

Do Predator Diets Signal Changes in Forage Fish Populations? Implications for Food Web Dynamics and Ecosystem Indicators

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1. A brief summary of the hypothesis or goals and the scholarly work/activities performed using the GRF Support

Our primary objective was to compare a suite of mid-upper trophic level predators that signal changes in forage fish populations and assess the implications for food web dynamics and ecosystem indicators. Through collaborative fisheries research, we used four commercially important fish species and one seabird species to sample forage fish and invertebrate populations off the Central Oregon Coast and test the following hypotheses:

- i. A high concordance among commercial fishes and seabird diets in “good” forage fish years - predator populations will concurrently benefit from strong forage fish year classes.
- ii. Low concordance among commercial fishes and seabird diets in “poor” forage fish years - opportunistic predators are forced to show more specialized foraging to find alternative prey.

The GRF funds helped support field sampling and lab analyses during spring through fall 2011, a La Niña influenced season, thereby providing a contrasting comparison to the 2010 El Niño influenced season. Field sampling included collecting and analyzing 424 fish stomach samples and 304 murre diet samples during the 2011 field season.

We found that the greatest degree of dietary overlap was observed between Chinook salmon (*Oncorhynchus tshawytscha*) and common murre (*Uria aalge*), with both smelts (Osmeridae) and clupeids (primarily *Clupea pallasii*) observed as the dominant prey types. Diets differed between El Niño and La Niña conditions for two predators, murre and black rockfish (*Sebastes melanops*). During La Niña, smelts decreased, while sand lance (*Ammodytes hexapterus*) increased in common murre diets. Black rockfish had fewer larval Dungeness crabs (*Cancer magister*) and a greater proportion of other crab species associated with the later spring transition. In contrast, Chinook salmon and Pacific halibut (*Hippoglossus stenolepis*) diets were similar during El Niño and La Niña conditions. Using multiple predators across several diverse taxa provided a way to detect seemingly subtle changes in prey communities and can contribute to more comprehensive understanding of food web dynamics and ecosystem indicators under changing ocean conditions.

2. A brief summary of any additional scholarly activities the GRF funding made possible for the investigator(s).

Data collected on this project contributed to a M.S. Thesis by Amanda Gladics, Marine Resource Management, College of Earth, Ocean, and Atmospheric Sciences. She presented the results of this study at the Heceta Head Conference, Florence OR, and the California Cooperative Oceanic Fisheries

Investigations meeting, La Jolla, CA, and completed her thesis in April 2012. A manuscript from this project was submitted and is currently in revision for Marine Ecology Progress Series.

GRF funds also allowed the P.I. to process 3 years of archived tissue samples from common murrelets for dietary stable isotope analysis. This contribution extended my time series for these data to 8 years, permitting initial time series analysis. I analyzed and presented these data at the October 2012 North Pacific Marine Science Organization (PICES) meeting.

Presentations:

Suryan, R.M., A.J. Gladics. 2012. Effects of environmental variation on diets and stable isotope signatures of a piscivorous seabird in a coastal upwelling system. PICES Annual Science Meeting, Hiroshima, Japan.

Gladics, A.J., R.M. Suryan, R.D. Brodeur, L.M. Segui, L. Filliger. 2011. Seabirds, salmon and groundfish: using predator diets to track shifts in the marine prey community in the Northern California current. California Cooperative Oceanic Fisheries Investigations annual conference, La Jolla, California.

Gladics, A.J., R.M. Suryan, R.D. Brodeur. 2011. Seabirds, salmon and groundfish: marine predators diets on the central Oregon coast. Heceta Head Conference, Florence, Oregon.

Thesis and manuscript:

Gladics, A.J. 2012 *Dietary responses of marine predators to variable oceanographic conditions in the Northern California Current*. M.S. Thesis, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University. 100pp.

Gladics, A.J., R.M. Suryan, R.D. Brodeur, L.M. Segui, L.Z. Filliger. In revision. Marine predator diets and variable oceanographic conditions: Implications for food web dynamics and ecosystem indicators. Marine Ecology Progress Series

3. How and/or on what were the GRF funds expended?

We used GRF funds to support part-time, hourly wages for a summer student worker, volunteer intern housing, living stipend, travel to/from field site, lab equipment (dissecting microscope, computer & software), miscellaneous field supplies, and stable isotope analysis lab fees.

List all external funding requests (i.e. proposals) that have been developed and submitted as a result of the GRF Funding.

Oregon Sea Grant: Upper Trophic Level Response to Changes in Production Regimes and Food Web Dynamics off Oregon.

GRF support also was used as contributing funds on numerous graduate student-directed scholarship applications.