

Seward line monitoring – Hopcroft (UAF, 15120114-J)

**FY15 PROGRAM PROJECT
PROPOSAL FORM**

Project Title: Long term monitoring: Environmental drivers component - The Seward Line: Marine Ecosystem monitoring in the Northern Gulf of Alaska

Project Period: February 1, 2015 – January 31, 2016

Primary Investigator(s): Russell R Hopcroft (rrhopcroft@alaska.edu), Tom Weingartner & Ken Coyle (UAF), Jeremy Mathis (UAF/NOAA).

Abstract: The ocean undergoes year-to-year variability in the physical environment, superimposed on longer-term cycles, and potential long-term trends. These variations influence ocean chemistry, and propagate through the lower trophic levels, ultimately influencing fish, seabirds and marine mammals. Over the past 50 years the Northern Pacific appears to have undergone at least one clear “regime shift”, while the last 12 years have seen multi-years shifts of major atmospheric indices, leaving uncertainty about what regime the coastal Gulf of Alaska is currently in. Regime shifts are often expressed as fundamental shifts in ecosystem structure and function, such as the 1976 regime shift that resulted in a change from a shrimp dominated fisheries to one dominated by pollock, salmon and halibut. Long-term observations are also critical to describe the current state, and natural variability inherent in an ecosystem at risk of significant anthropogenic impact. Given the potential for such profound impacts, this proposal seeks to continue multidisciplinary observations which began in 1997 along the Seward Line and in PWS that assess the current state of the Northern Gulf of Alaska, during 2012-2017. Such observations form critical indices of ecosystems status that help us understand some key aspects of the stability or change in upper ecosystems components for both the short and longer-term. By analogy, the weather has been for more than a hundred years, yet regular observations are still needed to know what is happening and what can be expected in the near future.

Estimated Budget:

EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
\$98.1	\$59.9	\$100.5	\$104.0	\$113.7	\$476.2

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
\$300	\$400	\$400	\$400	\$400	\$2,000

Date: September 2, 2014

I. EXECUTIVE SUMMARY

A. Statement of Problem

Long times-series are required for scientists to tease out pattern (and cause) from simple year-to-year variability. Like other regions, the Northern Pacific undergoes significant inter-annual variability, driven partially by variations in major climatic indices (e.g. El Niño, the Pacific Decadal Oscillation). Larger longer-term variations referred to as “regime shifts” have occurred in the past, and will likely occur again. Regime shifts are expressed as fundamental shifts in ecosystem structure and function, such as the 1976 regime shift that resulted in a switch within the Gulf of Alaska from a shrimp-dominated fishery to one dominated by pollock, salmon and halibut. Long-term observations are also critical to describe the current state, and natural variability inherent in an ecosystem at risk of significant anthropogenic impact. Given the potential for such profound impacts, the Seward Line Long-term Observation Program (<http://www.sfos.uaf.edu/sewardline/>) provides these critical observations on the current state of the Northern Gulf of Alaska ecosystem. Seward Line observations over the past 16 years have fundamentally revised our understanding of the coastal Gulf of Alaska ecosystem and allow us an appreciation of not only its major properties, but also their inter-annual variability. To date, we have observed both unusually warm and cold years, which influence the timing of the planktonic communities, but not necessarily their ultimate abundance and biomass.

In the past 12 months, an additional 5 years of funding have been secured from an established consortium partner, new instrumentation has been funded, and 2 papers have been submitted (one accepted, one in review) based on Seward Line observations.

II. COORDINATION AND COLLABORATION

A. Within a EVOTC-Funded Program

Within Gulf Watch, this project links tightly with the GAK1 mooring, providing a cross shelf context for its observations. It complements the CPR, PWS, and Lower Cook Inlet/Kachemak Bay long-term monitoring efforts by providing more detailed oceanographic evaluation of the GOA shelf and the major passages in PWS than provided by the other programs. All of these components overlap in their sampling locations relatively little, enough to ensure comparability between datasets, but not enough to be duplicative. Hopcroft serves on the Science Coordinating Committee, and participates regularly in associated functions to this end.

B. With Other EVOSTC-funded Projects

This project provides environmental context and indices to Prince William Sound Herring Program.

C. With Trustee or Management Agencies

This project places EVOS within a consortium of NPRB, AOOS and NOAA currently funding the line. Full annual costs of the program are \$400-500K including ship time. ADF&G considers Seward Line data while generating Pink Salmon return forecasts for PWS.

III. PROJECT DESIGN

A. Objectives for FY15

The scientific purpose of this project is to develop an understanding of the response of this marine ecosystem to climate variability, and provide baselines against which to assess any other anthropogenic influences on the GOA ecosystem. Toward this end, the Seward Line cruises on the Gulf of Alaska shelf determine the physical-chemical structure, primary production and the distribution and abundance of zooplankton, along with their seasonal and inter-annual variations. Some of the data is compared with historical data sets whereas other data sets are a product of this continuing systematic sampling effort on this shelf.

Specifically, cruises:

1. Determine thermohaline, velocity, and macronutrient structure of the Gulf of Alaska shelf, emphasizing the Seward Line, and Prince William Sound stations (Fig 1).
2. Determine the state of carbonate chemistry (i.e. Ocean acidification)
3. Determine primary production and phytoplankton biomass distribution.
4. Determine the distribution and abundance of zooplankton.
5. Determine rates of growth and egg production of selected key zooplankton species.

B. Changes to Project Design

Most aspects of project remain the same as in the original proposal. Instrumentation on the CTD system has been improved, and additional bottles will be available for water chemistry. Methodological improvements in the quality of macronutrient chemistry require more field preparation and have necessitated dropping these measurements from the minor (“i”) stations along the Seward Line. Chlorophyll measurements have shifted to direct extraction and measurement at sea to alleviate emerging concerns about degradation of pigments associated with freezing. Microzooplankton sampling is being added to the core program. A combination of poor weather and increased complexity of cruises has lowered the priority of measuring zooplankton rates (i.e. growth and egg production).

IV. SCHEDULE

A. Project Milestones for FY15

As with most long-term observation programs, the Seward Line has the same Milestones annually.

Objectives 1-5. Cruises are executed early each May and in mid-September collecting data or samples to address all objectives each cruise. Final datasets are released annually.

Typically:

- Physical oceanography and chlorophyll are available 60 days after a cruise.
- DIC and TA are available 90 days after a cruise.
- Macronutrients and zooplankton are available 6 months after a cruise.
- Results are presented annually at the Alaska Marine Science Symposium

B. Measurable Project Tasks for FY15

May 2015 – Spring cruise executed

September 2015 – Late Summer cruise executed

January 2016 – Results presented at AMSS

Cruises are executed early each May and in mid-September collecting data or samples to address all planned objectives each cruise. Products associated with each objective are subsequently posted graphically to the project’s website at various intervals reflecting the degree or post-processing required.

V. PROJECT PERSONNEL – CHANGES AND UPDATES

NPRB’s recent LTM funding brings 3 additional PIs to the Seward Line project: Seth Danielson (UAF – physical oceanography), Suzanne Strom (phyto/micro-zooplankton – WWU) and Kathy Kuletz (seabirds – USFWS). None of these PIs will have direct access to EVOS funding.

VI. BUDGET

A. Budget Form

Please see included program workbook for budget forms.

B. Changes from Original Proposal

The overall EVOS funding request remains the same as in the original proposal.

C. Sources of Additional Funding

The Seward Line was selected for 5 years of collaborative funding through NPRB's Long-term Monitoring program (\$1M). In addition to supporting core activities, this funding will 1) add more detailed phyto/microzooplankton research and 2) formalize funding for observations of seabirds and marine mammals that have been supplied by USFWS at no cost to the project for the past 10 years.

A proposal to the Murdock Foundation to add high-resolution optical detection of biological and non-biological particles during CTD casts was funded (\$300K) and should be operation by next cruise. The new CTD frame (\$30K) required to accommodate this equipment was supported by a combination of AOOs, NOAA and UAF funds.