February 25, 2002

Program Office
Attn: Shawn P. Carey
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802-1668

Dear Mr. Carey:

Please find enclosed the Interim Progress Report for my project, NOAA award # NA16FX1433, SSLRI Project #31.

Sincerely,

Richard E. Thorne
Project Principle Investigator

cc: Penny Oswald, PWSSC

Interim Progress Report

A. **Project Identifiers**

1. Award Number: NA16FX1433
2. Grant Program Number: SSLRI Project 31
3. Recipient Organization:Prince William Sound Science Center
4. Principal Investigator: Richard E. Thorne
5. Project Title: Evaluation of Changes in the Foraging Behavior of Steller Sea Lions in Response to Precipitous Declines of the Herring Population in Prince William Sound
6. Funding: Federal $220,000
7. Award Period: August 1, 2001 to September 30, 2002
8. Period Covered by this Report: August 1, 2001 to January 31, 2002

B. **Project Summary**

Central to the controversy over the declines in the Steller sea lion (*Eumetopias jubatus*) population in Alaska is the assumption that fishery competition for prey jeopardizes population recovery, and that the primary prey is pollock, a hypothesis that we refer to as the "pollock-limited" hypothesis. In contrast, there is evidence that sea lions and other piscivorous predators in the Gulf of Alaska need fat-rich prey, such as herring and capelin, in their diet to prosper and grow. Furthermore, we have direct evidence in Prince William Sound that Steller sea lions specifically target and may prefer herring during the extended winter season in the North Gulf of Alaska. This has lead us to propose an alternative, the "herring limited hypothesis" as a focus of new research on Steller sea lions.

It is very difficult to reconstruct the events of the 1960's and 1970s with regard to impacts of herring declines, regime shifts and pollock abundance on the Steller sea lion populations. There is evidence to suggest that climate change has influenced the availability of herring and other fat-rich, near-shore fishes, but these data are also seriously confounded by the impact of historical commercial fishing practices. Our research has shown that current age-structure-based management estimates of herring biomass can be off by a factor of six fold, so at times the herring stocks could be seriously over-fished. This finding suggests that the impact of fishery competition for herring, not pollock, is a viable alternate hypothesis to the present pollock-limited concept. The fact that the commercial catches of herring before 1960 were in excess of what we see in total biomass today suggests that herring was once the dominant near-shore species in the Gulf of Alaska. Historical data show that sea lion and seabird populations thrived during the periods of high herring abundance. Before the commercial fisheries, the Alaska Natives referred to herring as "the grass of the sea." In contrast, pollock has not suffered the population demise of the herring and is still at a relatively high availability as prey.

Despite the difficulty of retrospective analysis of an inadequate database, there are elements of the current Steller sea lion foraging behavior and herring/pollock population trends in Prince William Sound that are instructive. The Steller sea lion population has

declined at a rate of 21% per year since 1990, the most precipitous decline of any population in the past decade. This decline parallels precipitous declines in the Prince William Sound herring population. Highly accurate estimates of both pollock and herring in Prince William Sound have been made by the Prince William Sound Science Center in cooperation with ADF&G for six and nine years respectively. Previous estimates, based on age composition and spawn deposition, indicate a much larger herring population prior to 1993. The Prince William Sound Science Center has also conducted quantitative aerial survey and boat survey estimates on Steller sea lion and other marine mammal populations for the past two years. This information has shown that the Steller sea lion population targets herring during the winter rather than pollock.

The magnitude of the herring population decline over the past decade in Prince William Sound is about fifty-fold. The total current adult herring biomass is on par with estimates of previous over-winter mortalities. Preliminary evidence from 2001 winter surveys suggests a change in Steller sea lion foraging behavior from previous years, reflecting a lack of concentrated adult herring biomass. If the trends of the last three years continue, the Steller sea lion population in Prince William Sound may undergo a winter foraging crisis similar to what may have happened historically in the Gulf of Alaska and Bering Sea.

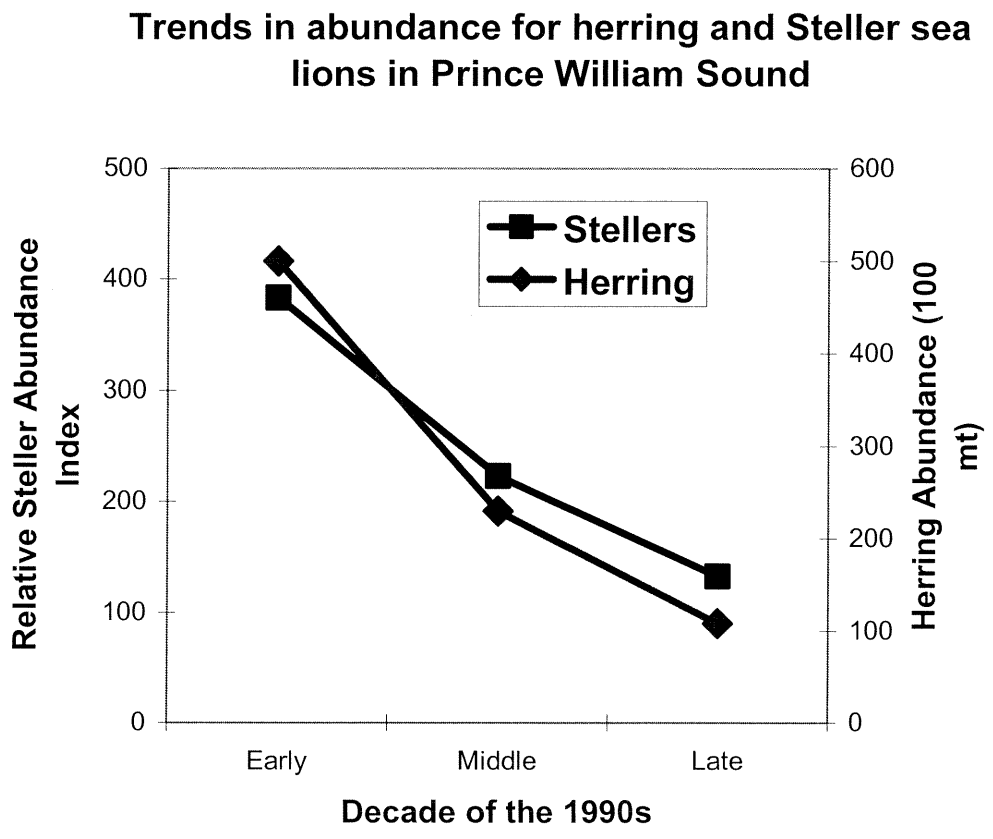
The Oil Spill Recovery Institute funds a single annual survey of adult herring and pollock in Prince William Sound during winter/spring 2001. Anecdotal evidence suggests that Steller sea lions rely on herring during the extended Alaskan winter, from October to April. This project expands the monitoring effort in order to document the seasonal dependence.

C. **Summary of Progress and Results**

The primary objective of this study is to conduct extensive surveys of Steller sea lion foraging activity in Prince William Sound during fall and spring. Previous investigations have shown intense foraging by Steller sea lions on herring during March. The primary question was the seasonal extent of this foraging activity. Specifically, when do herring enter Prince William Sound and form overwintering concentrations, and when do Steller sea lions begin to target these concentrations. Three surveys were conducted: early and mid-November and mid-December. The first survey found primarily juvenile pollock in the normal herring habitats of Rocky Bay and Zaikof Bay. Humpback whales were feeding on the juvenile pollock, but no Steller sea lions were sighted. The second survey, mid-November, found moderate herring concentrations in Northeast Prince William Sound, but few Steller sea lions. The third survey, mid-December, found herring in Zaikof Bay, where earlier only juvenile pollock were located. Both Steller sea lions and whales were actively foraging on the herring concentration. Thus it appears that the herring enter Prince William Sound sometime around mid-November, and Steller sea lions have located the herring and began targeted foraging with a month. Although humpback whales took advantage of the presence of near-surface, high-density schools of juvenile pollock in early fall, Steller sea lions waited until these habitats were occupied by herring before migrating and foraging.

An additional series of observations focused on a small group of Steller sea lions that typically forage on juvenile herring around Cordova during the fall/winter period. Three Steller sea lions were sighted in early November. The sighting increased to 6 in mid-November and to 14 in January when extensive herring abundance was observed.

Work was completed on the historical data on herring and Steller abundance in Prince William Sound. Figure 1 shows the relation between herring and Steller sea lion abundance in Prince William Sound during the past decade. Population declines were similar for both species. This is the first evidence that directly relates the decline of Steller sea lions to the abundance of their winter forage.



D. **Problems**: None