

## **Pribilof Islands Collaborative**

### **Consensus Statement on Northern Fur Seal Research Priorities**

Recognizing the urgency to address the declines of northern fur seal populations in the Bering Sea, the Pribilof Islands Collaborative (PIC) has carefully considered the current state of both traditional and formal scientific knowledge about the status of the northern fur seal and the factors that could have contributed to its dramatic declines over the past several decades. The participation of scientists from the Alaska Fisheries Science Center, National Marine Mammal Lab and various universities was instrumental in helping the PIC to understand the nature of key data gaps and agree on the following set of core questions and related research priorities. The PIC recognizes that it is the researchers, not the PIC, who are best suited to developing the details of specific research projects. The following recommendations therefore focus on identifying broad areas where better information would greatly improve our ability to distinguish among competing hypotheses for explaining the causes of the northern fur seal declines.

Overall, the PIC agreed on the following general conclusions from a review of the available science:

- There have been substantial declines in the northern fur seal population, stretching over several decades
- While there are several candidate hypotheses for explaining these declines, our understanding at this point is insufficient to understand which play a prominent role
- The available data suggest that several factors are likely contributors to the declines, but are insufficient to identify any single factor as a predominant cause of the declines.

There are five core questions that should motivate and organize research responses:

1. What is the effect of changes in ecosystem state in the Bering Sea and North Pacific Ocean on the northern fur seal population and on the system's overall carrying capacity of the northern fur seal?
2. What are the historic and contemporary effects of predation by killer whales and other predators, on the northern fur seal population?
3. What are the effects of commercial fishing activity in proximity to the Pribilof Islands on the northern fur seal population?
4. What is the effect of historic and commercial fishing activities in the North Pacific Ocean and Bering Sea on the northern fur seal population?
5. What is the effect of other human activities on the northern fur seal population?

Given the large geographic extent of the fur seal's range, the sustained population declines, now decades-long in length, and the fact that time lags in large, complex ecosystems are often important, research efforts should encompass the northern fur seal's entire range and address the historical patterns both of northern fur seal abundance and of the factors that could have caused or contributed to its declines.

The alternative hypotheses for explaining the fur seal's declines, as reflected in the five core questions, all yield predictions about where in the fur seal's life history different kinds of impacts or stresses would most likely occur. For example, poor conditions in the North Pacific (Questions 1 and 4) would potentially be reflected in lower survival rates of juveniles at sea,

while competition with commercial fishing activities around the Pribilof Islands for key prey species (Question 3) would potentially be reflected in higher pup mortality rates and/or reduced pup weights at the end of the breeding season, or in reduced fecundity over time. The PIC recommends that the complete set of alternative hypotheses be explicitly spelled out, along with the indicators relevant to each. This would provide helpful guidance both for planning and coordinating future research and for evaluating data as they become available.

Several major research priorities appear to be of primary importance. These include improved knowledge about:

- 1) Age-specific reproduction and survival rates across all age classes. This would help identify where in the northern fur seal's life history major stresses occur and determine whether these are due to changes in ecosystem carrying capacity or human activity.
- 2) Foraging behavior, diet preferences, and nutritional requirements for all age classes and throughout the entire year. This would clarify the nature and importance of competition for prey with commercial fishing, as well as the role of changes in prey populations driven by shifts in ocean climate.
- 3) Late-season pup condition on the Pribilof Islands, just prior to their departure for sea. This would help determine whether sources of stress on the northern fur seal population are more likely to occur around the Pribilof Islands or at sea in the North Pacific.
- 4) The location and magnitude of predation, particularly by killer whales. This would help resolve whether trends in the northern fur seal population are being driven by top-down or bottom-up mechanisms.
- 5) Whether comparisons inherent in the current system (for example, including- but not limited to- comparisons between rookeries and islands with different foraging patterns and prey bases, between rookeries and islands with differing trends in northern fur seal population size) can act as natural experiments to distinguish among alternative hypotheses and help lay the groundwork for the possible future use of directed adaptive management experiments.
- 6) Continue monitoring of mortality rates due to entanglement in marine debris. This would help determine the role of this source of mortality in the northern fur seal's declines.
- 7) The relationships between shifts in ocean climate and the range of factors that may have caused or contributed to the northern fur seal's declines.
- 8) Adaptive or experimental management approaches and designs that would be most appropriate.

The PIC believes that these research priorities, if addressed in a coordinated fashion, would furnish the information needed to isolate the causes of the northern fur seal declines, thereby providing the basis for more effective planning, management, and remediation.