U.S. Fish & Wildlife Service

Polar Bears

An Improved Framework for Harvest Management

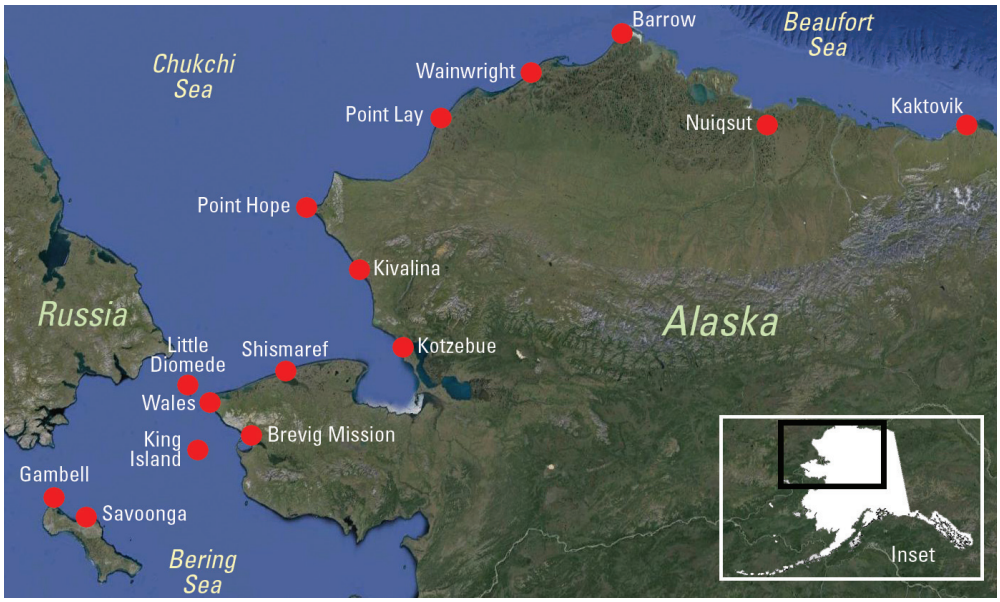
Climate change is having widespread ecological effects, including loss of Arctic sea ice. This has led to listing of the polar bear (*Ursus maritimus*) and several other ice-dependent marine mammals under the U.S. Endangered Species Act (ESA).

To inform planning and management for listed species, improved methods are needed to evaluate the effects of climate change on population status. For polar bears, this includes understanding interactions between climate and other factors such as subsistence harvest.

Polar bears are important as an economic, nutritional, and cultural resource for Inuit peoples around the Arctic. In the U.S., the Marine Mammal Protection Act allows Alaska Natives to harvest polar bears for subsistence purposes including making and selling handicrafts. Maintaining opportunities to harvest polar bears for many future generations is a fundamental goal of polar bear management.

With sea ice loss, polar bears in some parts of Alaska are spending more time on shore. This increases the potential for human-bear conflicts, which can result in bear mortalities. Ensuring human safety and reducing such conflicts is another goal of polar bear management.

In the 21st century, both the short- and long-term challenges of climate change will affect polar bear management and raise difficult questions. For example—is it possible to manage human-caused removals (i.e., the combination of subsistence harvest, defense kills, and other mortalities) in a way that does not have a negative effect on population status, and affords the best-possible chances of maintaining opportunities for subsistence harvest? A new population model suggests the answer is yes, if certain conditions are met and if an improved framework for management is followed.



Polar bears are an important part of the cultural and nutritional traditions of Inuit peoples around the Arctic. In Alaska, polar bears are harvested by community members in 15 coastal villages in the Bering, Chukchi and southern Beaufort seas. Harvests in the southern Beaufort Sea are managed under a Native-Native agreement between the Inuvialiut of Canada and the Inupiat of Alaska. Harvests in the Chukchi Sea are managed under a bilateral treaty with Russia. Co-management groups in both regions are well-positioned to use the management framework presented here, to ensure that subsistence harvest does not have a negative effect on population status as the loss of Arctic sea ice continues.

A New Population Model for Polar Bears

Understanding the population dynamics of polar bears can help identify the factors most important to management and long-term persistence. To this end, the U.S. Fish and Wildlife Service and the U.S. Geological Survey created a new, more detailed model for how polar bear populations work. This model includes the effects of population density (e.g., that reproduction may decline under crowded conditions), sex- and age-specific harvest vulnerabilities (e.g., that subsistence harvests select for male bears, and that young bears are most likely to be killed in human-bear conflicts), and the potential for declining population growth rates or environmental carrying capacity resulting from sea-ice loss (see Regehr et al. 2015).

These advances allowed the model to be used to answer the challenging questions posed by recovery planning for a species facing significant habitat loss from climate change and for which maintaining opportunities for subsistence harvest is an important goal.

Female polar bear with three yearlings in the Chukchi Sea. Monitoring the number of females with yearlings in a population is one way to track population status. USFWS/ Eric Regehr

Polar bear family group, Prudhoe Bay, Alaska. With sea ice retreating from the Alaska coast during summer, more polar bears are found on land, increasing opportunities for interactions with people and infrastructure. Proactive management is necessary to avoid increases in defense-of-life kills.

An Improved Framework for Harvest Management Under Climate Change

An improved framework for managing human-caused removals was developed by linking the new population model to the following factors: (1) changing sea ice conditions, to reflect potential future loss of the polar bear's sea-ice habitat; and (2) simulated population assessments, to reflect the infrequent and imprecise population data that is often collected in the real world. These developments resulted in a more realistic "state-dependent" management framework, which uses updated information on the status (or "state") of a population to make better decisions about management of the population. Such a framework is important to future polar bear management because conditions will change for polar bears over the long-term as sea ice continues to decline.

The new population model was used to estimate the maximum net productivity level (MNPL) for polar bears. MNPL refers to the size of a harvested population, relative to the carrying capacity of the environment, at which the population produces the largest surplus of animals that can be removed each year (e.g., for subsistence harvest).

After estimating MNPL, the state-dependent management framework was used to calculate a *sustainable harvest rate* that maintains populations above their MNPL and does not have a negative effect on population status. The value of this rate depends on management objectives (i.e., whether managers want more or less bears on the landscape), the precision and frequency of population data, and risk tolerance (i.e., how much risk managers are willing to accept that a population level might fall below its MNPL or below some other, undesirable level). In general, the historical standard 4.5-percent harvest rate for polar bears, at a 2:1 male-to-female ratio, was found to be reasonable under many biological and management conditions, although lower or higher rates may be appropriate in some cases.

Polar bear hide drying. Kaktovik, Alaska.

Important Considerations for Polar Bear Harvest Under Climate Change

The new population model and state-dependent management framework suggest that harvest of polar bears is unlikely to accelerate population declines that may result from declining carrying capacity caused by sea-ice loss, provided that several conditions are met: (1) the sustainable harvest rate reflects the population's intrinsic growth rate, and the corresponding harvest level is obtained by applying this rate to an estimate of population size; (2) the sustainable harvest rate reflects the quality of population data (e.g., lower harvest when data are poor); and (3) the level of human-caused removals can be adjusted. Additional reduction measures may be necessary if environmental conditions are deteriorating rapidly. An important condition is having up-to-date population metrics (e.g., survival and reproductive rates) and a precise estimate of the number of bears removed for harvest, defense of life, or other reasons. Applying this knowledge within the state-dependent framework can help meet the goals of continued subsistence harvest and cooperative management under the new challenges of climate change.

Reference

Regehr, E.V., Wilson, R.R., Rode, K.D., and Runge, M.C., 2015, Resilience and risk—A demographic model to inform conservation planning for polar bears: U.S. Geological Survey Open-File Report 2015-1029, 56 p., http://dx.doi.org/10.3133/ofr20151029.

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