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 Itiipaqaq 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, walruses, 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.

### 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 retrieving 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).
- Walruses are hauling out on land near Point Lay by the tens of thousands. Walruses 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.

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### References