FY10 INVITATION
PROPOSAL SUMMARY PAGE

Project Title: Long-Term Monitoring of the Alaska Coastal Current

Project Period: 1 October 2009 – 30 September 2012

Primary Investigator(s): Tom Weingartner, Institute of Marine Science, University of Alaska Fairbanks

Study Location: Gulf of Alaska

Key Words: Gulf of Alaska, Alaska Coastal Current, temperature, salinity, CTD, time series

Abstract:
This program continues a 39-year time series of temperature and salinity measurements at hydrographic station GAK 1. The data set, which began in 1970, now consists of monthly CTDs and a mooring with 6 - 7 temperature/conductivity recorders throughout the water column, a fluorometer and nitrate sensor at 20 m depth and a nitrate sensor at 150 m depth. The project monitors five important Alaska Coastal Current ecosystem parameters and to quantify and understand interannual and longer period variability in:

1. Temperature and salinity throughout the 250 m deep water column,
2. Near surface stratification,
3. Near and subsurface nitrate supply on the inner shelf,
4. Fluorescence as an index of phytoplankton biomass, and
5. Atmosphere-ocean heat fluxes.

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

FY10	FY11	FY12	FY13	Total
$141.5	$138.7	$133.6	0	$413.8

Non-EVOS Funds to be used:

FY10	FY11	FY12	FY13	Total

I. NEED FOR THE PROJECT

A. Statement of Problem

The Alaska Coastal Current (ACC) is an important component of the Gulf of Alaska marine environment. This narrow (~40 km), swift, year-round flow is maintained by the integrated forcing of winds and terrestrial freshwater discharge. Both the winds and the discharge vary seasonally (**Figure 1**), although not in-phase with one another: discharge is a maximum in fall and the westward (downwelling-favorable) winds are strongest in winter. The runoff contribution to the shelf is massive (~24000 $m^3\ s^{-1}$; or 20% greater than the Mississippi River discharge) and, in combination with the winds, affects shelf dynamics, stratification, and nutrient loads. These principal drivers of this shelf ecosystem also vary substantially at interannual and longer time scales (*Stabeno et al*., 2004; *Royer*, 2005; *Weingartner et al.*, 2005), although when compared with large scale climate indices, such as the Pacific Decadal Oscillation (*Mantua et al*., 1997), the winds are uncorrelated with this index (Stabeno et al., 2004) and the runoff only weakly correlated (*Weingartner et al.*, 2005).

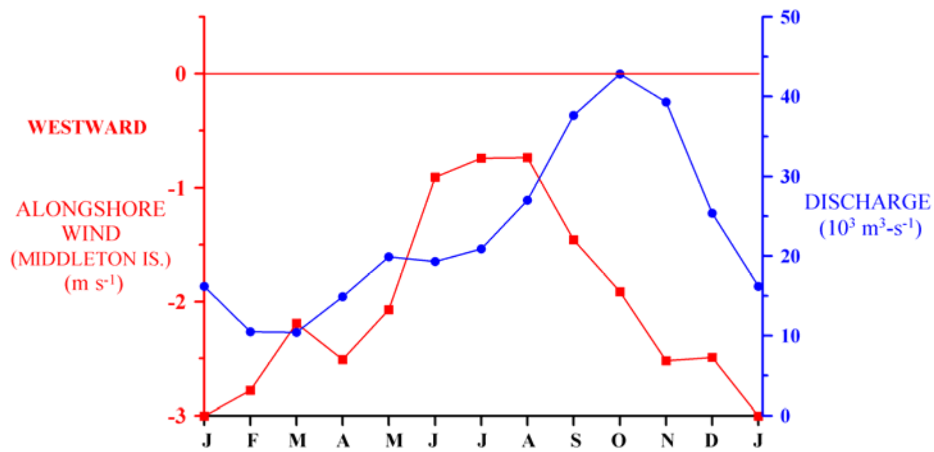

Figure 1. The mean monthly values of integrated coastal freshwater discharge (following Royer, 1982) and alongshore wind speed (computed from Middleton Island (see Figure 3 for the location of this island).

Approximately ~2/3 of the along-shelf (baroclinic) transport is carried within the ACC making it the most prominent circulation feature of the Gulf of Alaska shelf. The current originates on the British Columbian shelf (*Royer*, 1998), flows northward through the passages of Southeast Alaska, thence westward along Alaska's south coast, before entering the Bering Sea through Unimak Pass in the western Gulf of Alaska (*Schumacher et al., 1980; Stabeno et al.*, 2002; *Weingartner et al*., 2005) (**Figure 2**). It thus spans an alongshore distance of ~2000 km making it one of the longest coastal currents in the global ocean.

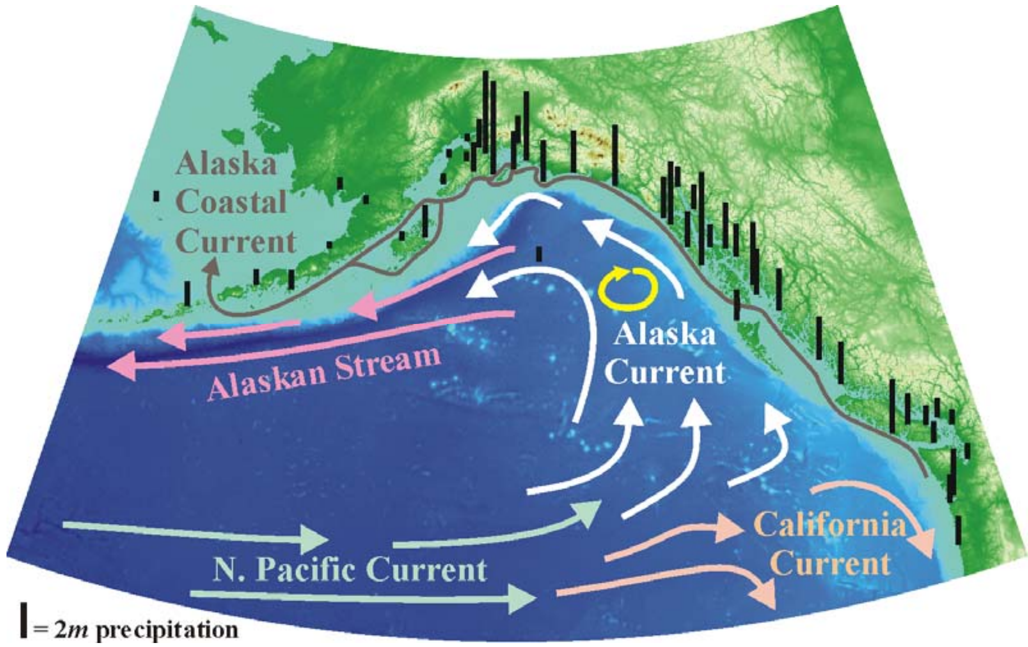

Figure 2. Schematic of the circulation of the Northeast Pacific and Gulf of Alaska. The vertical bars are the mean annual precipitation amounts at selected National Weather Service coastal sites and in the interior of the Gulf of Alaska (*Baumgartner and Reichel*; 1975).

A portion of the ACC flows through Prince William Sound (**Figure 3**; *Royer et al*., 1990; *Niebauer et al.,* 1994; *Vaughan et al*., 2001) and, thus affects the heat, salt, and nutrient budgets of the sound and its adjacent bays (*Gay et al.,* 2001). Indeed, *Niebauer et al.* (1994) estimate that the ACC replenishes the upper 100 m of Prince William Sound 2 – 3 times per year at least. In addition, the ACC carries sound waters back onto the shelf and it regulates exchange between the outer shelf and the fjords and bays along the coast, including Cook Inlet. Hence, the ACC affects environmental conditions for numerous nearshore Gulf of Alaska habitats. All of these attributes suggest that the ACC is an important ocean pathway by which climate signals, dissolved and suspended materials, contaminants, and organisms are advected around the gulf and into the Bering Sea. The current is also an important habitat and migratory corridor for a variety of marine organisms, in particular for juvenile salmon leaving the natal streams of Prince William Sound for the shelf and basin (*Boldt*, 2001). Since much of the circulation within the sound is associated with the ACC, this current is likely a crucial advective pathway for various herring life stages (*Norcross et al.,* 2001) implying that these fish also use the current as both a migratory path and a habitat during various stages of their life history.

Variability in the marine environment must be quantified and its causes understood in order to comprehend and predict the response of the Gulf of Alaska marine ecosystem to natural or human related causes. Ocean temperatures, salinities, nutrients, and phytoplankton blooms are easily monitored and fundamental properties of the ecosystem that affect upper trophic level variability. We propose to maintain at GAK 1: 1) the 39-year time series of temperature and salinity measurements, 2) monitor phytoplankton bloom characteristics begun in 2005 and continued intermittently since, and 3) continuous nutrient near-surface nutrient time series measurements begun in spring 2006. GAK 1 lies within the Alaska Coastal Current (ACC) on the northern Gulf of Alaska shelf downstream of Prince William Sound and upstream of Cook Inlet (**Figure 2**) and thus was in the path of the 1989 Exxon Valdez Oil Spill (*Royer et al.*, 1990).

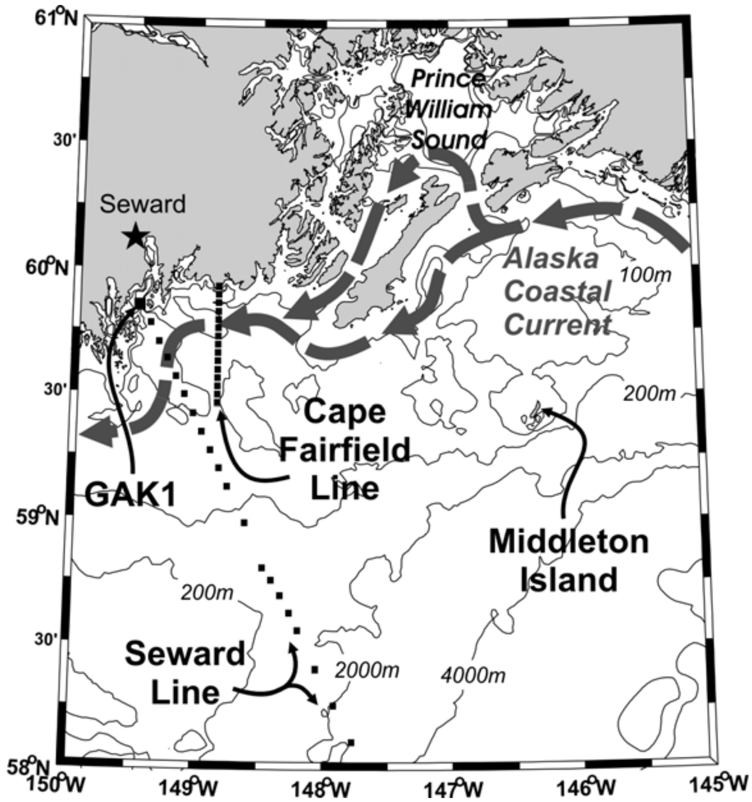

Figure 3. Schematic of the circulation of the Alaska Coastal Current in Prince William Sound and the adjacent Gulf of Alaska shelf. The Cape Fairfield and Seward lines were CTD transects sampled throughout the Global Ocean Ecosystem Dynamics (GLOBEC) Program (1997- 2004) used to characterize shelf properties and biological production. The Cape Fairfield transect was a high resolution CTD transect through the Alaska Coastal Current used to calibrate transport at GAK 1 (*Weingartner et al*., 2005).

Opportunistic sampling commenced at this station in 1970 and since November 1997, the EVOSTC has supported systematic sampling of temperature and salinity at GAK 1. The sampling includes monthly conductivity-temperature versus depth (CTD) measurements (begun in 1970) and hourly (or more frequently) temperature and conductivity measurements from a mooring consisting of 6 – 7 instruments distributed throughout the water column at GAK1. This hydrographic station is *the only station* in the Gulf of Alaska that measures salinity and it is *the only station* measuring temperature and salinity over the entire 250 m deep water column. *Weingartner et al.* (2003). *Weingartner et al*., (2005) and *Royer* (2005) give a more complete description and analysis of the data collected thus far. Important findings derived from GAK 1 under EVOSTC support include:

1. The anomalous summer 1997 warming (~1-2^{o}C above normal) was due to anomalously low summer cloud cover and wind speeds and was confined to the upper 40 m of the ocean.

2. The El Niño-induced warming (~2°C above normal) in winter 1998 occurred over the entire 250 m depth of the shelf, and was accompanied by unusually fresh shelf waters and above normal ACC transport. Stratification occurred early and might have induced an earlier than normal spring bloom. These anomalies provide a glimpse of what may be the norm if future climate change entails warmer and wetter winters in the Gulf of Alaska. Earlier stratification might induce an earlier spring bloom in the sound and the ACC thereby resulting in a timing mismatch between the bloom and zooplankton feeding.
3. Several factors were responsible for these anomalies: 1) coastal Alaska discharge [computed following *Royer* (1982)] was above average in fall 1997 and winter 1998, 2) Pacific Northwest river discharges were above average during summer and fall 1997, and 3) coastal downwelling around the Northeast Pacific was stronger than normal from summer through winter. In aggregate these factors decreased nearshore salinities and strengthened ACC alongshore transport. The simultaneous occurrence of all of these anomalies is unusual; 1997-98 was the only year since 1970 (the start of the GAK 1 record) in which all of these anomalies coincided.
4. Most of the discharge appears to be transported within the upper 75 m of the water column and within ~40 km of the coast.
5. There are statistically significant relationships between monthly anomalies of GAK 1 salinity and/or dynamic height and anomalies of ACC mass and freshwater transport. These results could be applied to resource management issues, for evaluating numerical model performance, and for retrospective ecosystem studies. For example, *Coyle* (2005) suggests that variations in ACC alongshore transport in late winter/spring affects zooplankton dispersal and recruitment processes.
6. Coastal discharge can hindcast ACC transports using the precipitation record assembled by Royer (1982) that begins in 1930 for the Gulf of Alaska. Weingartner et al. (2005) extended Royer's runoff time series from 1930 to 1900 based upon correlations between anomalies of runoff and atmospheric sea level pressure difference between Seward and Ketchikan (ΔSLP_{KS}). We find that winter ΔSLP_{KS} anomalies are correlated with the winter Pacific Decadal Oscillation (PDO) anomalies. Minimum discharge occurred from 1900-1910 and maximum discharge in the 1930s. Coastal discharge and coastal salinities suggest a decrease in freshwater discharge in the Gulf of Alaska from the late 1950s through the mid-1970s. Discharge increased from the mid-70s through the early-80s, coincident with the regime shift of the 1970s and with the PDO (*Mantua et al.,* 1997; *Overland et al*., 1999). These findings add to suggestions of a freshening across the North Pacific Ocean basin since the 1970s (*Wong et al.,* 1999).
7. The mooring has provided a platform for other scientists, for example in 2001-02 we placed prototype halibut tags, developed by USGS-BRD scientists, onto the GAK 1 mooring for testing. These tags are now being routinely used to study halibut migrations.
8. The GAK1 monthly time series has underscored the large interannual and interdecadal variability of the northern Gulf of Alaska. With the inception of the moored time series, shorter period variations, reflecting important dynamical transitions, are being detected and quantified. The in-month variance of the moored data is generally less than the monthly variance computed from the historical monthly CTD sampling and the integral time scales are longer than 1 month. Both results suggesting that temporal aliasing associated with the monthly CTD sampling has not been a significant problem.

9. *Royer* (2005) documented a 30 year warming and freshening trend in the upper 100 m of the Gulf of Alaska shelf that implies an increase in ACC transport (Weingartner et al., 2005) and an increase in upper layer stratification (*Royer et al*., submitted), which could influence biological production.
10. The general warming and freshening in the northern Gulf of Alaska might have led to the outbreak of *Vibrio parahaemolyticus* reported in Prince William Sound (*Royer et al.*, submitted). The freshening surface layer appears to retain summer heat thereby allowing these organisms (which causes gastroenteritis in humans) to flourish. More frequent similar occurrences are predicted if the present trends in upper ocean salinity and temperature continue.
11. We have determined that the ACC is a principal source of freshwater for the Bering Sea shelf and thereby influences biological processes on both this shelf and the Chukchi Sea through Bering Strait (*Weingartner et al.*, 2005; *Aagaard et al*., 2006). These results imply that the GAK 1 monitoring effort has implications for other important Alaskan marine ecosystems.
12. We are documenting the extraordinary cooling that commenced in fall of 2006 and which continues through the present. These recent findings are expanded upon below but covered in detail in *Janout et al.* (in prep.).

GAK 1 measurements supported by EVOS showed that for the winter of 2006/07 northern Gulf of Alaska (GOA) waters cooled to the lowest temperatures observed since the early 1970's (**Figure 4**). The cooling extended over much of the shelf, and temperatures in May 2007 were ~1.5 ºC lower than normal throughout the water column. Stratification was weak due to an

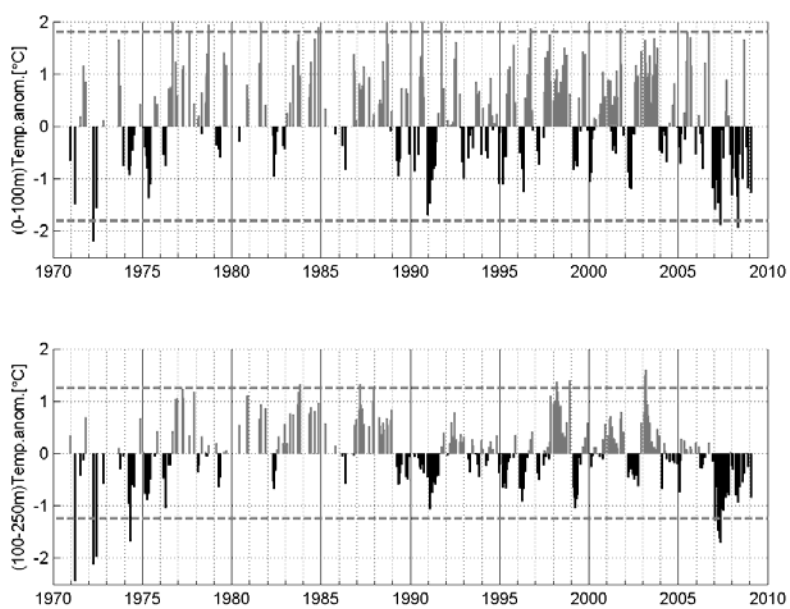

Figure 4. Detrended upper (0-100 m, top) and lower (100-250 m, bottom) layer GAK1 monthly temperature anomalies [ºC] computed from CTD profiles from ~1970 to January 2008 including a 2 standard deviation bound. (Updated from *Royer and Grosch*, 2006).

anomalous salinity distribution, which included above normal surface- and below normal bottom salinity. Deep temperatures remained low until late fall 2007, when downwelling winds erased the cold signal. During the winter of 2007/08, the cooling was renewed, although limited to the upper 100 m due to vertical salinity stratification enhanced by above normal coastal freshwater runoff in late 2007. Retrospective analyses of the GAK 1 record shows that anomalously low winter and spring temperatures are a function of winter salt stratification and winter air-sea heat fluxes, which together account for 81% of the variation in deep (100-250 m) temperatures. Hence a critical ingredient in the wintertime evolution of temperature on this shelf is the runoff, which controls salinity and stratification.

This cooling trend appears to be continuing for a third year based on GAK 1 data obtained through March 2009. **Figure 5** shows the March 2009 GAK 1 temperature and salinity profiles (**Figure 5**) in comparison to the long-term mean and March 2007. March 2009 temperatures in the upper 150 m of the water column are 0.75 to 1^{o}C below the long-term March mean and only slightly warmer than those of March 2007, which was the coldest March observed since the early 1970s. The salinity profile also indicates below normal winter stratification over the upper 150 m, which corresponds to the depth of the cooling anomaly. Hence the more recent data corroborate *Janout et al.'s* (in prep.) contention that winter runoff exerts an important control on winter temperature distribution on this shelf.

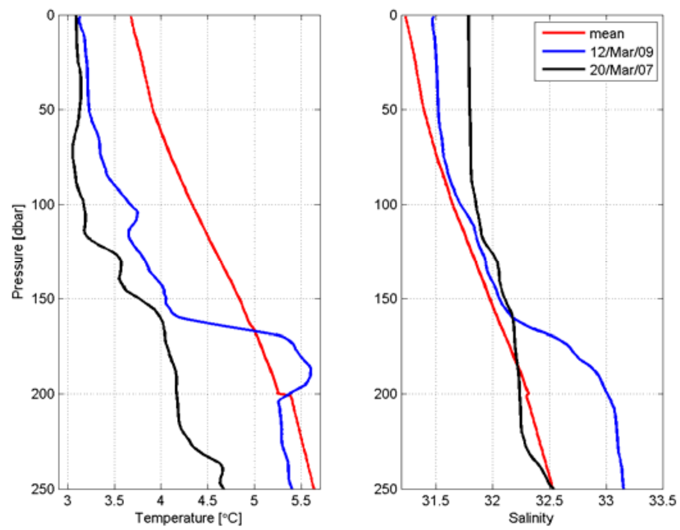

Figure 5. GAK 1 vertical profiles of temperature (left) and salinity (right) for the long-term mean (red), March 2007 (black), and March 2009 (blue).

We have used the moored data sets to compute winter Growing Degree-Days (GDD; *Neuheimer and Tagg*, 2007), so that these data can be used in the herring energetics studies conducted by Dr. R Heintz of NOAA's Auke Bay Lab. Dr. Heintz is constructing juvenile herring energetics models and these data will allow him to assess the model response to a variety of over-wintering (Oct. – May) GDDs observed in the GOA. **Figure 6** shows one example of these calculations based on hourly temperature records from 30 m depth on the GAK 1 mooring (we have constructed these for each depth on the mooring).

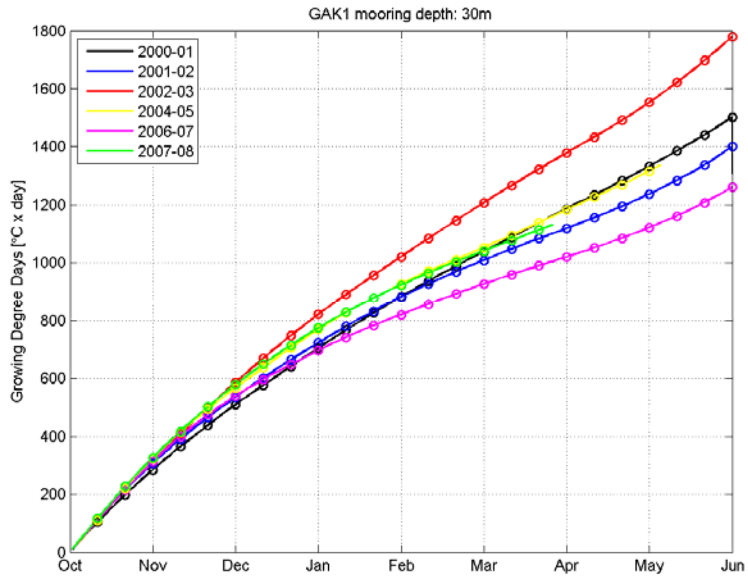

Figure 6. Growing degree days at 20 m depth between October 1 and May 31 for 2000 – 2008. (The record in 2004-05 was curtailed because the mooring was dragged off site in that year.

It is apparent that GDD can vary interannually by ~20% in January to more than 30% by April. Heinz will be able to apply these data to his models to assess juvenile herring over-wintering energy consumption. *Norcross et al.* (2001) contend that relatively warm winters increase metabolic rates in age-0 herring, which leads to reduced survival and average size. If this hypothesis is correct, then the recent winter cooling trend might lead to enhanced herring survival and recruitment in the future. Moreover, Janout et al. (in prep.) have suggested that simple atmospheric pressure patterns might be a reasonable indicator of historical ocean temperatures for the northern GOA. If so, that analysis can be used to hindcast winter ocean temps since 1900, thereby creating a data set that might be helpful in retrospective fisheries studies.

GAK 1 data has also supported efforts to assess the recovery of marine species and services affected by the oil spill, which underscored the need to understand natural climate variability and its influence on the recovery of species injured by the oil spill (*Purcell et al.*, 1999; *Piatt and Irons*, 1999; *Duffy*, 1999; *Anderson et al.*, 1999). Some of our previous results were obtained in conjunction with data collected under the auspices of the NSF-NOAA funded Northeast Pacific Coastal Gulf of Alaska GLOBEC (Global Ocean Ecosystem Dynamics) program, which seeks to understand how climate variability affects marine ecosystems. GLOBEC field sampling is now over but that program provided essential data that helped establish the usefulness of GAK 1 at both regional and broader scales. More recent results were obtained in collaboration with the NPRB-supported program to conduct biological oceanographic data along the Seward Line in May and September of each year. In addition, many of the biological data sets collected under the auspices of the GLOBEC (1998 – 2004) program represented the first systematic and year-round biological sampling for nutrients, phytoplankton, and zooplankton conducted on this shelf. The interpretation of these various data sets continues and we anticipate that GAK 1 data will be used in retrospective and predictive studies to address prior biological variability in this ecosystem using ecosystem models. The GAK 1 data are also freely available to any researcher, resource manager and the public as they are routinely made available on our webpage (http://www.ims.uaf.edu/gak1/).

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

The ACC is an important focus habitat of EVOSTC for it links Prince William Sound and continental shelf marine habitats. Terrestrial runoff from around the Gulf of Alaska affects ACC dynamics and its nutrient and sediment load although oceanic processes substantially modify these influxes. The ACC transmits these signals to many of the nearshore habitats around the gulf. We propose to monitor temperature, salinity, nitrate, and phytoplankton (chlorophyll fluorescence) bloom properties at GAK 1 in the ACC. These variables are inexpensively monitored and useful indices of ecosystem variability, when gathered over a long time period. Salinity primarily controls density gradients, which affects circulation and vertical mixing. Temperature influences stratification and affects the metabolic rates of marine organisms. Nitrate is a critical macronutrient that supports phytoplankton production and hence production at higher trophic levels. Fluorescence provides an index of phytoplankton biomass and indicates the frequency and magnitude of blooms. Interannual variations in any of these parameters could promote changes in biological production at higher trophic levels. The data and results proposed herein will provide the long-term temporal context of the natural variability of the ACC and, by extension, Prince William Sound. The data are essential in understanding how species affected by the oil spill are recovering, since this recovery occurs in an environment with large natural variety that could also affect recovery.

II. PROJECT DESIGN

A. Objectives

The over-arching goal of this program is to provide a high quality, cost-effective, long-term data that are simple measures of the variability of the Gulf of Alaska marine environment. In addition we seek to provide the data to numerous stakeholders, including scientists, resource managers, fishers, climatologists, and the public. We propose to monitor five important ACC ecosystem parameters in order to quantify and understand interannual and longer period variations:

1. Temperature and salinity throughout the water column,
2. Near surface stratification since this affects phytoplankton bloom dynamics,
3. Near and subsurface nitrate supply on the inner shelf, since this important nutrient affects phytoplankton production,
4. Indices of phytoplankton biomass, since this is an index of primary production, and
5. Middleton Island atmosphere-ocean heat fluxes, since these fluxes primarily control upper ocean temperatures and might be related to broader scale climatological indices.

B. Procedural and Scientific Methods

Following past protocols, we propose monthly CTD measurements and year-long, continuous measurements from a subsurface mooring with temperature and conductivity (T/C) recorders placed at nominal depths of 20, 30, 60, 100, 150, 200, and 250 m. A (Wetlabs, Inc.) fluorometer is included at 20 m, to determine timing and duration of the spring and summer blooms. GLOBEC measurements show that the spring bloom extends from the surface to at least 20 m depth, but by early summer, the chlorophyll maximum is at ~20 m depth (*Childers et al*., 2005). The fluorometer emits an illuminated beam of light (at 470 nm) that stimulates chlorophyll in the beam path. The absorbed light excites the chlorophyll molecules, which emit light (fluoresce) at a 695 nm. The emitted light is detected by the fluorometer and the intensity of the fluorescence is proportional to chlorophyll biomass. (Note that fluorescence is only a relative measure of chlorophyll concentration. Absolute values would require systematic water sample measurements over time and additional laboratory analyses to convert the fluorometer data to absolute chlorophyll concentrations. We believe that this extra effort and cost is not essential to our particular goals.) We also include 1 - 2 ISUS (*In Situ* Ultraviolet Sensor) sensors at 20 m and at 150 m depth (if the instrument is available). These instruments optically determine nitrate based on the nitrate UV-absorption spectrum. This spectrum is unique for nitrate and it is resolved by the 256-channel ISUS spectrometer and interpreted by an algorithm developed by the Monterey Bay Aquarium Research Institute. The 20 m ISUS is within the euphotic zone and complements the fluorometer data. The 150 m ISUS will gauge the annual re-supply of nitrate to this shelf (and also Prince William Sound) through the annual exchange between deep shelf and slope waters (*Royer*, 1975; *Weingartner et al.*, 2005). The deep water (and nitrate) is mixed to the surface in winter and is thereby available to phytoplankton at the onset of the spring bloom. ISUS sensors appear to provide sufficiently reliable data ($\pm$ 2 μM) for a whole year [*Whitledge*, 2006]. The ISUS sensors are provided at no cost to this project because they were provided (and will be maintained) with support from the Alaska Ocean Observing System.

The moored instruments and monthly CTD sampling schemes are complementary; one provides high vertical resolution at monthly time scales and the other provides high temporal resolution, but at coarser vertical spacing. The monthly CTDs provide redundancy in the event an instrument fails on the mooring. The GAK 1 monthly temperature and salinity are statistically significant predictors of monthly anomalies of the alongshelf baroclinic transport in the ACC (from November – August; *Weingartner et al.* [2005]) so ACC transport anomalies are monitored indirectly from the GAK 1 data.

The moored T/C recorders are Microcats (at depths greater than 20 m) and a SeaCat (at 20 m depth to incorporate the fluorometer) both manufactured by Seabird, Inc. Seabird performs pre- and post-calibrations upon which we determine sensor drift (typically ~0.01^{o}C -yr^{-1} and ~0.03, or better, Practical Salinity Unit yr^{-1}). The monthly CTD casts are collected from a chartered fishing vessel resident in Seward using a portable CTD (Seabird SBE-25). The SBE 25 has an accuracy ~0.01 or better for salinity and .005^{o}C for temperature. Bio-fouling will gradually degrade the signal quality of the fluorometer so we strive to deploy the mooring in March or early April (depending upon weather) in order to minimize fouling potential prior to the spring bloom in April or May. Temperature and salinity data are sampled at 15-minute intervals except at 20 m depth where power supply considerations for the fluorometer and ISUS dictate hourly sampling. Example time series of the temperature and salinity data are shown as contour plots in **Figure 7,** which contrasts the seasonal changes in temperature and salinity between the 2000-01 and the cold winter of 2006-07.

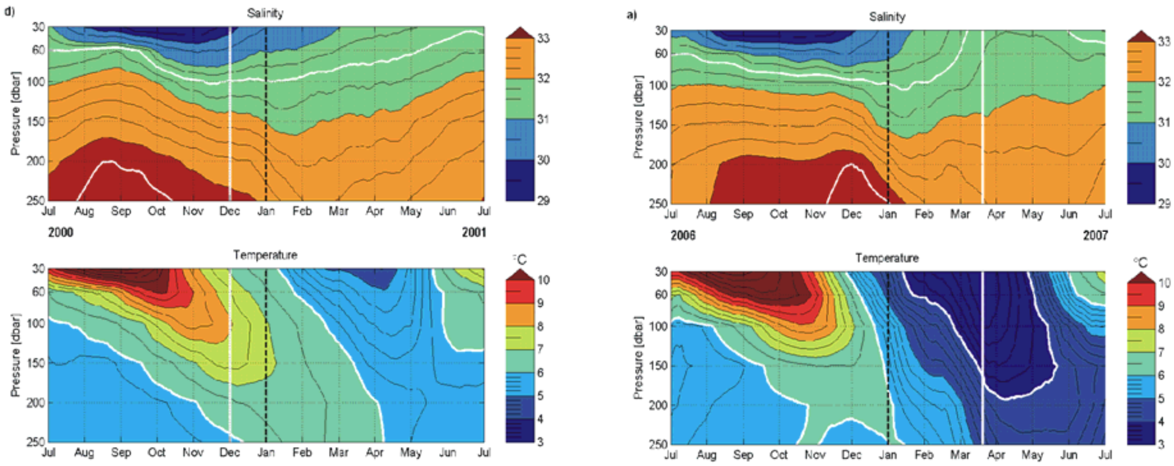

Figure 7. Contour plots of salinity (top panels) and temperature (bottom panels) from July 2000 to June 2001 (left) and July 2006 to June 2007 (right) at GAK 1. In each plot, the black dashed line indicates January 1 and the white line indicates when the GAK 1 mooring was exchanged.

C. Data Analysis and Statistical Methods

The temperature and salinity data analyses are straightforward. We will compute standard statistical estimates for each month and depth and compare these with historical data since the thrust of this effort is to quantify interannual variability. We continue to incorporate Royer's (1982) discharge time series (provided courtesy of Royer through no cost to this project) and air-sea heat fluxes derived from Middleton Island data (which begins in 1948) in our analyses of salinity and temperature variability. We have generated the historical heat flux calculations which show that winter heat losses (from the ocean to the atmosphere) are more variable both interannually and at longer periods than summer heat gains. For example, winter heat loss has decreased by nearly 20% since the mid-1970s and this change was reflected in the warming at GAK 1 through 2005 (*Royer*, 2005). Since that time winter heat loss has increased substantially and returned to values that occurred in the early 1970s. Winter heat loss, in conjunction, with runoof, affects the ocean temperature distribution through spring when many young larvae are emerging to feed. On the other hand summer heat gains appear to be relatively consistent from year to year because this is primarily a function of cloud cover. *Royer et al*. (2006) contend that summer surface temperatures over the shelf and in Prince William Sound are primarily a function of the stratification. They suggest that stronger stratification traps heat in the surface layer and elevates surface temperatures, whereas weaker stratification allows the solar energy to diffuse to greater depths. Within the ACC, stratification is primarily a function of the vertical salinity gradients that we are measuring at GAK 1. We have lately expanded our assessment of heating and cooling rates for comparison with the long-term values derived from Middleton Island. These data are being assembled from a variety of meteorological buoys distributed around the GOA shelf. We are finding that there is considerable spatial variability in these heat fluxes and that the winter air-sea heat derived from Middleton Island (on the outer shelf) tend to underestimate those closer to shore, especially those within Prince William Sound and Cook

Inlet. We are continuing to quantify the spatial variability in heat fluxes as part of this project and anticipate completing this analysis and submitting a publication by 2010. Our approach is to construct linear regressions between Middleton Island heat fluxes and those elsewhere in order to re-construct a historical time series of GOA heat fluxes and sea surface temperatures.

We will also quantify spring and summer phytoplankton blooms in relation to changes in stratification, runoff, and winds. Stratification estimates will be made from the 3 uppermost instruments and the monthly CTD surveys. The fluorescence data will provide an estimate of the number of blooms and bloom duration observed in spring and summer. This approach is necessarily subjective since a bloom event is defined with reference to a base line, which may drift over time because of bio-fouling. However, when present, biofouling develops after the spring bloom, so our qualitative descriptions are primarily valuable in describing year-to-year variability of the spring bloom. GLOBEC measurements, as well as those by *Eslinger et al.* (2001) from Prince William Sound, indicate that the timing of the spring bloom varies considerably from year-to-year perhaps by as much as several weeks. *Weingartner et al*. (2003) show that the onset of the spring bloom on the Gulf of Alaska shelf is tied to the quantity and phasing of winter and early spring runoff because freshwater is the principal stratifying agent in the ACC in both seasons. For example, the spring bloom in the ACC was delayed until May in 2007 and 2008 because of the weak stratification; in contrast it occurred between early to mid-April during the GLOBEC years when winters were wetter and warmer.

Climate model predictions for this region (Intergovernmental Panel on Climate Change [*IPCC*, 2001]) indicate that winters will become warmer and wetter over the Gulf. Based on the GAK 1 time series this was the trend since the late 1970s (*Royer*, 2005; *Royer et al*., 2006; *Janout et al.*, in prep.). If the IPCC predictions are correct, then we might expect that the onset of the spring bloom will occur earlier in the year (*Weingartner et al*., 2003; *Weingartner et al*., 2005) as stratification develops earlier. Such changes could alter the lower trophic structures in the Gulf of Alaska and/or create a mismatch in timing between the phytoplankton bloom and zooplankton hatch. Such changes could have substantial consequences for higher trophic components.

D. Description of Study Area

The fieldwork will be conducted at Station GAK1 at the mouth of Resurrection Bay (**Figure 3**). The station is at ~59^o 51'N, 149^o 28'W, and is located on the inner edge of the ACC midway between Prince William Sound and Cook Inlet in approximately 265 m water depth. Because much of the ACC flows through the sound (*Niebauer et al.*, 1994), GAK 1 characterizes salinity and temperature properties of Prince William Sound waters.

E. Coordination and Collaboration with Other Efforts

All data sets will be available on the GAK 1 website (http://www.ims.uaf.edu/gak1/). The GAK 1 data will be particularly valuable to the scientists involved with herring projects in Prince

William Sound and we routinely inform other members (usually via e-mail) of the herring restoration work on our findings. For example, Hershberger's studies (USGS; *Prince William Sound Herring Disease Program*) on epizootic mortality resulting from infectious and parasitic diseases suggest that herring response to disease might involve a temperature relationship. We have constructed the GDD curves based on the Heintz's request, which is relevant to his project, *Are Herring (Clupea Pallasi) Energetics in PWS a Limiting Factor in Successful Recruitment of Juveniles and Reproduction Investment of Adults?* The GAK 1 data set also complements Kline's (PWSSC; *Prince William Sound Herring Forage Contingency*) efforts on zooplankton abundance and biomass. Kiefer (USC; *An Ecosystem Model of Prince William Sound Herring: A Management & Restoration Tool*) is developing an ecosystem model that will incorporate ocean temperature variability. Two PhD students of G. Kruse are currently employing the GAK1 dataset in their respective studies of Kodiak red king crab and spiny dogfish. We are also aware that A. Seitz and B. Norcross are submitting proposals to examine juvenile herring habitat use. As discussed above this project is being supplemented by the Alaska Ocean Observing System (AOOS), which is providing the ISUS nitrate samplers (with each sampler costing $30,000). Finally, the National Park Service (NPS) is building on their long-term (~10 years) temperature and salinity measurements in Glacier Bay National Park. We have been advising them on their sampling protocol, which will consist of approximately monthly CTD sampling at several stations within Glacier Bay. NPS has indicated that they will share these data with us for inclusion in future analyses of the GAK 1 data. Their participation, at no cost to this project, thus expands the geographic coverage of routine environmental monitoring in the Gulf of Alaska.

III. SCHEDULE

A. Project Milestones

Objective 1. Updated in annual report and on website and to be made available by March-April following the year that the mooring is recovered.

Objective 2. Updated in annual report and on website and to be made available by March-April following the year the mooring is recovered.

Objective 3. Updated in annual report and on website and to be made available by March-April following the year the mooring is recovered.

Objective 4. Updated in annual report and on website and to be made available by March-April following the year the mooring is recovered.

Objective 5. Updated in annual report and on website and to be made available two years after the end of the calendar year (owing to delays associated with attaining and processing the Middleton Island data sets from the National Weather Service).

B. Measurable Project Tasks for FY 10 through FY09 (October 1, 2009 – August 31, 2012)

Fiscal Year 2010

FY 10, 1st quarter (October 1, 2009 – December 31, 2009)

Oct., Nov., Dec: Monthly CTD surveys;
FY 10, 2nd quarter (January 1, 2010 – March 31, 2010)
January 20 - 25: Attend Alaska Marine Science Symposium
Jan., Feb., Mar.: Monthly CTD surveys, recover and re-deploy GAK 1 mooring. Conduct post-calibrations of instruments.
FY 10, 3rd quarter (April 1, 2010 – June 30, 2010)
Apr. May, June: Monthly CTD surveys. Complete post-calibration on mooring instruments, process mooring and CTD data.
FY 10, 4th quarter (July 1, 2010 – September 30, 2010)
Jul., Aug., Sept.: Monthly CTD surveys, update heat fluxes. Submit annual report.

Fiscal Year 2011
FY 11, 1st quarter (October 1, 2010 – December 31, 2010)
Oct., Nov., Dec: As in FY 10, 1st quarter
FY 11, 2nd quarter (January 1, 2011 – March 31, 2011)
Jan., Feb., Mar.: As in FY 10, 2nd quarter
FY 11, 3rd quarter (April 1, 2011 – June 30, 2011)
Apr. May, June: As in FY 10, 3rd quarter
FY 11, 4th quarter (July 1, 2011 – September 30, 2011)
Jul., Aug., Sept.: As in FY 10, 4th quarter.

Fiscal Year 2012
FY 12, 1st quarter (October 1, 2011 – December 31, 2011)
Oct., Nov., Dec: As in FY 10, 1st quarter.
FY 12, 2nd quarter (January 1, 2012 – March 31, 2012)
Jan., Feb., Mar.: As in FY 10, 2nd quarter.
FY 12, 3rd quarter (April 1, 2012 – June 30, 2012)
Apr. May, June: As in FY 10, 3rd quarter.
FY 12, 4th quarter (July 1, 2012 – September 30, 2012)
Jul., Aug., Sept.: As in FY 10, 4th quarter.

Fiscal Year 2013
FY 13, 1st quarter (October 1, 2012 – December 31, 2012)
Oct., Nov., Dec: Write Draft Final Report
FY 13, 2nd quarter (January 1, 2013 – March 31, 2013)
Jan., Feb., Mar.: Submit Draft Final Report

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge

There is no formal traditional ecological knowledge or community involvement component in this program. We informally conduct data and information sharing with interested users through our website, which provides information on project history, prior results, and data access. We also give presentations to local (Fairbanks) schools. By the end of April 2009 we will have given presentations to the communities of Cordova and Kodiak on the recent cooling, with travel support for Janout provided by NPRB and Sea Grant. We also work with Sea Grant MAP agents to solicit community input and share our findings with local communities and fishermen, however, this is done informally.

B. Resource Management Applications

This project monitors fundamental parameters that characterize the variable physical, nutrient, and chlorophyll conditions of the Gulf of Alaska shelf and especially the ACC and thus has potential applications to the management of a variety of marine resources. For example, these data were used in an Alaska Sea Grant funded project to assess Kodiak Island King Crab recruitment processes (G. Kruse, PI). We add that we were originally invited by the EVOSTC to submit proposals to maintain GAK 1 at the beginning of restoration and recovery efforts in the late 1990s. The continuation of this effort was also urged by representatives of USGS-BRD, ADF&G, NOAA-NMFS, and several public community stakeholders during the establishment of the Gulf Ecosystem Monitoring Program. Over the years we have fielded numerous requests for data (or questions pertaining to it) from scientists, commercial and charter fishermen, and economic advisors to the seafood processing industry. (The latter were primarily interested in climate change issues that could influence investment strategies.). We note that the cooling trend that began in 2006-07 represents a natural experiment that, if maintained, may have broad marine ecological implications for the GOA and particularly, for the over-wintering success of age-0 herring.

PUBLICATIONS AND REPORTS

Data and results will be provided via Internet as mentioned and presented at the annual Alaska Marine Science Symposium. Dr. T. Royer has also made annual presentations to PICES on the environmental status of the Gulf of Alaska, which includes the GAK 1 data. Funding for the PICES presentations is covered under separate grants to Dr. Royer. The Janout et al. manuscript referred to throughout this proposal is now undergoing final internal review and we anticipate submitting this paper to the Journal of Geophysical Research by the end of April 2009.

PROFESSIONAL CONFERENCES

No funds are requested for conference travel other than the annual Alaska Marine Science Symposium held in January each year in Anchorage. In the past year we have given two presentations at national meetings on the recent cooling observed in the GOA. These were: M. Janout, S. Danielson, T. Weingartner, and T. Royer *On the nature of the 2006-07 cooling on the northern Gulf of Alaska shelf*. presented at the AGU/ASLO Ocean Sciences Meeting, Orlando, FL. This presentation was updated for the January 2009 Alaska Marine Science Symposium in January 2009. M. Janout, R. Hopcroft, K. Coyle, and T. Weingartner. *Temperature controlling processes and the recent cooling in the northern Gulf of Alaska.* (Mr, Janout received an award for best PhD student oral presentation for this talk.)

PROPOSED PRINCIPAL INVESTIGATOR

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CURRICULUM VITA FOR THE PRINCIPAL INVESTIGATOR

THOMAS J. WEINGARTNER

EDUCATION

Ph.D. Physical Oceanography, 1990, North Carolina State University
M.S. Physical Oceanography, 1980, University of Alaska
B.S. Biology, 1974, Cornell University

MEMBERSHIPS

American Geophysical Union; American Meteorological Society

PUBLIC SERVICE

Member, Prince William Sound Science Center Advisory Committee
Guest Co-Editor, Deep-Sea Research Special Issue on Northeast Pacific GLOBEC Program
Member, Organizing Committee, 2005 Gordon Conference on Coastal Oceanography
Past Member, Science and Technology Advisory Committee, Gulf Ecosystem Monitoring Program, 2002 – 2004
Member, Fall 2004 NSF's Physical Oceanography Review Panel
Past Member, GLOBEC Northeast Pacific Executive Committee, 2000 - 2003
Past Member, Science Steering Committee, NSF - Arctic System Science-Ocean Atmosphere Ice Interaction (OAII) Shelf-Basin Interaction Project (2/98 - 2/03).
Past Member, Science Steering Committee, NSF - ARCSS-OAII Shelf-Basin Interactions (1995 -2002)
Past Member, UNOLS Fleet Improvement Committee (1994 – 1998)

PROFESSIONAL EXPERIENCE

Professor; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 6/99 - present
Assistant Professor; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 11/93 - 1999
Research Associate; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 9/91 - 10/93
Postdoctoral Student; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 7/88 - 8/91
Graduate Research Assistant; Department of Marine, Earth and Atmospheric Sciences, North Carolina State U.; Raleigh, North Carolina; and Department of Marine Science, U. of South Florida; St. Petersburg, Florida; 8/84 - 10/88

PROFESSIONAL INTERESTS

Physical oceanography of the Arctic and North Pacific Ocean and the adjacent shelves, biophysical linkages in oceanography.

FIVE MOST RELEVANT PUBLICATIONS

Janout, M. J., T. Weingartner, S. Danielson, and T. Royer, On the nature of the 2006/07 cooling on the northern Gulf of Alaska shelf (in preparation for the *Journal of Geophysical Research*)

Weingartner, T.J., S. Danielson, and T. C. Royer, Freshwater Variability and Predictability in the Alaska Coastal Current *Deep-Sea Research*, 52: 169 – 192, 2005.

Weingartner, T. Physical and Geological Oceanography: Coastal Boundaries and Coastal and Ocean Circulation (Chap. 4, p. 35 - 48), IN: The Gulf of Alaska: Biology and Oceanography, edited by P. Mundy, University of Alaska Sea Grant (Ak-SG-05-01), 214 p., 2005.

Weingartner, T.J., K. Coyle, B. Finney, R. Hopcroft, T. Whitledge, R. Brodeur, M. Dagg, E. Farley, D. Haidvogel, L. Haldorson, A. Hermann, S. Hinckley, J. Napp, P. Stabeno, T. Kline C. Lee, E. Lessard, T. Royer, S. Strom, 2002, The Northeast Pacific GLOBEC Program: Coastal Gulf of Alaska, *Oceanography*, V15, No 2, 48-63

Niebauer, H. J., T. C. Royer, and T. J. Weingartner, 1994. Circulation of Prince William Sound, Alaska, *Journal of Geophysical Research* 99, 14,113 - 14126.

FIVE ADDITIONAL PUBLICATIONS

W. J. Williams, T. J. Weingartner, A. J. Hermann, Idealized 2-dimensional modeling of a coastal buoyancy front under downwelling-favourable wind-forcing with application to the Alaska Coastal Current, accepted to the *Journal of Physical Oceanography*

Rogers-Cotrone, J, A. Yankovsky, and T. J. Weingartner. The impact of spatial wind variations on freshwater transport by the Alaska Coastal Current, in press, *Journal of Marine Research*.

Weingartner, T. J., L. Eisner, G. L. Eckert, and S. Danielson, Southeast Alaska: Oceanographic Habitats and Linkages, *J. Biogeography* 36(3):387 - 400.

Janout, M. A., T. J. Weingartner, S. R. Okkonen, T. E. Whitledge, and D. L. Musgrave. Some characteristics of Yakutat Eddies propagating along the continental slope of the northern Gulf of Alaska, in press *Deep-Sea Research*, Part II.

Williams, W., T. J. Weingartner, and A. Hermann, 2007. Idealized 3-dimensional modeling of seasonal variation in the Alaska Coastal Current. *Journal of Geophysical Research*, 112, C07001; doi:10.1029/2005JC003285.

Aagaard, K., T.J. Weingartner, S.L. Danielson, R.A. Woodgate, G.C. Johnson, and T.E. Whitledge, 2006: Some controls on flow and salinity in Bering Strait, Geophys. Res. Lett., 33, L19602, doi:10.1029/2006GL026612

SCIENTIFIC COLLABORATIONS WITHIN PAST 48 MONTHS:

K. Aagaard (U. Washington), E. Carmack (Institute of Ocean Sciences), A. Hermann (NOAA-PMEL), R. Pickart (Woods Hole), D. Quadfasel (U.Hamburg), T. Royer (Old Dominion), P. Stabeno (NOAA-PMEL), W. Williams (Institute of Ocean Sciences), R. Woodgate (U. Washington).

OTHER KEY PERSONNEL

Mr. Seth Danielson is a physical oceanographer who has worked in both the GLOBEC and EVOS-supported GAK 1 projects for several years. He has the responsibility for data processing, analyses, and maintenance of the project web page and will be intimately involved in preparing the final report and presentations at the annual meeting. Mr. David Leech is the Seward based mooring and marine technician responsible for the design and deployment of the mooring and maintenance of the instruments. He will also conduct the monthly CTD sampling from the chartered vessels. Danielson and Leech are both employees of the University of Alaska's Institute of Marine Science.

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Aagaard, K., T.J. Weingartner, S.L. Danielson, R.A. Woodgate, G.C. Johnson, and T.E. Whitledge, 2006: Some controls on flow and salinity in Bering Strait, Geophys. Res. Lett., 33, L19602, doi:10.1029/2006GL026612.

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Budget Justification

FY10

Salary support ($42.3) Dr. Thomas Weingartner is the project PI and is responsible for project management. He will devote 0.75 months to the project. Mr. Seth Danielson is responsible for data processing, analyses, archiving and maintenance of the project web page and requires 2 months of support. Mr. David Leech will spend 2 months on the project with 168 hours at university mandated overtime pay while he is at sea for the CTD and mooring work. One month of this time and the overtime will be spent in the design and fabrication of the mooring and this time is included in the equipment category of the budget.

Travel ($2.7) Funds are requested for one person to travel (round-trip Fairbanks – Anchorage) with two days per diem for attending the annual Alaska Marine Science Symposium meeting. Two round-trips are also requested for Mr. Seth Danielson to travel to Seward and conduct two of the monthly CTD casts while Leech is in the field for other projects.

Services ($27.7) The service request includes funds for annual instrument calibrations (6 Microcats, 1 Seacat, and 1 SBE-25) plus the shipping of the instruments to and from Seabird in Seattle. Additional funds are needed to cover the costs for twelve days on the charter fishing vessel for twelve of the monthly CTD sampling periods. The mooring recovery and deployment is performed from a larger vessel at a rate of $2000/day. We have budgeted for an extra day for the mooring work in the event that problems arise in mooring recovery/deployment operations.

Equipment ($39.0) Equipment includes the design and fabrication of the mooring (which involves 1 month of Leech's time) and mooring hardware (batteries, vanes, anchors, line, shackles etc.) and an Oceanetic Measurement Ltd emergency satellite locator beacon. (The beacons are installed on the subsurface float and transmit a signal in the event that the mooring is prematurely released or inadvertently pulled to the surface by a vessel.) In addition, we request funds to purchase one new Microcat (with pressure) to replace one of our older (~10 years) units.

FY11

Salary support ($44.4) Dr. Thomas Weingartner will devote 0.75 months to the project. Mr. Seth Danielson is responsible for data processing, analyses, archiving and maintenance of the project web page and requires 2 months of support. Mr. David Leech will spend 2 months on the project with 168 hours at university mandated overtime pay while he is at sea for the CTD and mooring work. One month of this time and the overtime will be spent in the design and fabrication of the mooring and this time is included in the equipment category of the budget.

Travel ($3.0) Funds are requested for one person to travel (round-trip Fairbanks – Anchorage) with two days per diem for attending the annual Alaska Marine Science Symposium meeting. Two round-trips are also requested for Mr. Seth Danielson to travel to Seward and conduct two of the monthly CTD casts while Leech is in the field for other projects.

Services ($27.7) The service request includes funds for annual instrument calibrations (6 Microcats, 1 Seacat, and 1 SBE-25) plus the shipping of the instruments to and from Seabird in Seattle. Additional funds are needed to cover the costs for twelve days on the charter fishing vessel for twelve of the monthly CTD sampling periods. The mooring recovery and deployment is performed from a larger vessel at a rate of $2000/day. We have budgeted for an extra day for the mooring work in the event that problems arise in mooring recovery/deployment operations.

Equipment ($33.4) Equipment includes the design and fabrication of the mooring (which involves 1 month of Leech's time in each year of the project) and mooring hardware (batteries, vanes, anchors, line, shackles etc.) In addition, we request funds to purchase one new Microcat (with pressure) to replace one of our older (~10 years) units.

FY12

Salary support ($45.8) Dr. Thomas Weingartner will devote 0.75 months to the project. Mr. Seth Danielson is responsible for data processing, analyses, archiving and maintenance of the project web page and requires 2 months of support. Mr. David Leech will spend 2 months on the project with 168 hours at university mandated overtime pay while he is at sea for the CTD and mooring work. One month of this time and the overtime will be spent in the design and fabrication of the mooring and this time is included in the equipment category of the budget.

Travel ($3.0) Funds are requested for one person to travel (round-trip Fairbanks – Anchorage) with two days per diem for attending the annual Alaska Marine Science Symposium meeting. Two round-trips are also requested for Mr. Seth Danielson to travel to Seward and conduct two of the monthly CTD casts while Leech is in the field for other projects.

Services ($27.7) The service request includes funds for annual instrument calibrations (6 Microcats, 1 Seacat, and 1 SBE-25; total cost is $4890) plus the shipping ($800) of the instruments to and from Seabird in Seattle. Additional funds are needed to cover the costs for twelve days ($1500/day) on the charter fishing vessel for twelve of the monthly CTD sampling periods. The mooring recovery and deployment is performed from a larger vessel at a rate of $2000/day. We have budgeted for an extra day for the mooring work in the event that problems arise in mooring recovery/deployment operations.

Equipment ($27.0) Equipment includes the design and fabrication of the mooring (which involves 1 month of Leech's time in each year of the project) and mooring hardware (batteries, vanes, anchors, line, shackles etc.)

FY10-FY12

In-kind contributions The ISUS nitrate analyzers and the technician responsible for these is covered by a grant from the Alaska Ocean Observing System (AOOS) to Dr. Terry Whitledge of the Institute of Marine Science, University of Alaska.

Benefits Staff benefits are applied according to UAF's fixed benefit rates for FY09 with the Office of Naval Research (ONR). A copy of the negotiated rate proposal is available at: http://www.alaska.edu/controller/cost-analysis/negotiated_agreements.html.

Indirect Costs ($56.1) The University of Alaska has an agreed indirect rate for Trustee Council funded projects of 25% total direct costs (TDC).

Data Management and Quality Assurance/Quality Control (QA/QC) Statement

1. Study Design
The sampling types include monthly CTD casts and quarter hourly temperature and salinity measurements from Microcats (at 30, 50, 100, 150, 200, and 250 m) and hourly measurements from the Seacat at 20 m depth. The fieldwork will be conducted at Station GAK1 at the mouth of Resurrection Bay and is based out of Seward, Alaska. The station is at ~59.85^{o}N, 149.47^{o}W. GAK 1 is located on the inner edge of the ACC midway between Prince William Sound and Cook Inlet in approximately 265 m water depth. Examples of statistical analyses to be used are monthly means and standard deviations with these compared with historical data using Student's t-tests, power spectra, auto- and cross-correlations, and linear regressions. (See pages 6 – 9 of the project plan)

2. Acceptable data criteria
This is discussed in section 6 below.

3. Data characteristics
The data consist of time series from the mooring and monthly profiles of temperature and salinity (as described in item 1). The data to be collected are physical measurements and consist of: temperature, salinity, and fluorescence and a time stamp. AOOS is sponsoring the collection of the nitrate data from the ISUS instruments. (See pages 6-9 of the project plan)

4. Algorithms
The Seabird manuals for the Microcats and Seacats are available from the manufacturer and provide descriptions on how the sensor voltages are converted to physical units. We compute density and depth using the International Equation of State of Seawater based on Matlab software routines encoded for this purpose and used throughout the oceanographic community.

5. Physical samples.
Not applicable to this project.

6. Calibration procedures.
We insure data quality with the temperature-conductivity recorders (Microcats, Seacat, and SBE-25 CTD) in several ways. First, the instruments are on an annual calibration schedule and the calibration history is maintained at IMS and as Seabird. Second, prior to deployment of the moorings we operate each instrument in a well-mixed seawater bath in Seward for two days. The purpose of this pre-deployment test is to check that each instrument's clock and pre-set sampling period is correct and that all instruments are recording the same temperature and salinity. This is not a calibration, only a check to make sure that each instrument is recording the same values of temperature and salinity. Third, post-recovery processing screens the data for erroneous spikes (that might have resulted from temporary clogging of the conductivity cell for example. (The fluorescence measurements are relative only and therefore not calibrated as discussed on pages 6-9 of the project plan.). Meteorological data from Middleton Island and various buoys are calibrated by NOAA (National Data Buoy Center and National Weather Service).

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 10- FY 12

Budget Category:	Proposed FY 10	Proposed FY 11	Proposed FY 12	Proposed FY 13	TOTAL PROPOSED
Personnel	$42.3	$44.4	$45.8	$0.0	$132.4
Travel	$2.7	$3.0	$3.0	$0.0	$8.7
Contractual	$27.7	$27.7	$27.7	$0.0	$83.1
Commodities	$0.0	$0.0	$0.0	$0.0	$0.0
Equipment	$39.0	$33.4	$27.0	$0.0	$99.3
Indirect *(will vary by proposer)*	$ 18.2	$18.8	$19.1		$56.1
SUBTOTAL	$129.8	$127.2	$122.6	$0.0	$379.6
General Administration (9% of subtotal)	$11.7	$11.4	$11.0	$0.0	$34.2
PROJECT TOTAL	$141.5	$138.7	$133.6	$0.0	$413.8
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0

COMMENTS: The ISUS nitrate analyzers and the technician responsible for these is covered by a grant from the Alaska Ocean Observing System (AOOS) to Dr. Terry Whitledge of the Institute of Marine Science, University of Alaska.

FY10 - 13

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4A
NON-TRUSTEE
AGENCY SUMMARY

EXXON VALDEZ **OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs: Name	Project Title	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Tom Weingartner	PI		0.8	12.2		9.2
David Leech	Technician		1.0	9.9		9.9
Seth Danielson	Technician		2.0	11.6		23.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.8	33.7	0.0	
					Personnel Total	$42.3

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Round Trip Fairbanks to Anchorage	0.4	1	2	0.1	0.5
Round Trip Fairbanks to Anchorage, drive to Seward	0.4	2	8	0.2	1.9
Car Rental Anchorage to Seward	0.2	2			0.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.7

FY10

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B
PERSONNEL &
TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
Vessel Charter for CTDs (12 1-day trips, $1500/day)	18.0
Vessel Charter for Moorings (1 2-day trip, $2000/day)	4.0
MicroCat and SeaCat calibrations (6 @$475, 1 @$520)	3.4
SEBE-25 calibration	1.5
Shipping	0.8
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$27.7

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY10

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
Equipment Fabrication	1.0	21.7	21.7
WetLabs ECO-FLS (with bio-wiper)	1.0	6.3	6.3
Seabird 37SMP Microcat with pressure	1.0	4.6	4.6
Mooring hardware	1.0	6.5	6.5
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$39.0

Existing Equipment Usage: Descriptior	Number of Units	Inventory Agency

FY10

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B EQUIPMENT DETAIL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs: Name	Project Title	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Tom Weingartner	PI		0.8	12.8		10.2
David Leech	Technician		1.0	10.2		10.2
Seth Danielson	Technician		2.0	12.0		24.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.8	35.0	0.0	
					Personnel Total	$44.4

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Round Trip Fairbanks to Anchorage	0.4	1	2	0.1	0.7
Round Trip Fairbanks to Anchorage, drive to Seward	0.4	2	8	0.2	2.0
Car Rental Anchorage to Seward	0.2	2			0.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3.0

FY11

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
Vessel Charter for CTDs (12 1-day trips, $1500/day)	18.0
Vessel Charter for Moorings (1 2-day trip, $2000/day)	4.0
MicroCat and SeaCat calibrations (6 @$475, 1 @$520)	3.4
SEBE-25 calibration	1.5
Shipping	0.8
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$27.7

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY11

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
Equipment Fabrication	1.0	22.3	22.3
Seabird 37SMP Microcat with pressure	1.0	4.6	4.6
Mooring hardware	1.0	6.5	6.5
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$33.4

Existing Equipment Usage: Descriptior	Number of Units	Inventory Agency

FY11

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B EQUIPMENT DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs: Name	Project Title	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Tom Weingartner	PI		0.8	13.4		10.7
David Leech	Technician		1.0	10.5		10.5
Seth Danielson	Technician		2.0	12.3		24.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.8	36.2	0.0	
					Personnel Total	$45.8

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Round Trip Fairbanks to Anchorage	0.4	1	2	0.1	0.6
Round Trip Fairbanks to Anchorage, drive to Seward	0.4	2	8	0.2	2.0
Car Rental Anchorage to Seward	0.2	2			0.4
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3.0

FY12

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B
PERSONNEL &
TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
Vessel Charter for CTDs (12 1-day trips, $1500/day)	18.0
Vessel Charter for Moorings (1 2-day trip, $2000/day)	4.0
MicroCat and SeaCat calibrations (6 @$475, 1 @$520)	3.4
SEBE-25 calibration	1.5
Shipping	0.8
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$27.7

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY12

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
Equipment Fabrication	1.0	23.0	23.0
Mooring hardware	1.0	4.0	4.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$27.0

Existing Equipment Usage: Descriptior	Number of Units	Inventory Agency

FY12

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B EQUIPMENT DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs: Name	Project Title	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY13

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B PERSONNEL & TRAVEL DETAIL

EXXON VALDEZ **OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$0.0

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY13

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Descriptior	Number of Units	Inventory Agency

FY13

Project Title: Long-Term Monitoring of the Alaska Coastal Current
Lead PI: Tom Weingartner

FORM 4B
EQUIPMENT
DETAIL