denali Whiting, Edward Ahyakak, Frank Garfield, Henry "Boyuk" Goodwin, and Pearl Goodwin. We also thank Anna Bryan, Ryan Adam, Aaron Morris, Joe Skin, Isaac Leavitt, and Andrew von Duyke for tagging assistance. Research on ice seals was conducted under permit #15324 issued to ADFG by the National Marine Fisheries Service and under an approved ADFG Animal Care and Use Committee Protocol #2014-03, 2015-25, and 2016-23.

## RESULTS

- We deployed satellite-linked transmitters on **24 young bearded seals** from 2014–2017.
- Seals were **tracked 10–457 days**.



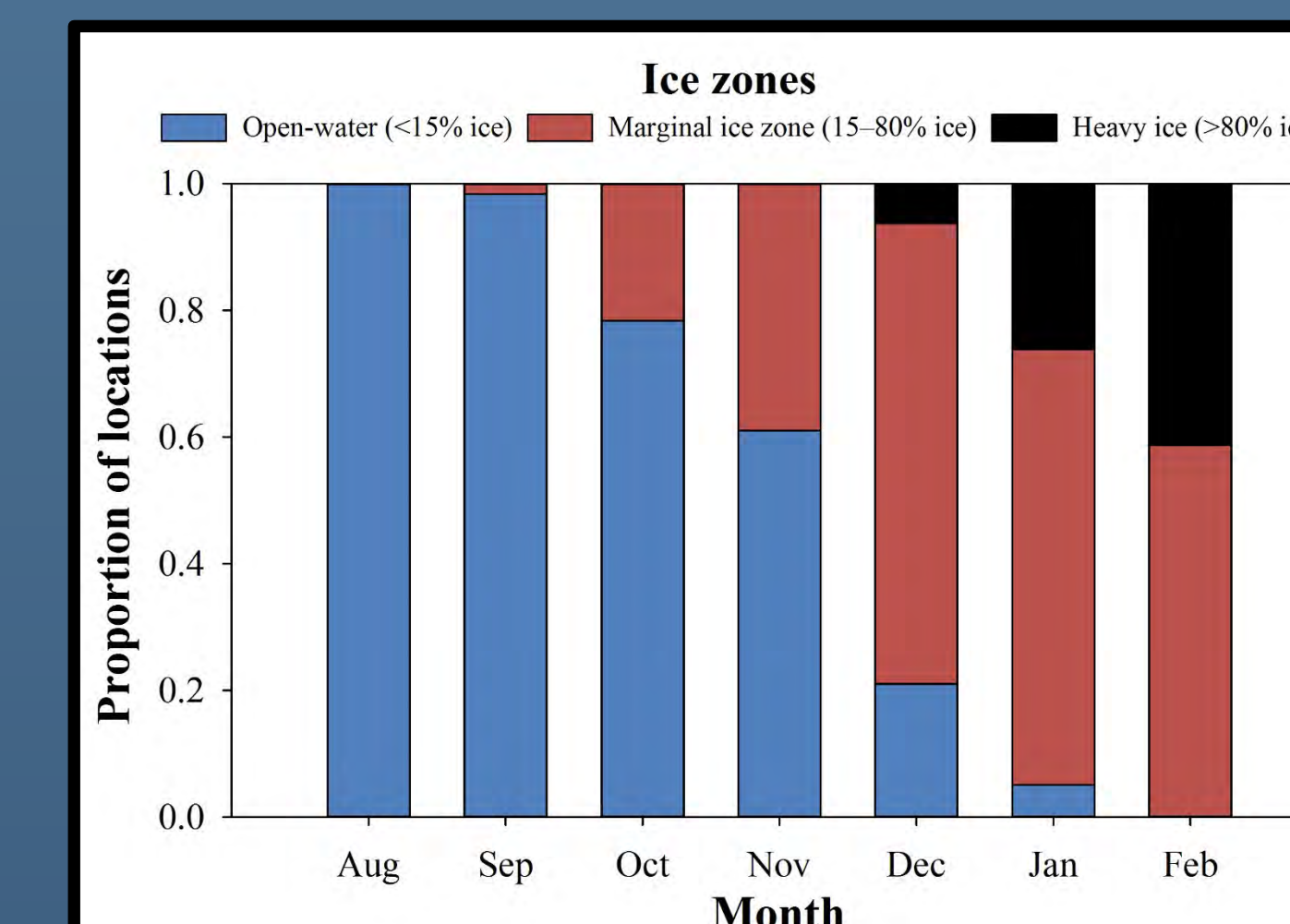
**Figure 2.** Movements of 24 bearded seals from 2014 to 2017. Seals were tagged with satellite-linked transmitters near St. Michael, Koyuk, Nome, Kotzebue, and Utqiagvik (Barrow), Alaska. Daily locations were estimated using a CRW model.



**Figure 1.** Attaching satellite-linked transmitters to captured bearded seals: a) Palsson Fitka, July 2016 and, b) Merlin Henry, and Mark Nelson (ADFG), September 2016.

## MOVEMENTS AND HABITAT ASSOCIATIONS

- As sea ice advanced south (September–February),
  - Seals moved toward coastal waters or the southern ice edge (Fig. 2).
  - Seals were **located in progressively heavier ice** (by concentration) with each successive month ( $P < 0.01$ ).
- During August–February, seals were located in waters ~25–45 m deep.

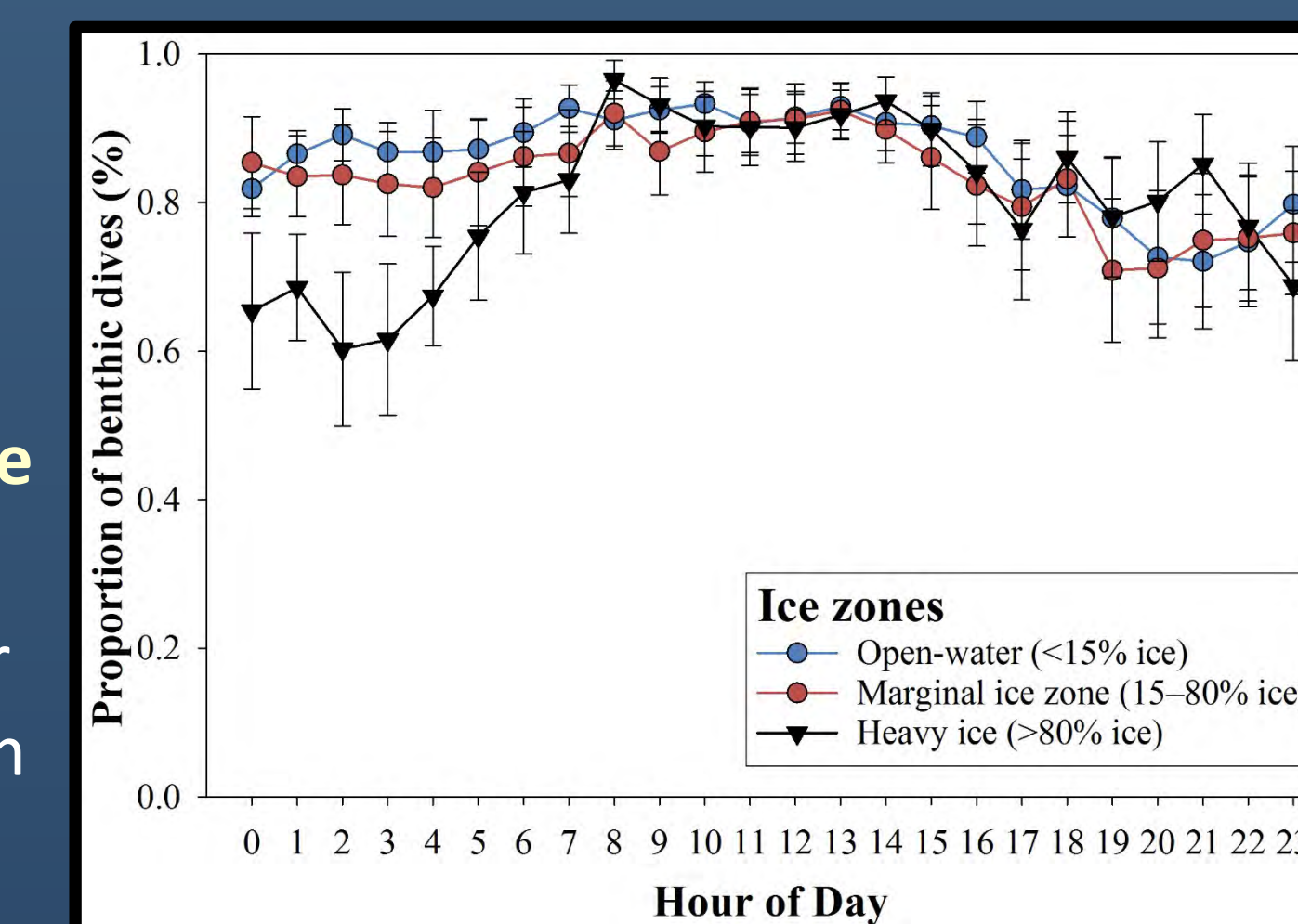


**Figure 3.** Proportion of estimated daily locations located in each ice zone by month.

## DIVE BEHAVIOR

### PROPORTION OF BENTHIC DIVES

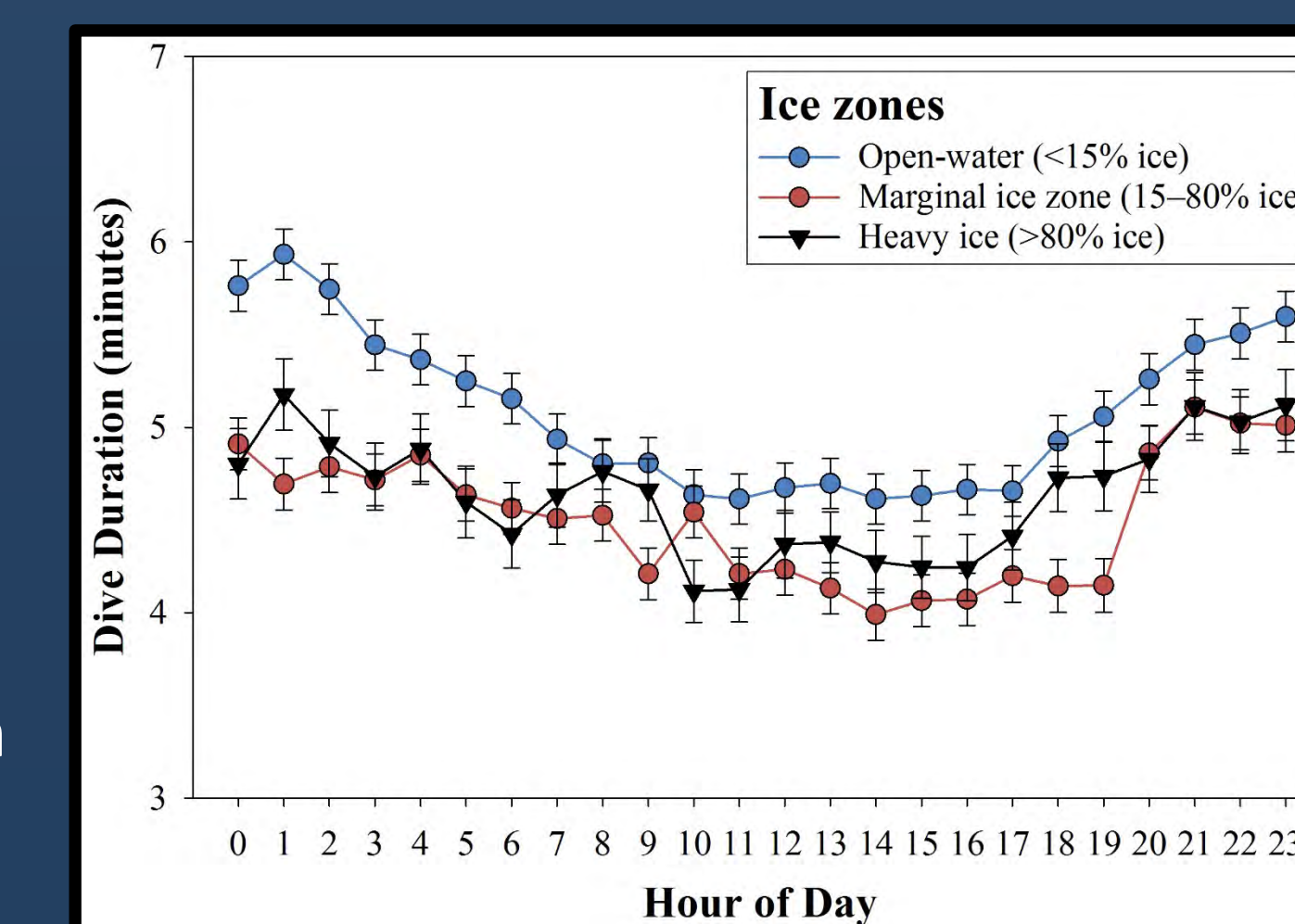
- Best model: **Ice zone X Hour + Bathymetry**
- Seal made proportionally **fewer benthic dives** from 0000–0400 when in heavy ice vs. marginal ice or open water ( $P < 0.01$ ).
- Overall, seals made proportionally fewer benthic dives from 1900–0000 than from 0700–1400 ( $P < 0.01$ ).
- Seals made proportionally fewer benthic dives in deep (50–70m; 60%) vs. shallow (0–40m; 87%) water ( $P < 0.01$ ).



**Figure 4.** Proportion of benthic dives made in each ice zone by hour of day.

### DURATION OF BENTHIC DIVES

- Best model: **Ice zone X Hour**
- Seals made **shorter benthic dives when in heavy and marginal ice** vs. open water ( $P < 0.01$ ).
- Dives were longer from 2100–0200 than from 0900–1800 ( $P < 0.01$ ).



**Figure 5.** Dive duration of benthic dives made in each ice zone by hour of day.

## SUMMARY

- In heavy ice, seals made proportionally fewer benthic dives and durations were shorter in heavy and marginal ice than in open water.
- Seals made proportionally fewer benthic dives at night, possibly in response to the vertical migration of their prey; however, durations were longer at night than the rest of the day.
- The presence and concentration of sea ice appears associated with reduced benthic foraging.
- Continued studies of bearded seal foraging behavior are necessary to monitor for changes in behavior with continued changes in sea ice.





## **Climate Change, Marine Mammals, and Indigenous Hunting in Northern Alaska: Insights from a Decade of Traditional Knowledge Interviews**

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*Alaska Marine Science Symposium, 22–25 January 2018, Anchorage AK*

Iñupiaq, Yup'ik, and Cup'ik hunters in 14 Alaska Native communities described a rapidly changing marine environment in qualitative traditional knowledge interviews conducted over the course of a decade with 110 individuals. Based on their observations, sea ice conditions are the most notable change, with later freeze-up, thinner and less reliable ice, and earlier and more rapid break-up. Marine mammal populations in northern and western Alaska have been affected by changes in the physical environment, with alterations to migratory timing and routes, distribution, abundance, health, and behavior. Despite these changes, marine mammal populations in the region remain generally healthy and abundant. For hunters, access is the biggest challenge posed by changing conditions. Sea-ice is less safe for travel, particularly for more southerly communities, making hunting more dangerous or impossible. Rapid break-up has reduced the time available for hunting amid broken ice in spring, formerly a dependable and preferred season. Social change also affects the ways in which hunting patterns change. Increased industrial development, for example, can also alter marine mammal distribution and reduce hunting opportunity. Reduced use of animal skins for clothing and other purposes has reduced demand. More powerful and reliable engines make day trips easier, reducing the time spent camping. An essential component of adjustment and adaptation to changing conditions is the retention of traditional values and the acquisition of new information to supplement traditional knowledge. Our findings are consistent with, and add detail to, what is known from previous traditional knowledge and scientific studies. The ways in which hunters gather new information and incorporate it into their existing understanding of the marine environment deserves further attention, both as a means of monitoring change and as a key aspect of adaptation. While the changes to date have been largely manageable, future prospects are unclear, as the effects of climate change are expected to continue in the region, and ecological change may accelerate. Social and regulatory change will continue to play a role in fostering or constraining the ability of hunters to adapt to the effects of climate change.

**Seasonal movements and high-use areas of spotted seals (*Phoca largha*) in the Pacific Arctic.**

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*Alaska Marine Science Symposium, 28 January–1 February 2019, Anchorage AK*

Spotted seals (*Phoca largha*) are pelagic foragers that use Bering Sea pack ice for pupping, nursing, and resting when ice is present (December–June) and nearshore habitats for resting during the open-water season (July–November). Warming of Pacific Arctic waters associated with climate change may affect fish and invertebrate prey of spotted seals, and therefore affect their foraging behavior. Decreases in the extent of sea ice and lengthening of the open-water season have eased access to the Arctic for development and shipping, prioritizing the need to identify areas important to seals. Our understanding of movements and foraging habitats of spotted seals, however, is limited. We worked with Alaska Native hunter-taggers along the Beaufort and Bering sea coasts to deploy satellite-linked tags on 24 spotted seals from July through September 2016–2018 to study movements and habitat use. Individual seals were tracked 137–443 days. During the open-water season, the movements and behavior of seals tagged in the Beaufort (Dease Inlet and Colville River) and Bering (Scammon Bay) seas differed. Seals tagged in the Beaufort Sea made frequent east-west movements between foraging areas in the Chukchi Sea and the Alaskan coast, including their tagging locations, often resting on islands near Icy Cape, Peard Bay, and Dease Inlet. The primary foraging area was between Herald Shoal and nearshore waters of the northeast Chukchi Sea (<50 m deep). Seals tagged in the Bering Sea also made frequent east-west movements, here between foraging areas in the central Bering Sea and the Alaskan coast, often resting on islands near Scammon Bay. The primary foraging area was between St. Lawrence Island and St. Matthew Island (<60 m deep). In December, seals tagged in the Beaufort Sea moved south, ahead of the advancing pack ice. By mid-January, all seals regardless of tagging location occupied pack ice and foraged in the central Bering Sea. These results show the importance of regionally spaced tagging locations to understanding movements and habitat use throughout the Pacific Arctic. Continued studies of seal movements will be necessary to monitor for changes in behavior with continued changes in climate and development activities.



# Seasonal movements and high-use areas of spotted seals (*Phoca largha*) in the Pacific Arctic

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BUREAU OF OCEAN ENERGY MANAGEMENT



## BACKGROUND

Spotted seals (*Phoca largha*) are pelagic foragers that use Bering Sea pack ice for pupping, nursing, and resting when ice is present and rest on shore during the open-water season. Warming of Pacific Arctic waters associated with climate change may affect fish and invertebrate prey of spotted seals, and therefore affect their foraging behavior. Decreases in the extent of sea ice and lengthening of the open-water season have eased access to the Arctic for development and shipping, prioritizing the need to identify areas important to seals. Our understanding of movements, high-use areas, and foraging habitats of spotted seals is limited. Therefore, we worked with Alaska Native hunter-taggers along the Beaufort and Bering sea coasts to deploy satellite-linked transmitters on spotted seals from July through October 2016–2018 to describe movements and identify high-use areas.

## METHODS

- We worked with seal hunters to capture spotted seals in entanglement nets and instrument them with satellite-linked transmitters.
  - SPLASH** (Wildlife Computers, USA) or **CTD tags** (Sea Mammal Research Unit, Scotland) were glued to the hair on their mid-dorsum.
  - SPOT tags** (Wildlife Computers, USA) were attached to a rear flipper.
- MOVEMENTS:**
  - We used location data collected by all SPLASH, CTD, and SPOT tags.
  - We estimated daily locations for all tagged seals using a continuous-time Correlated Random Walk (CRW) model (package *crawl* in R).
  - We evaluated movements of seals based on:
    - Season:** Open-water (May–November) and Ice (December–April).
    - Tagging area:** Beaufort and Bering seas.
- HIGH-USE AREAS:**
  - We identified high-use (core) areas based on the density of daily estimated locations within 50×50 km square cells across our study area. The volume rasters calculated are utilization distributions (UD).
  - UDs were calculated for:**
    - Season,**
    - Tagging area, and**
    - Distance from shore:**
      - Offshore (>5 km): associated with foraging
      - Nearshore (<5 km): associated with resting and foraging
        - Haul-out data collected by tags informed identification of resting areas.
  - We considered **core areas** to be cells with UD of <50% volume.



Spotted seal instrumented with a CTD tag, 2016.

## RESULTS

- We deployed satellite-linked transmitters on **24 spotted seals** from 2016–2018 (4 SPLASH, 20 CTD, and 24 SPOT tags).
- Seals were **tracked 137–443 days**.

## OPEN-WATER SEASON MOVEMENTS



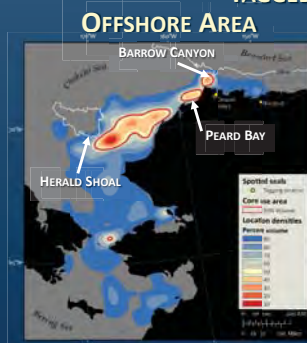
- All seals made **frequent east-west movements** between foraging areas and the Alaskan coast, including returning to tagging locations.
- Seals **tagged in the Beaufort Sea** moved between foraging areas in the Chukchi Sea and the Alaskan coast.
- Seals **tagged in the Bering Sea** moved between foraging areas in the central Bering Sea and the Alaskan coast.
- Seals rarely moved between the Bering and Chukchi seas.

## ICE SEASON MOVEMENTS



- In December, seals **tagged in the Beaufort Sea** moved south, ahead of the advancing pack ice.
- By mid-January, **all seals** regardless of tagging location occupied pack ice and foraged in the central Bering Sea.

## HIGH-USE AREAS TAGGED IN BEAUFORT

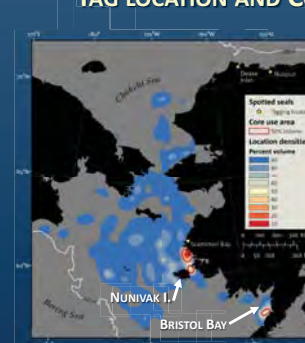


The primary foraging area was between Herald Shoal and nearshore waters of the northeast Chukchi Sea (<50 m deep).



Resting areas primarily included islands near Icy Cape, Dease Inlet and Kotzebue Sound.

## HIGH-USE AREAS TAG LOCATION AND COASTAL PROXIMITY POOLED



- When sea ice was present, seal high-use areas overlapped regardless of tag location and distance from shore.
- Seals foraged and rested primarily near Nunivak Island and the Alaska coast.
- Low sea ice in the Bering Sea in recent years may be limiting spotted seals from using the central Bering Sea.

## SUMMARY

- Spotted seals in the Chukchi and Bering seas made frequent east-west foraging movements, rested on shore, and rarely moved between seas during the open-water season.
- Movement patterns we identified highlight the importance of tagging seals in multiple regions annually to understand movements and habitat use throughout their range.
- Continued studies of seal movements will be necessary to monitor for changes in behavior with changes in climate and development activities.

## FUTURE WORK

- Examine how seal high-use areas are influenced by oceanographic characteristics and sea ice.

## ACKNOWLEDGEMENTS

Seal tagging projects were funded by the Bureau of Ocean Energy Management, USA and Office of Naval Research, USA. We appreciate the support of the Ice Seal Committee and assistance from the hunter-tagger crews; Morgan Simon, River Simon, Al Smith, Wybon Rivers, Verron Long, and Richard Tukle. We also thank Ryan Adam, Isaac Leavitt, Aaron Morris, Justin Olnes, and Joe Skin and for tagging assistance. The National Oceanic and Atmospheric Administration, Marine Mammal Laboratory provided 8 flipper (SPOT) tags. Research on ice seals was conducted under permits 15324 and 20466 issued to ADFG by the National Marine Fisheries Service and under an approved ADFG Animal Care and Use Committee Protocol: 2016-23, 0027-2017-27, 0027-2018-29.



**Oceanographic characteristics associated with movements and high-use areas of spotted seals (*Phoca largha*) in the Chukchi and Bering seas.**

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*23<sup>rd</sup> Society of Marine Mammalogy and 2<sup>nd</sup> World Marine Mammal Joint Conference, 9–12 December 2019, Barcelona, Spain*

Spotted seals (*Phoca largha*) are pelagic foragers that use seasonal pack ice for pupping, nursing, and resting when ice is present (December–June) and coastal haulout sites for resting during the open-water season (July–November). Decreases in the extent and duration of ice cover associated with climate change have eased access to the Arctic for development and shipping, prioritizing the identification of areas important to seals. We worked with Alaska Native hunters to deploy satellite-linked tags on 24 spotted seals (including 20 CTD tags) in nearshore areas of the Beaufort and Bering seas during 2016–2018 to study movements and identify high-use areas. Individual seals were tracked for 137–638 days. Seals tagged in the Beaufort Sea moved into the Chukchi Sea and made recurrent east-west movements, spending 1–27 days foraging near Herald Shoal, primarily in warm Alaskan Coastal Water, and 0.1–5.7 days resting on coastal islands. Seals tagged in the Bering Sea also made recurrent east-west movements, spending 1–25 days foraging in the central Bering Sea, primarily between St. Lawrence Island and St. Matthew Island in Alaskan Coastal Water and Bering Shelf Water, and 0.03–6.2 days resting on coastal islands. In December, seals in the Chukchi Sea moved south, ahead of the advancing pack ice, into the Bering Sea. By mid-January, all seals regardless of their tagging location foraged along the pack ice edge in the central Bering Sea. CTD data will be used to identify oceanographic characteristics of the high-use foraging areas. Tagging seals in both the Beaufort and Bering seas allowed us to identify spotted seal movements and high-use areas throughout the continental shelf. Further studies that include additional tagging locations will likely identify other important foraging and resting areas.