

Project: Regional, seasonal and species differences in trophic feeding ecology of western and central Aleutian Steller sea lion (*Eumetopias jubatus*) prey \$112.3K

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Non-NMFS collaborators: Lorrie Rea (UAF), Todd O'Hara (UAF)

Industry partner: Ocean Peace Inc. (contact: Todd Loomis)

Overview

Stable isotope ratios of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) will be determined in at least 10 marine finfish and cephalopod species thought to contribute to Steller sea lion (*Eumetopias jubatus*) diet in the Aleutian Islands to better understand the trophic position of these potential prey species. Stable isotope data generated by this study will also be contributed to ongoing stable isotope diet modeling efforts for Steller sea lions to build a better understanding of what prey species are important to sea lions in the western, central and eastern Aleutians Islands. These data will also be made available to Alaska Fisheries Science Center (AFSC) researchers studying the diet of killer whales (*Orca orca*) in the Aleutian Islands.

Over the past 3 years UAF and ADF&G have worked closely with the USGS and University of Colorado Denver to develop mixing models to predict the percent composition of Steller sea lion diet. These diet models use $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ measured in the whisker tissues of young Steller sea lion pups along with $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from the published literature for marine fish which are potential prey species for sea lions in the Gulf of Alaska and eastern Aleutian Islands (Christ et al. 2012, Scherer et al. 2012). These models are promising, but are currently limited in regional scope given that we require isotope information for prey species in the foraging areas of concern and have not been able to locate published stable isotope data for marine fishes in the western Aleutians. These $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values would aid in our interpretation of variations in concentrations of environmental contaminants (funding pending) to determine how much, or if, trophic interactions are involved (e.g., biomagnification of mercury).

Research Description

Samples of known and potential Steller sea lion finfish prey species (and some non-fish bycatch species) will be collected and donated by fishermen on Ocean Peace Inc. vessels during customary commercial fishing practices in the western, central and eastern Aleutian Islands. No additional fishing effort will be required for the collection of these prey samples and prey samples will be collected by subsampling the commercial catch and bycatch. Approximately 20 individual fish (to assure we get at least 5 males and 5 females per species) from each of at least 10 marine fish species known or highly suspected to be ingested by Steller sea lions (based on published scat data from Merrick et al. 1997, Sinclair and Zeppelin 2002, Trites et al. 2007, McKenzie and Wynne 2008) will be identified on the fishing vessel, and frozen whole for transport to UAF. Known sea lion prey typically harvested in the commercial fishery are Atka mackerel (*Pleurogrammus monopterygius*), Pacific cod (*Gadus macrocephalus*), walleye pollock (*Theragra chalcogramma*), arrowtooth flounder (*Atheresthes stomias*), Kamchatka flounder (*Atheresthes evermanni*), Irish lord (*Hemilepidotus* spp.), sculpins (family Cottidae), and rockfish (*Sebastes* spp.). Ocean Peace Inc. trawls in fisheries management areas 541 and 542 in the winter (February to April) allowing us to collect samples of potential prey relevant to animals foraging in the eastern and central Aleutian Islands. There have been no recent commercial fisheries conducted in the winter in fisheries management area 543. Feeding ecology of marine fishes has the potential to change seasonally due to changes in primary

productivity that could impact $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values through the food web. We will test for seasonal differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ within each sampled prey species in the eastern and central Aleutian Islands to determine if WAI summer prey stable isotope values could reasonably be used to model diet of adult females in the winter as well.

We are also interested in estimating diet composition of adult female Steller sea lions during the summer months (June to August) when they are nursing a young pup on the rookery and have a potentially limited foraging range. Ocean Peace Inc. trawls in fisheries management areas 541, 542 and 543 in the summer allowing us to collect samples of potential prey relevant to animals foraging in both the western and central Aleutian Islands. Although commercial retention of Atka mackerel and Pacific cod are prohibited in area 543, we have worked with the Alaska Fisheries Science Center, NMFS/NOAA to obtain permission to keep up to 20 Atka mackerel and 20 Pacific cod that were captured in trawls that target Pacific Ocean perch (*Sebastes alutus*) through a research authorization to UAF. Additional Aleutian Island fish collections will be facilitated through AFSC researchers on scheduled research cruises in 2014 to target collection of potential prey from regions in the proximity of Steller sea lion breeding rookeries. At the Wildlife Toxicology Laboratory approximately 300 fish will be weighed and measured (fork length); and muscle will be subsampled and freeze dried for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope analysis to be conducted at the UAF Stable Isotope Facility.

Deliverables

- 1) Contribute to semi-annual reports on research progress to AFSC.
- 2) Collaborative research presentation at the 2016 Alaska Marine Science Symposium on regional and species differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope values of potential Steller sea lion prey.
- 3) Summary excel spreadsheet of stable isotope data analyzed during the performance period will be shared amongst UAF, AFSC and industry collaborators.
- 4) Contribute $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope values of potential Steller sea lion prey to an ongoing collaborative UAF/ADG&G/USGS/UCD project modeling diet of Steller sea lions in the Aleutian Islands.
- 5) Contribute $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope values of potential Steller sea lion prey to an ongoing project coordinated by Dr. Paul Wade investigating diet of Killer whales in the Aleutian Islands.
- 6) Submit a final report on completed research to AFSC by 31 December 2015.

Budget

The budget for the work outlined above will be \$112,300.

	Total
Salary	\$38,513
Fringe Benefits	\$7,777
Travel	\$1,423
Isotope Analysis	\$7,500
Teleconferences	\$100
Equipment calibration	\$300
Sample shipping	\$4,000
Conference registration	\$100
Poster printing	\$100
Supplies	\$4,600
MTDC	\$64,319
Indirect Costs	\$32,160
Grad student tuition	\$15,821
Total	\$112,300

Budget Justification

Salaries

Senior Personnel. Funding to support a total of 80 hours is requested for the Principal Investigator of this project, Lorrie Rea. Funding to support a total of 80 hours is requested for the Co-Investigator Todd O'Hara. Per UAF policy, faculty members receive leave benefits at a rate of 1.5%, calculated on salary. Salaries are expected to increase at 2.9% each year. *Total cost to project: \$10,596.*

Other personnel. Funds are requested to support 70 hours for a laboratory technician who will assist with sample preparation and data management. Per UAF policy, staff members receive leave benefits at a rate of 20.6%, calculated on salary. Salaries are expected to increase at 3.25% each year. *Total cost to project: \$2,826.*

Students. Support is requested during the academic year and summer for a graduate student who will be responsible for fish sampling and assist with stable isotope sample preparation. Students work up to 560 hours during the academic year and 640 hours during summer. *Total cost to project: \$38,513.*

Fringe Benefits

Staff benefits are applied according to UAF's provisional benefit rates for FY14, which are negotiated with the Office of Naval Research (ONR) annually. Rates are 31.2% for senior salaries and 41.9% for staff. *Total cost to project: \$7,777.*

Travel

Funds are requested for one person to attend and present the results of research at the Alaska Marine Science Symposium in Anchorage, AK in January 2016. Airfare is estimated at \$424. M&I is estimated at \$60/day (5 days), lodging @ \$99/night (4 nights), with another \$303 for

ground transportation and car rental. All pricing is based on current pricing, US Government figures, and UA Board of Regents policy. *Total cost to Project: \$1,423.*

Other Direct Costs

Materials & Supplies. A total of \$4,600 is requested for lab supplies such as a freezer for storage of fish samples, a vacuum pump for freeze drying fish, grinding jars and liquid nitrogen for preparing samples for stable isotope analysis. .

Lab Services. Funds are requested for stable isotope analysis. *Total cost to project: \$7,406.*

Freight. Funds of \$4000 are requested to cover the cost of multiple shipments of frozen fish from the Aleutian Islands to UAF.

Teleconferences. Funds of \$100 are requested to support toll charges for teleconferences with research team members.

Equipment calibration. Funds of \$300 are requested to have laboratory balances inspected and calibrated prior to initiation of this study.

Printing. Funds of \$100 are requested to support printing of a conference poster for dissemination of results at the Alaska Marine Science Symposium.

Conference registration. \$100 is requested to support conference registration for the Alaska Marine Science Symposium.

Other. UAF requires that any graduate student supported by a research project over the course of the academic year also receive tuition support for the life of the project. Costs in Year 1 are \$15,821 (tuition).

Indirect Costs

Facilities and Administrative (F&A) Costs are negotiated with the Office of Naval Research and for research are calculated at 50.0% of the Modified Total Direct Costs (MTDC). MTDC includes Total Direct Costs minus tuition and other student support, subaward amounts over \$25,000, participant support costs, and equipment. A copy of the agreement is available at: <http://www.alaska.edu/cost-analysis/negotiation-agreements/>.

