Gulf of Alaska mooring (GAK1) monitoring – Weingartner (UAF, 15120114-P)

FY15 PROJECT PROPOSAL SUMMARY PAGE
Continuing, Multi-Year Projects

Project Title: Long-term monitoring: Environmental Drivers component - Long-term Monitoring of Oceanographic Conditions in the Alaska Coastal Current from Hydrographic Station GAK

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

Primary Investigator(s): Thomas Weingartner, Principal Investigator, School of Fisheries and Ocean Science, University of Alaska, Fairbanks, AK 99775 (907-474-7993; tjweingartner@alaska.edu)

Study Location: Mouth of Resurrection Bay, 59° 51'N, 149° 28'W

Project Website http://www.ims.uaf.edu/gak1/

Abstract*: This project is a component of the integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services submitted by McCammon et. al.

This program continues a 44-year time series of temperature and salinity measurements at hydrographic station GAK 1. The data set, which began in 1970, now consists of quasi-monthly CTDs and a mooring with 6 temperature/conductivity recorders throughout the water column. The project monitors four important Alaska Coastal Current ecosystem parameters that will quantify and help understand interannual and longer period variability in:

1. Temperature and salinity throughout the 250 m deep water column,
2. Near surface stratification,
3. Baroclinic transport in the Alaska Coastal Current

In aggregate these variables are basic descriptors of the Alaska Coastal Current, an important habitat and migratory corridor for organisms inhabiting the northern Gulf of Alaska, including Prince William Sound.

Estimated Budget:

EVOSTC Funding Requested* (*must include 9% GA)*:

FY12	FY13	FY14	FY15	FY16	TOTAL
$109.5	$112.5	$115.7	$119.1	$122.5	$497.8

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: September 2, 2014

I. EXECUTIVE SUMMARY

The purpose of this project is to provide long-term monitoring data on the physical oceanography of the Alaska Coastal Current and the northern GoA shelf. The Alaska Coastal Current (ACC) is the most prominent feature of the Gulf of Alaska's shelf circulation. It is a narrow (~40 km), swift, year-round flow maintained by the integrated forcing of winds and coastal freshwater discharge. That forcing is variable and reflected in ACC properties. The current originates on the British Columbian shelf and exits the Gulf into the Bering Sea through Unimak and Amukta passes. Substantial portions of the ACC circulate through Prince William Sound and feed lower Cook Inlet and Kachemak Bay before flowing southwestward through Shelikof Strait. The current controls water exchanges, and transmits its properties into the fjords and bays between Prince William Sound and the Alaskan Peninsula. The monitoring proposed herein quantifies variability of the Gulf's inner shelf environment. ACC monitoring provides the broader-scale context for understanding variability in adjacent marine ecosystems and its effect on particular species (e.g., herring, salmon, and forage fish). The ACC's variability is transmitted to nearshore habitats around the gulf.

Measurements at GAK 1 at the mouth of Resurrection Bay, began in 1970. Initially the sampling was opportunistic, became more regular in the 1980s and 1990s, and systematic beginning in 1997 with EVOSTC support. Since then it has included quasi-monthly conductivity-temperature versus depth (CTD) casts and hourly temperature and salinity measurements at 6 depths distributed over the water column. GAK 1 is *the only station* in the GoA that measures both salinity and temperature over the 250 m deep water column.

The 44-year GAK 1 time series has documented:

1. The large interannual differences associated with El Nino and La Nina events, including substantial differences in the spring bloom between these phenomena (Weingartner et al., 2003, Childers et al., 2005).
2. The intimate connection between coastal freshwater discharge and the depth-varying evolution of winter and spring temperatures over the shelf (Janout et al., 2010; Janout 2009).
3. That GAK 1 is a reliable index of ACC transports of mass, heat, and freshwater (Weingartner et al., 2005).
4. That GAK 1 near-surface salinities are correlated with coastal freshwater discharge from around the Gulf (Weingartner et al., 2005).
5. Variations in mixed-layer depth in the northern Gulf, which affects primary production (Sakar et al., 2006; Henson, 2007)
6. Decadal scale trends in salinity and temperature, (Royer, 2005; Royer and Grosch, 2006; Weingartner et al., 2005, and Janout et al., 2010).
7. The relationships between temperature and salinity variations and the Pacific Decadal Oscillation and the strength and position of the Aleutian Low (Royer, 2005; Weingartner et al., 2005, and Janout et al., 2010)
8. That the record can guide understanding the variability in iron concentrations, a potentially limiting micro-nutrient required by many phytoplankton. Preliminary efforts indicate that iron and surface salinity are correlated at least in certain seasons (Wu, et al., 2008).
9. The evolution of the anomalously cold winter of 2007-08, which showed how winter runoff may affect the vertical distribution of temperature in the spring (Janout et al., 2010; Janout et al., 2012).
10. That the vertically-integrated density at station GAK 1 is in-phase with and largely responsible for the annual cycle of sea-level at Seward (Kelly, in prep.)

As shown by Meuter et al., (1994), Meuter (2004), and Spies (2009), these issues affect ecosystem processes on both the shelf and within Prince William Sound and Lower Cook Inlet/Kachemak Bay.

II. COORDINATION AND COLLABORATION

A. Within a EVOTC-Funded Program

All data sets will be available on the GAK 1 website (http://www.ims.uaf.edu/gak1/). The GAK 1 data are being integrated with other scientists in Gulf Watch Alaska as well as with other interested scientists not involved in the program. For example, we have assisted the National Park Service in establishing a similar monthly sampling and data processing protocol in Glacier Bay National Park. That NPS data is being blended with the GAK 1 to examine shelf-wide differences in temperature and salinity properties. Essentially the Glacier Bay data set complements GAK 1 since the Glacier Bay data is collected upstream (in terms of the general circulation characteristics of the GOA shelf. Collectively, the Glacier Bay and GAK1 data sets provide a broad-scale perspective of the GOA shelf environment. The GAK 1 data are an essential complement to the EVOSTC-supported efforts along the Seward Line, and with the EVOS-TC supported physical oceanographic sampling conducted in Prince William Sound and in Lower Cook Inlet. We can thus quantify both temporal and regional spatial variability in physical properties of the waters of this ecosystem.

B. With Other EVOSTC-funded Projects

The GAK 1 data set provides the only long-term historical data set on temperature and salinity trends in the northern Gulf of Alaska. Its primary value with respect to all EVOS-TC funded projects is to allow a retrospective assessment of oceanic anomalies on the inner shelf waters of the Gulf of Alaska. It provides a basis for researchers in the nearshore and herring projects to examine their results in the light of known historical variability in the physical aspects of the marine environment. It also allows the other programs to place their measurements of physical properties into an historical context.

C. With Trustee or Management Agencies

III. PROJECT DESIGN – PLAN FOR FY15

A. Objectives for FY15

The fundamental goal of this program is to provide a high quality, long-term data to quantify and understand monthly, seasonal, interannual and longer period variability of the GoA shelf. This measurement provides the broader scale spatial perspective discussed on pages 1 -5. Specifically we will measure:

1. Temperature and salinity throughout the water column,
2. Near surface stratification since this affects phytoplankton bloom dynamics,
3. Baroclinic transport in the Alaska Coastal Current

These objectives are to be accomplished through a combination of quasi-monthly shipboard sampling at GAK 1 and with an oceanographic mooring deployed at that location.

B. Changes to Project Design

Not applicable

IV. SCHEDULE

A. Project Milestones for FY 15

1. Temperature and salinity throughout the water column,
2. Near surface stratification since this affects phytoplankton bloom dynamics,
3. Baroclinic transport in the Alaska Coastal Current.

B. Measurable Project Tasks

FY 14, 1st quarter (February 1 – May 31, 2015)

February 2014 Project funding available

Begin quasi-monthly CTD sampling at GAK1; recover and re-deploy the GAK 1 mooring in March

FY 14, 2nd quarter (June 1, 2015-August 30, 2015)

Continue quasi-monthly CTD sampling at GAK1

FY 14, 3rd quarter (September 1, 2015-November 30, 2015)

Continue quasi-monthly CTD sampling at GAK1

FY 14, 4th quarter (December 1, 2015 – January 31, 2016)

Continue quasi-monthly CTD sampling at GAK1. Post data on website

V. PROJECT PERSONNEL – CHANGES AND UPDATES

Not applicable.

VI. BUDGET

A. Budget Forms (Attached)

Please see included program workbook for budget forms.

B. Changes from Original Proposal

Not applicable

C. Sources of Additional Funding

Not applicable