In Summary...

The Decline of the Steller Sea Lion in Alaskan Waters

Untangling Food Webs and Fishing Nets

Photo by Rolf Ream, courtesy NOAA/NMFS/NMML

Steller sea lions live in the North Pacific with about 70% living in Alaskan waters. The number of Steller sea lions in Alaskan waters has dropped by more than 80% in the past three decades. The decline resulted in their protection under the Endangered Species Act (ESA) since 1997 for the population west of Cape Suckling. A precipitous population decline from 1985-1990 – about a 15.6% decrease per year - indicated that Steller sea lions were subject to a threat that spurred the decline but had ended or abated by the 1990s. Since the early 1990s (through 2001), the population has continued to decrease but at a more gradual rate of 5.2% annually and individual rookeries show different population trends.

BACKGROUND

Under the ESA, federal agencies must ensure that actions they authorize are not likely to jeopardize the survival or recovery of protected species or damage the protected species' critical habitat. This requirement has made it imperative to identify human activities that may contribute to the decline of Steller sea lions so that regulatory actions can be adjusted to address threats to the western population's survival. In response to a request from Congress, the North Pacific Fishery Management Council asked the National Academies to examine possible causes of Steller sea lion decline and the potential efficacy of new management measures.

HYPOTHESIZING CAUSES OF DECLINE

The several hypotheses that attempt to explain the decline of the sea lions can be divided into two categories. The "bottom-up" hypotheses include potential causes that would limit the amount or quality of food available to the sea lions such as: 1) Large scale fishery removals reducing the availability or quality of prey species 2) A climate/regime shift changing the abundance or distribution of prey 3) Non-lethal disease and 4) Pollutants contaminating fish eaten by sea lions.

"Top-down" hypotheses encompass factors that kill sea lions independently of the capacity of the environment to support the sea lion population. These include: 1) Predator switching by killer whales (or sharks) to target sea lions, 2) Increasing incidental take (or disturbance) through capture or entanglement in fishing gear, 3) Subsistence harvesting of sea lions taking more than estimated, 4) Underestimation of sea lion shooting, and 5) Increasing mortality from pollution and disease, independent of nutrition.

Existing data on the current phase of decline indicate that bottom-up hypotheses resulting in food limitation are unlikely to represent the primary threat to Steller sea lion recovery. Although no hypotheses can be excluded based on existing data, top-down sources of mortality appear to pose the greatest threat to the current population. It is important to remember that a combination of both types of factors may contribute to the decline. Also, geographic variation may mean that different factors are responsible for mortality in different parts of the sea lions' range.

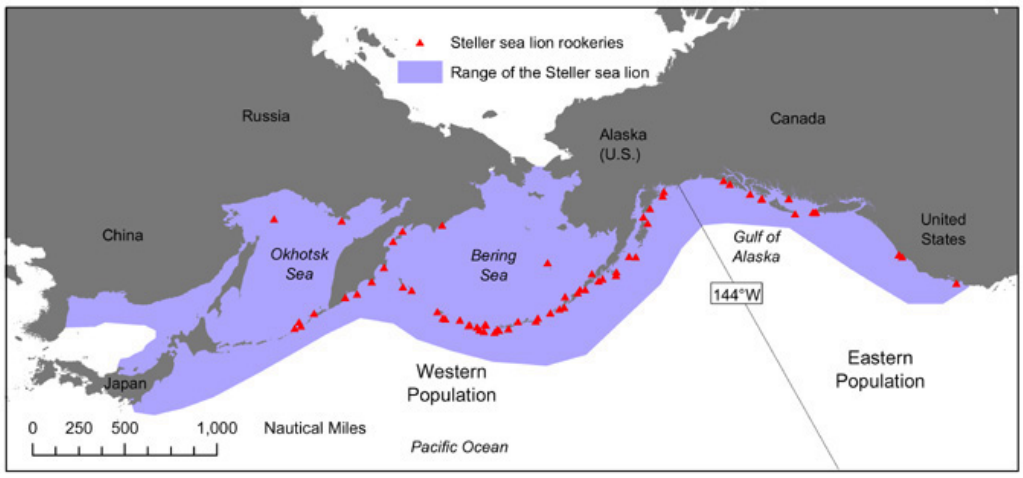

Figure 1. The range (in blue) and rookeries (in red) of Steller sea lions. 144° W defines the boundary between the eastern and western populations. Source: National Marine Fisheries Service, Alaska Fisheries Science Center.

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THE NEED FOR EVIDENCE

Although most evidence indicates that groundfish fisheries are not depleting the food resources necessary to sustain the current western population of sea lions, there is insufficient evidence to fully exclude fisheries as a contributing factor to the decline. Sea lions may get ensnared in fishing gear because of the ample food available around fishing operations. Attraction of killer whales to these same vessels could increase the vulnerability of sea lions to predation. **Investigations of top-down sources of Steller sea lion mortality should be increased to evaluate the proportionate impact of these factors on population decline.**

MONITORING AND MANAGEMENT

The report recommends using adaptive management to uncover the effect of the fisheries on Steller sea lion survival. Because of potential interference of the Alaska groundfish fisheries with the recovery of endangered Steller sea lions, the fisheries have been increasingly restricted as the sea lion population has continued to decline. In an adaptive management experiment, the western population could be divided into several treatment units, with "closed" and "open" areas centered on rookeries. The "closed" areas would be subject to local closures and the "open" areas would have all fishery restrictions related to Steller sea lions removed.

The approach is germane to the problem because it directly tests the involvement of the fishery in the decline and reduces the possibility that regulation of the fishing industry is perpetuated without demonstrable benefit to the Steller sea lion population. The removal of all sea lion-related fishing restrictions in the open areas creates opportunities for the industry and provides a contrasting management treatment necessary for comparison with closed areas. The approach controls for changes that are unrelated to fishing, such as ecological effects related to climate variability.

Research and monitoring should be directed towards measuring the vital rates and response variables most indicative of the status of the Steller sea lion population, including:

Population trends. The current program for monitoring the juvenile and adult population by aerial survey should be continued along with the direct pup counts at selected rookeries.

Vital rates. Vital rates, last measured in the mid-1980s, urgently require updating. Measurements should include fecundity, age at first reproduction, age distribution, juvenile survival, adult survival, and growth rates.

Critical habitat. The telemetry program on at-sea distribution of sea lions and related foraging activity used to define critical habitat should be expanded to more areas. Stomach telemetry tags that monitor temperature shifts associated with ingestion of prey should improve correlations of at sea distribution with feeding. The activity and impacts of fisheries should be documented, including studies to determine if fisheries cause localized depletion of the various groundfish stocks.

Environmental monitoring. Assessment of various ecological features of the sea lion environment will provide a broader context for evaluating sea lion population trends, including assessments of oceanographic conditions, plankton composition, forage fish abundance and distribution, and monitoring of harmful algal bloom frequency.

Predator feeding habits and population size. Much more information is necessary to evaluate the impact of predation. Better estimates of killer whale diet, population size and distribution throughout Alaska are required to estimate potential predation mortality, and observer programs should be instituted to record killer whale feeding behavior in different regions.

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