

## **EXHIBIT 1:**

### **HIGH-RESOLUTION FORAGING BEHAVIOR AND MOVEMENT PATTERNS OF STELLER SEA LION JUVENILES IN REGIONS OF STABILITY AND DECLINE**

**Award Number NA17FX1414**

**Dept of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service**

**Recipient: University of Alaska Anchorage (J.M. Burns)**

**Semi-Annual Project Report**

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#### **PROJECT SUMMARY:**

The ongoing decline in the western population of Steller sea lions (*Eumetopias jubatus*) has placed marine mammal management in direct conflict with several important commercial fisheries, and has focused attention on identifying habitat and prey resources critical for population survival. Research into the causes of the decline has focused largely on two factors: reduced prey availability (due either to fisheries competition or environmental change) and/or declines in the survivorship of juveniles - the age class most susceptible to changes in the prey landscape due to their lack of foraging experience, smaller size, and reduced dive capacity. Determining how juvenile sea lions select foraging locations and make foraging decisions in light of biological and environmental conditions is critical if we are to understand how changes in fish abundance will impact condition and survival. It is also critical if we are to assess when in the year juveniles are most sensitive to prey availability, where (relative to their haul out sites, rookeries, and designated critical areas) the bulk of juvenile foraging takes place, and whether differences in population trajectories are correlated with variation in individual foraging effort (as would be expected if prey availability differed).

While several management actions have been taken based on assumptions about how sea lions utilize their habitat, to date the data collected has been unsuitable for use in the fine-scale analysis techniques that are most appropriate for addressing the above issues. However, recent advances in tag technology now make it possible to outfit juvenile sea lions with small, high-resolution instruments that collect and transmit the highly detailed dive data necessary to determine how individual animals manage their time and energy resources when foraging. In addition, we will receive many, high quality locations from tagged animals, which in turn will allow us to construct habitat use maps with much greater spatial and temporal resolution. The need for more detailed information on how Steller sea lions select and utilize foraging grounds, and the absence of the high-resolution dive data necessary to do this has been highlighted by the recognition that the Western population decline is not uniform, and that counts around in the Dutch Harbor area are increasing.

Therefore this project is designed around using high-resolution SRDLs deployed on juvenile in area of decline and increase in order to collect the data necessary to address the following hypotheses: 1) that Steller sea lion juveniles in both regions select foraging areas with particular environmental features likely to aggregate prey resources; 2) that juvenile sea lions diving in regions with recently declining and increasing counts demonstrate different foraging behaviors and effort; and 3) that differences in foraging behavior and habitat use of Steller sea lion juveniles are correlated with age, nutritional and physiological status.

In addressing these hypotheses, this research will enable us to link biological (prey composition, distribution, and abundance) and physical characteristics of the foraging environment (temperature, bathymetry, location) with the foraging behavior and strategies of a free-ranging marine vertebrate predator. These links can be built at a much finer scale than previously due to the use new technology, and so can provide detailed 3-dimensional maps of sea lion habitat use patterns in regions where populations are increasing and decreasing. In particular, we hope to determine whether juveniles in the declining

population must work harder (as judged by dive duration, frequency, or pattern) in order to find prey resources.

## **EXHIBIT 2:**

We are deploying behavioral data logger instruments (diving and movements) on Steller sea lions to describe their foraging patterns in Alaskan waters (see EXHIBIT 1 for full details). These animals are experiencing a severe decline in numbers; data collected by these instruments may help explain this decline.

The communications facility requested for this project is the standard operation frequency of the Argos satellite data relay and location calculation system. We are using instruments built by the Sea Mammal Research Unit, which are built around a standard, commercial Seimac "Wild Cat" platform transmitter terminal.

We must use the Argos satellite relay system because the sea lions we are studying live in areas where there is no alternative radio receiving facility available. It is also infeasible to utilize recoverable behavioral data logging instruments on these animals due to difficulty of access and recapture.

**For more information, our contact at Service Argos, Inc., operator of the Argos satellite relay system, is:**

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**Transmitter embedded within these instruments is manufactured by:**

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