EVOSTC FY17-FY21 INVITATION FOR PROPOSALS
FY18 PROGRAM PROPOSAL SUMMARY PAGE

Program Number and Title

18120114 - Gulf Watch Alaska Program: Long-term Monitoring of Marine Conditions and Injured Resources

Team Lead(s) and Affiliation(s)

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Date Proposal Submitted

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Program Abstract

The Gulf Watch Alaska (GWA) program directly addresses the *Exxon Valdez* Oil Spill Trustee Council's focus area, integrated long-term monitoring of marine conditions and injured resources services. The overarching goal of GWA is to provide sound scientific data and products that inform management agencies and the public of changes in the environment and the impacts of these changes on injured resources. GWA has a consortium of 14 projects organized in the following functional groups: three monitoring components (environmental drivers, pelagic, and nearshore), a program management team, a science review panel, a science coordinating committee, and an outreach steering committee.

The program has five primary objectives: 1) sustain and build upon existing time series in the EVOS-affected regions of the Gulf of Alaska, 2) provide scientific data, data products and outreach to management agencies and a wide variety of users, 3) develop science synthesis products to assist management actions, inform the public and guide monitoring priorities for the next 15 years, 4) continue to build on collaborations between the GWA and Herring Research and Monitoring (HRM) programs, as well as other Trustee program focus areas including the data management program, lingering oil and potential cross-program publishing groups, and 5) leverage partnerships with outside agencies and groups to integrate data and expand capacity through collaborative efforts.

Recent highlights from the first six years of the GWA program show continued development of program infrastructure and compilation of scientific information for the long-term. Five-year final reports were submitted to the EVOSTC, 45 datasets were published to the public on DataONE, and 19 papers were accepted for a special journal issue of Deeps Sear Research II.

Our plans for FY18 have not changed and include continuing the legacy of our LTM datasets and expanding our knowledge of the GOA ecosystem and its changing conditions.

EVOSTC Funding Requested* (must include 9% GA)

FY17	FY18	FY19	FY20	FY21	TOTAL
$2,278,750	$2,574,860	$2,351,260	$2,502,340	$2,342,630	$12,049,840

Non-EVOSTC Funds to be used, please include source and amount per source: (see Section 6C for details)

FY17	FY18	FY19	FY20	FY21	TOTAL
$1,671,000	$1,712,000	$1,658,000	$1,677,000	$1,622,000	$8,340,000

1. EXECUTIVE SUMMARY

This proposal requests continuation of the Gulf Watch Alaska (GWA) long-term monitoring (LTM) program for FY 2018, year 7 of the program. The *Exxon Valdez* Oil Spill (EVOS) Trustee Council (EVOSTC) initiated funding for the GWA LTM program in 2012 (McCammon et al. 2011) and recommended continuation for the next 5-year increment, years 5-10 (Lindeberg 2016). The Trustees plan to support a LTM program for 20 years. As requested by the EVOSTC this program is designed to monitor key components that play important roles in the Gulf of Alaska (GOA) marine ecosystem. These components include environmental drivers such as temperature and nutrient availability; pelagic populations of predators and prey; and the nearshore ecosystem. Through this effort, scientists and resource managers will be able to continue to monitor injured resources from the EVOS and have a better understanding of potential impacts to these resources from natural and anthropogenic changes in the environment.

GWA is a consortium of 14 projects, ten of which started before 2012 and several with data sets extending prior to the EVOS. A wide array of information and tools have been effectively coordinated and synthesized by the GWA program to date (GWA 3 Year Science Synthesis Report, 2015; GWA final reports 2016; pending special issue publication of Deep-Sea Research II – Topical Studies in Oceanography). The program has fostered partnerships that include: professional administrative support, advanced data housing, scientific collaboration and synthesis across projects and disciplines, and a significant outreach capacity through agency partners. Collectively, this group of 24 scientists represents unsurpassed expertise and knowledge of the GOA ecosystem and spill-affected region. The overarching goals of the program are to:

A. *Collect long-term ecological monitoring information from the GOA EVOS affected region*
B. *Make monitoring data publicly available for use by stakeholders, managers, and facilitate synthesis efforts*
C. *Assess monitoring data holistically across projects, components, and programs (i.e., HRM and Lingering Oil) to better understand the range of factors affecting individual species and the ecosystem*

Our plans for the next fiscal year have not changed from the original FY17-21 proposal package. For FY18, we are submitting a program proposal (this document), two program management proposals (PM I and PM II) and eleven monitoring project proposals. Individual project proposals and budget plans are provided, as requested, in the program's Research Workspace to EVOSTC staff members.

Brief summaries of each project under the GWA program have been compiled below. These are not meant to be comprehensive, but provide a quick means for reviewing key aspects of all projects (e.g., who, what, where, when, interim findings, and highlighted time series datasets where appropriate). For more details, please see individual project work plans. Figure 1 shows the GWA "footprint" for the various monitoring projects.

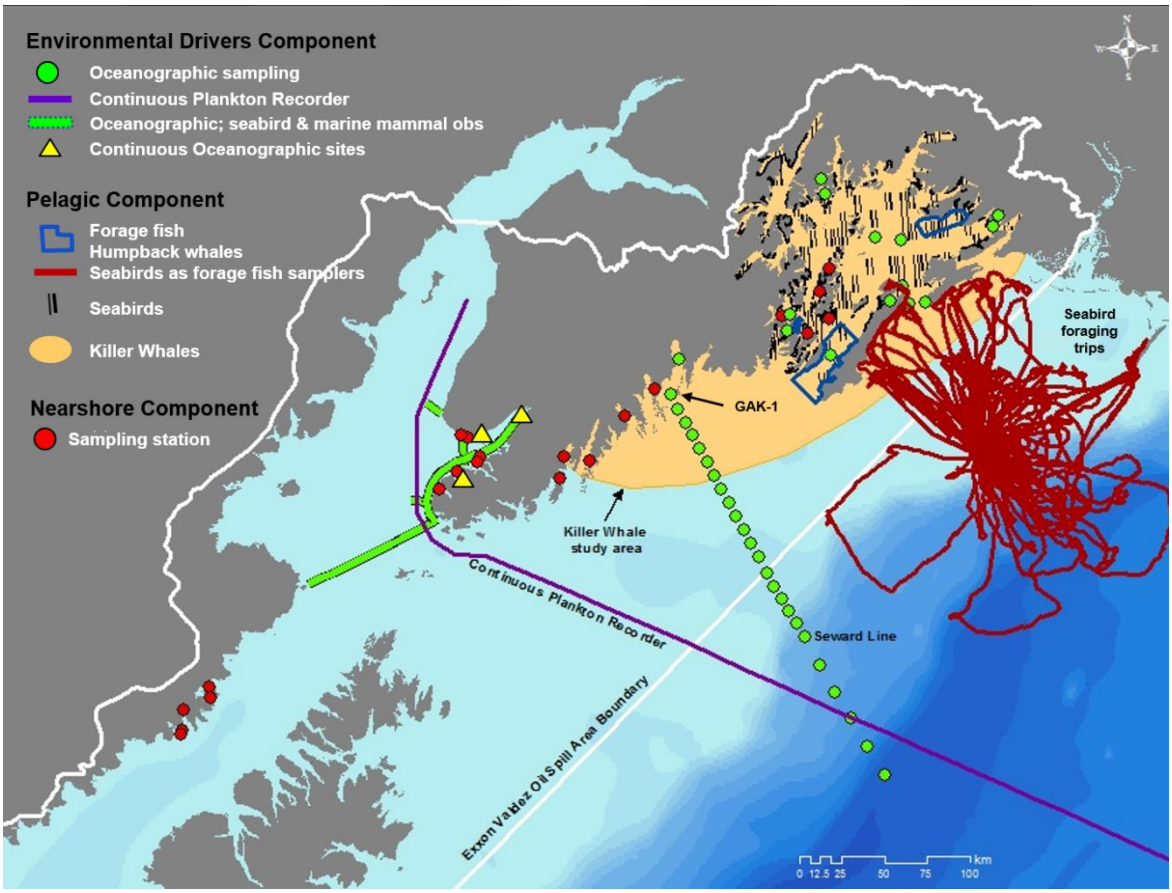


Figure 1. Gulf Watch Alaska monitoring "footprint" by ecosystem component and project focus.

INTEGRATED PROGRAM MANAGEMENT AND ADMINISTRATION

Program coordination and science synthesis (GWA Program Management I) – Mandy Lindeberg, Rob Suryan, and Donna Aderhold, NOAA Auke Bay Laboratories

This project is established at the Program Management Team (PMT) level of the GWA program and explicitly provides coordination and oversight of science syntheses of data collected under the LTM program.

Program coordination and science synthesis is a key component that improves linkages between monitoring efforts spanning large regional areas (Prince William Sound [PWS], GOA shelf, lower Cook Inlet). Program coordination includes facilitating program planning and sharing of information between principal investigators (PIs), other Trustee funded programs, and non-Trustee organizations. Major accomplishments of program management and science coordination in FY17 included coordinating completion, review, and submission of FY12-16 GWA final reports, completion of the Deep-Sea Research II GWA special issue (19 papers), and inauguration of the second 5-yr period of GWA for the PMT. During FY18, key directions of program coordination and science synthesis will include improving efficiencies and facilitating program reporting requirements for PIs, identifying GWA indicators from each project to contribute to annual ecosystem status and oil spill recovery assessments, standardizing reporting, and identifying main cross-program science synthesis products for GWA, the Herring Research and Monitoring (HRM) program, and other GOA investigations.

Program administration, logistics, and outreach (GWA Program Management II) – Katrina Hoffman, Prince William Sound Science Center (PWSSC)

This project is also established at the PMT level of the GWA LTM program and provides for program administration and outreach. The PWSSC serves as the Administrative Lead and fiscal agent for GWA. PWSSC has extensive fiscal experience with the National Oceanic and Atmospheric Administration (NOAA), and is the party through which all non-Trustee Agency funds are distributed. PWSSC issues and manages contracts for subawards to the various non-Trustee Agencies participating in GWA, for whom we also coordinate semi-annual reporting to NOAA. PWSSC ensures regular program engagement with EVOSTC staff, Trustees, and Public Advisory Committee members. They coordinate logistics for annual PI meetings for all GWA participants and make telecommunications available for remotely-connected meetings. They support travel and logistics for all GWA Science Review Panel members. During FY17-18, PWSSC will convene the Outreach Steering Committee, which will guide the development of products to inform the public and managers about changes in the environment and the impact of said changes on injured resources and services. PWSSC is also the administrative lead agency for the HRM program, allowing for efficient fiscal management of and reporting for both programs.

Environmental Drivers Component

The Environmental Drivers component of the GWA program provides the spatial and temporal context for understanding change in the physical and chemical environment. As in the first five years of GWA, this observation network consists of five separate, but interconnected components distributed across the spill-impacted GOA and are key to improving our understanding of the intersection of the Alaska Coastal Current with PWS, Resurrection Bay, and Lower Cook Inlet:

Gulf of Alaska mooring (GAK1) – Seth Danielson and Tom Weingartner, University of Alaska Fairbanks (UAF)

The GAK1 project continues a 45-year time series of temperature and salinity measurements at hydrographic station GAK1. The project monitors five important Alaska Coastal Current ecosystem parameters that quantify and help us understand hourly to seasonal, interannual, and multi-decadal variability in temperature and salinity throughout the 250 m deep water column, near surface stratification, surface pressure fluctuations, fluorescence as an index of phytoplankton biomass, and along-shelf transport. Key results for data collected during oceanographic monitoring at GAK1 from 1970 to present provide evidence for several long-term trends on the GOA shelf over that period, including: 1) an overall warming of shelf water (of nearly 0.8 °C in the upper 100 m over 40 years), with intermittent periods of cooler temperatures (Figure 2); 2) an increase in salinities in deeper waters (> 100 m); 3) a decrease in upper ocean (0 – 100 m) salinities; and 4) increasing stratification. The upper ocean salinity decrease is in agreement with the long-term trend toward increasing freshwater discharge throughout the GOA.

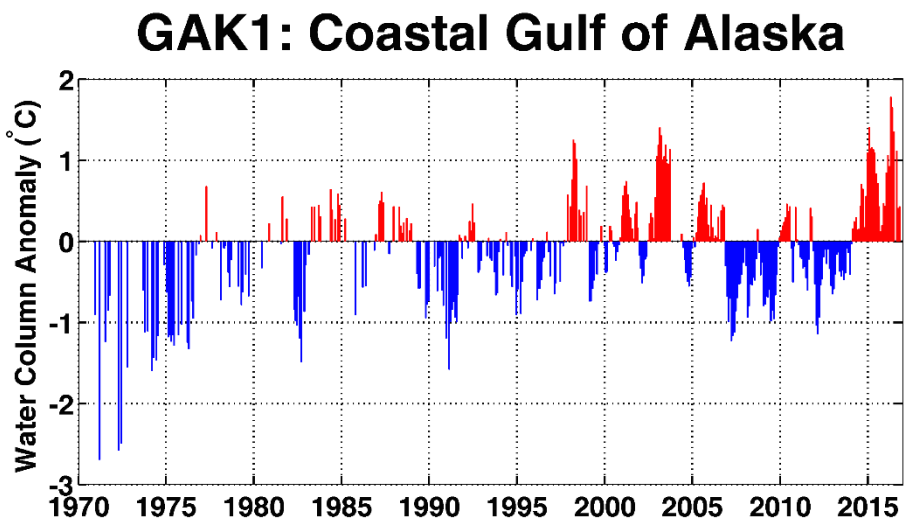


Figure 2. GAK 1 time series 1970-2016. Temperature anomalies from the GAK-1 dataset at 50 m depth exhibit a long-term trend in warming along with signals associated with the cycles of El Nino and other phenomena.

Seward line – Russ Hopcroft, UAF

This project continues the multi-disciplinary oceanographic observations initiated in fall 1997 in the northern GOA. Cruises occur in early May and early September to capture the typical spring bloom and summer conditions, respectively, along a 150-mile cross shelf transect to the south of Seward, Alaska. The line is augmented by stations in the entrances and deep passages of PWS. We determine the physical-chemical structure, the distribution and abundance of phytoplankton, microzooplankton and mesozooplankton, and survey seabirds and marine mammals. Dominated by a strong seasonal cycle, the Northern GOA ecosystem does not respond in a currently predictable way, profoundly affected by warmer years, fresher years, and light conditions in spring, that influence the timing of planktonic processes, but not necessarily their ultimate abundance or biomass (Figure 3). In contrast, temperature is much less variable during late summer. Furthermore, our observations suggest that the recent North Pacific warm-water anomalies impacted rates of Neocalanus lipid accumulation and their overwintering health.

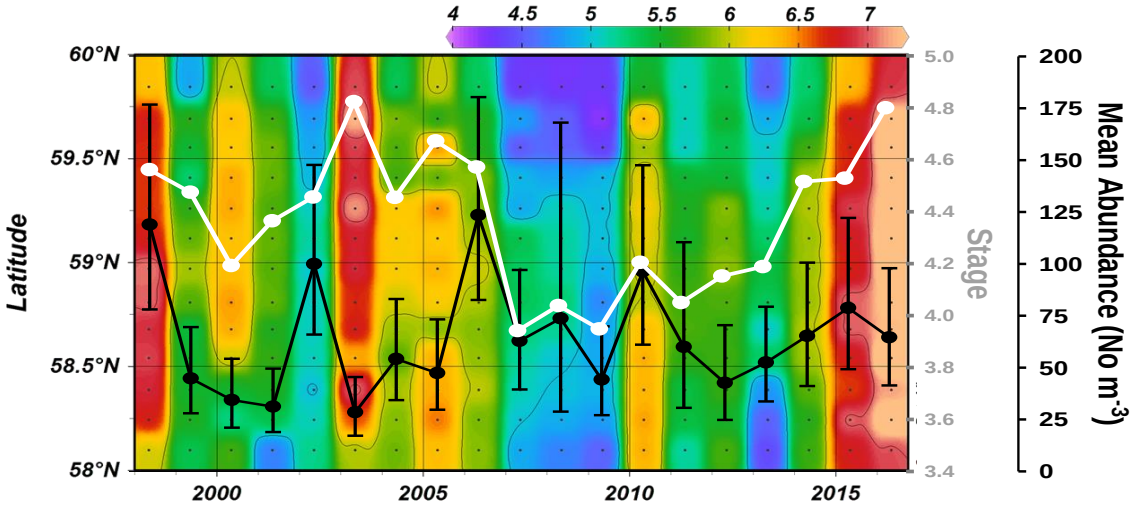


Figure 3. Seward Line time series 1998-2016. Early May temperature average of the upper 100m along the Seward Line, with abundance (black) and mean stage (white) of *Neocalanus* spp.

Oceanographic conditions in Prince William Sound – Rob Campbell, PWSSC

This project continues to take physical and biological measurements in PWS's marine ecosystem. Regular vessel surveys are conducted to maintain ongoing time series observations. An autonomous profiling mooring will be deployed each year in central PWS to provide daily depth-specific measurements of the surface layer that will be telemetered out in near real-time. An in-development in situ plankton camera will also enumerate zooplankton, large phytoplankton and other particles, with some taxonomic discrimination. A long-term time series of CTD casts in PWS has been maintained by the GWA program and contains 23,150 unique profiles dating back to 1974. Analysis of the anomalies in temperature shows a warming trend over the last 40 years at most depths (Figure 4). The temperature trend at the surface is flat, presumably due to enhanced inputs of cold meltwater at the surface along the margin of the GOA.

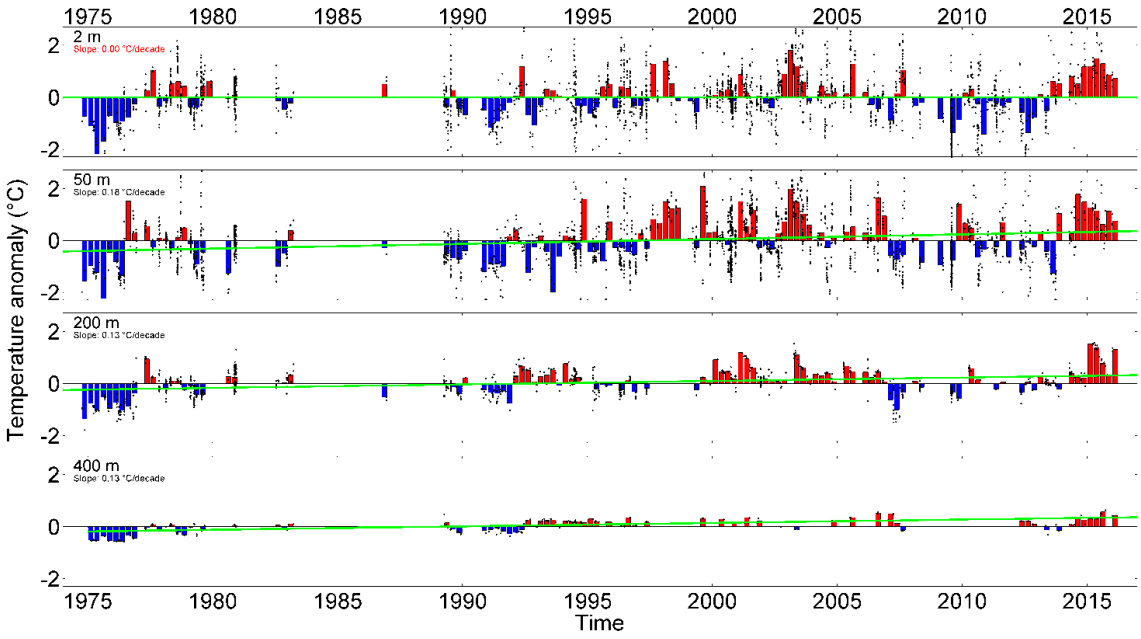


Figure 4. PWS time series 1974-2016. Temperature anomalies at four selected depths in central PWS. Anomalies were calculated as the residual to a second order cosine curve fit to all years' data (to remove seasonality). Black points are observations, bars are quarterly averages, and the green line indicates the linear trend. Slopes with text in black are significantly different from zero (p<0.05).

Oceanographic conditions in Lower Cook Inlet/ Kachemak Bay – Doroff & Holderied, UAA/KBNERR and NOAA Kasitsna Bay Laboratory

The lower Cook Inlet/Kachemak Bay oceanographic project assesses the effects of oceanographic variability on nearshore and pelagic species injured by the EVOS. We currently have oceanographic data from a 6-year time series within Cook Inlet/Kachemak Bay (Figure 5) and 15-year record of continuous nearshore water chemistry observations in Kachemak Bay. Ship-based oceanographic surveys are monthly, seasonally, and annually in Cook Inlet/Kachemak Bay, with CTD casts (including fluorescence, turbidity, and dissolved oxygen), phytoplankton, and zooplankton collected along repeated transects. This project provides important environmental driver information downstream of the Seward Line and Continuous Plankton Recorder sampling in the northern GOA. Year-round, higher frequency sampling in Cook Inlet/Kachemak Bay also provides assessment of seasonal and shorter time scales of variability relevant to GWA ecosystem-level monitoring. By sampling inland waters upstream (PWS) and downstream (Cook Inlet/Kachemak Bay) of other environmental driver components, we strengthen our ability to evaluate local (sound, inlet) and remote (shelf, North Pacific) climate forcing effects on nearshore ecosystems. From 2012 to 2016 there was an increase in temperature both seasonally and interannually, which was most pronounced after 2013. This was true for both surface waters and waters at depth (blue and red ovals, Figure 5). Salinity experienced a freshening trend at depth; however, not in the surface waters (purple circle, Figure 5). These results are consistent with those from GAK1 over the same upper 100 m of the water column, but different from lower water column (< 100 m) observations at GAK1.

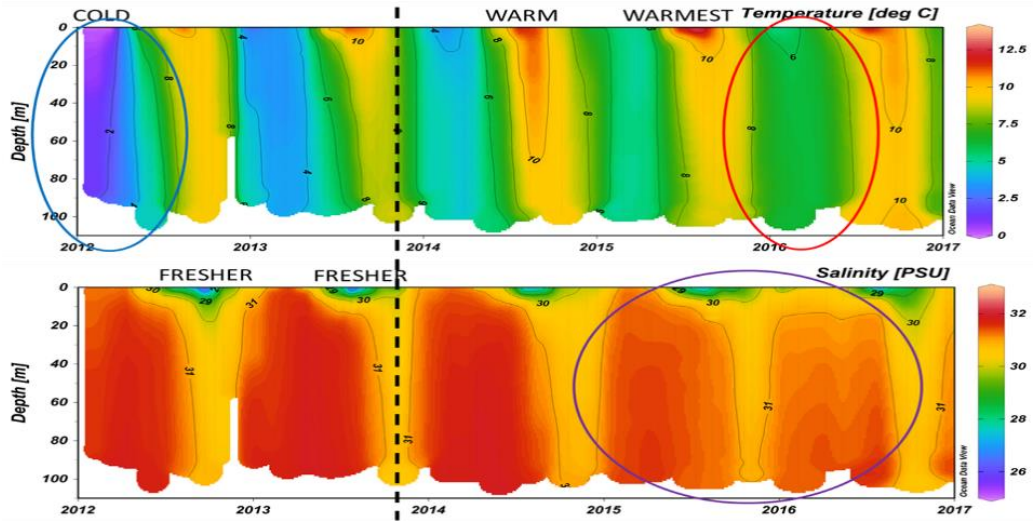


Figure 5. Kachemak Bay time series 2012-2017. Vertical profiles of water column temperature (top, degrees C) and salinity (bottom, PSU) collected from monthly CTD casts at a mid-Kachemak Bay station. See text above for explanation of circles.

Continuous plankton recorder –Sonia Batten, Sir Alister Hardy Foundation for Ocean Science (SAHFOS) and Robin Brown, North Pacific Marine Science Organization

This project maintains the Continuous Plankton Recorder (CPR) transect which samples the Alaskan shelf from lower Cook Inlet across the slope into the open GOA approximately six times per year, usually between April and September. The CPR provides a record of taxonomically resolved, seasonal, near-surface zooplankton and large phytoplankton abundance over a wide spatial scale. In autumn 2013, the transition from cool conditions to unusually warm conditions occurred and changes in the plankton were quite dramatic (Figure 6, top panel). There was a change in the large diatom community to species more favored by low nutrients, and cell counts were low in spring, especially in 2016. The zooplankton community in summer was dominated by small species (Figure 6, bottom panel) which do better in warm conditions.

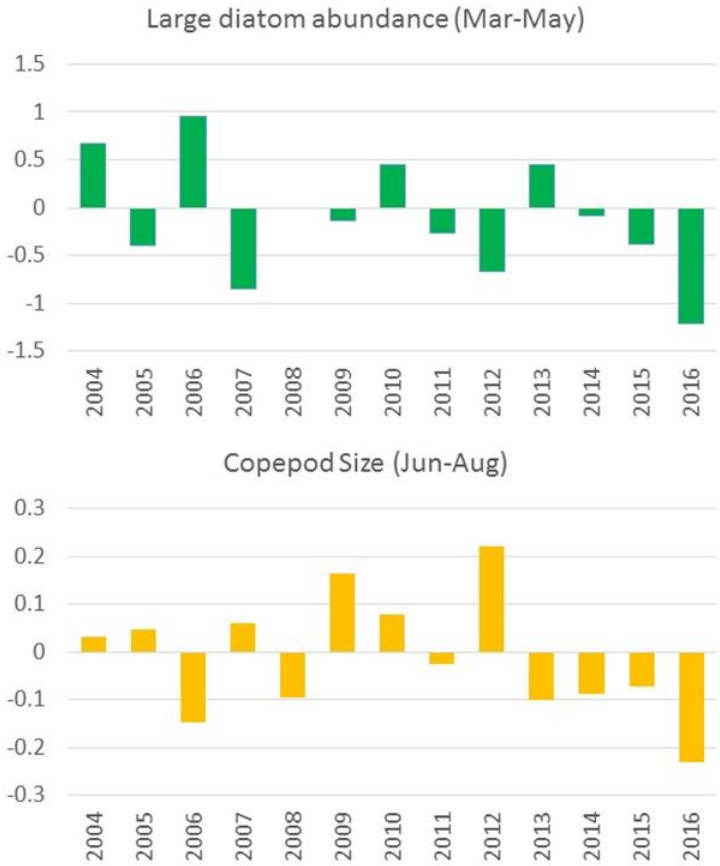


Figure 6. CPR time series 2004-2016. Mean anomaly time series of large diatom abundance in spring (top) and the mean size of the summer copepod community (bottom).

PELAGIC COMPONENT

The pelagic component research team monitors key pelagic species groups using five projects focused on killer whales, humpback whales, forage fish, and marine birds (two projects, summer and fall/winter). The two over-arching questions for the pelagic component to answer in the next five years are: 1) what are the population trends of key upper trophic level pelagic species groups in PWS – killer whales, humpback whales, and marine birds? and 2) how do predator-prey interactions, including interannual changes in prey availability, contribute to underlying changes in the populations of pelagic predators in PWS and Middleton Island?

Long-term killer whale surveys – Craig Matkin, North Gulf Oceanic Society

This is a continuation of the long-term killer whale monitoring program that was initiated in 1984 in PWS. A primary focus has been on resident killer whales and the recovery of AB pod, and the threatened AT1 population of transient killer whales, which suffered serious losses at the time of EVOS and have not recovered (Figure 7). Sampling procedures include photo-identification, annual skin biopsies, observing predation, sampling prey, remote acoustic monitoring, time-depth tags, photographic drones, and focal observations of whales for feeding studies. This project clearly demonstrates the need for long-term monitoring to fully assess recovery, or potentially local extinction, of long-lived, slowly reproducing species.

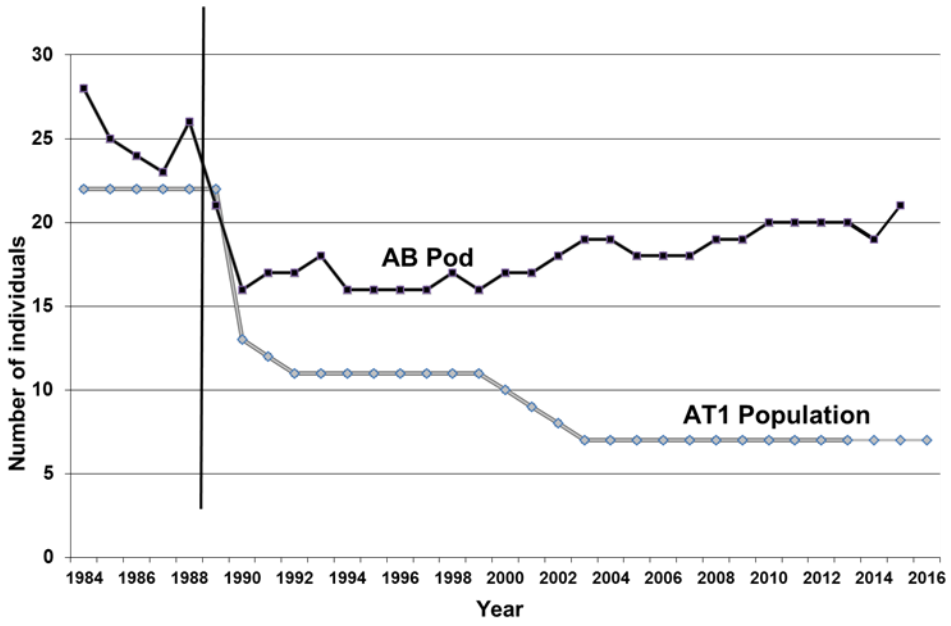


Figure 7. PWS time series of the numbers of killer whales in AB pod (1984-2015) and AT1 population (1984-2016).

Prince William Sound marine bird surveys – Kathy Kuletz and Robert Kaler, U.S. Fish and Wildlife Service (USFWS)

This project will conduct small boat-based surveys to monitor abundance of marine birds in PWS during July 2018 and July 2020. Historical data include fifteen surveys spanning 1989 to 2015 and have been used to monitor population trends for marine birds in PWS following the EVOS (Figure 8). Marine bird surveys compliment the benthic monitoring and forage fish monitoring aspects (including Middleton Island) of the LTM program by providing a population trend index useful for interpreting marine ecosystem patterns observed in PWS. Key findings thus far reveal marine bird communities as a whole to be spatially structured along a primary onshore-offshore environmental gradient, and secondarily structured along an estuarine-marine environmental gradient. Analysis of spatial habitat associations and temporal change of *Brachyramphus* murrelets found that abundance estimates for both marbled murrelets (*Brachyramphus marmoratus*) and Kittlitz's murrelets (*B. brevirostris*) decreased by more than two-thirds over the study period. There was no evidence that rates of change differed along environmental or geographic gradients and no evidence that changes in seasonal patterns of abundance occurred.

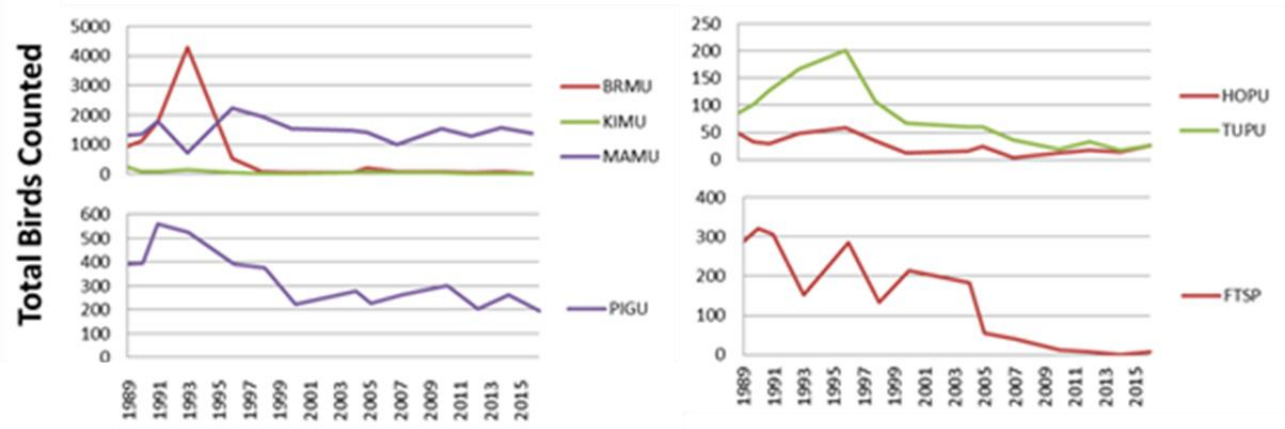
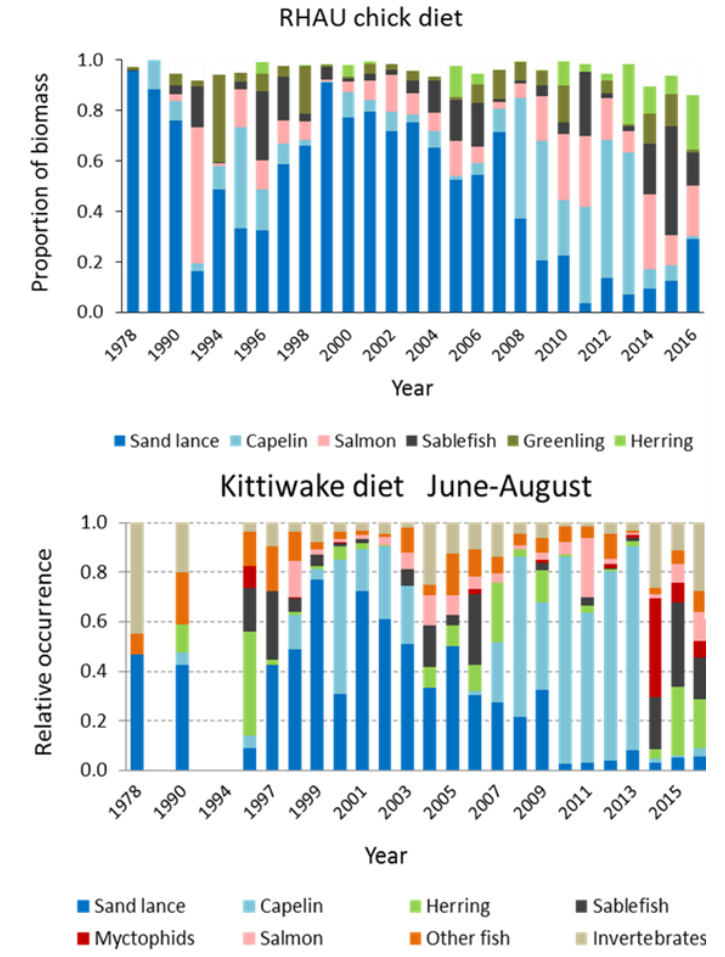


Figure 8. PWS time series 1989-2015. Select pelagic foragers (murrelets, guillemots, puffins, and petrels) in PWS showing a declining trend.

Forage fish distribution and relative abundance – Mayumi Arimitsu and John Piatt, U. S. Geological Survey (USGS) Alaska Science Center

This project is moving in a new direction by providing spring/summer forage fish indices to link with environmental drivers and other GWA spring/summer sampling components, and integrated fall predator-prey surveys to estimate forage biomass in the immediate vicinity of predator aggregations and fish condition prior to overwintering. By integrating with fall/winter humpback whale and marine bird surveys, we will sample forage fish in the same locations and times, thus providing valuable prey information for two pelagic predator groups of key value to EVOSTC. Work focuses on smaller geographical areas within PWS and takes advantage of known persistent predator aggregations to locate prey that can then be well monitored over time with reasonable financial resources. Additionally, using predators as samplers of forage fish can provide an important index of changes in summer prey species composition over time. Thus, we will incorporate into the GWA Pelagic Component a long-term seabird diet data collection program from Middleton Island as a cost-effective means to monitor forage fish stocks in the northern GOA. Time series data from Middleton Island, the longest available from any location in Alaska, show that after several years of high frequency of occurrence in seabird diets in 2008 – 2013, capelin virtually disappeared from diets in 2014 – 2016 (Figure 9).



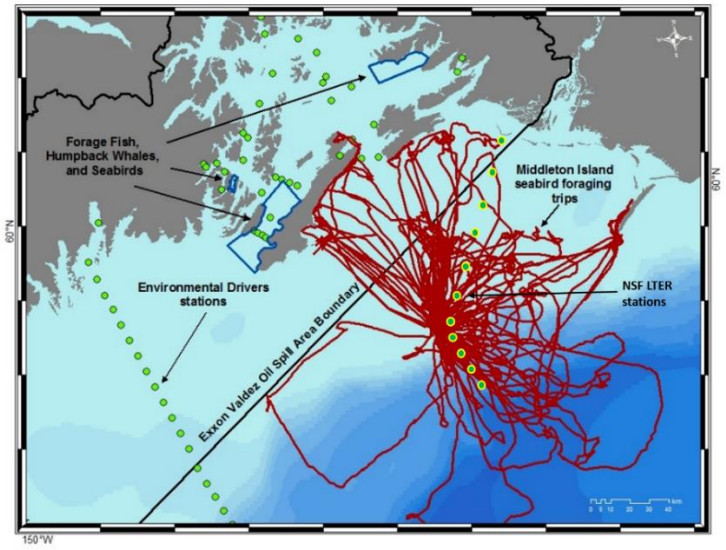


Figure 9. Middleton Is. time series 1978-2015. Interannual variation in diet composition of chick-rearing rhinoceros auklets (upper left panel) and black-legged kittiwakes (lower left panel) on Middleton Island, 1978 to 2016. Map of pelagic sampling areas and environmental drivers stations (including new NSF LTER stations) in PWS and GOA, and sample of foraging trips from GPS-tagged rhinoceros auklets and black-legged kittiwakes returning to Middleton Island with forage fish (2015-2016; right panel).

Humpback whale predation on herring – John Moran and Jan Straley, NOAA National Marine Fisheries Service (NMFS) Auke Bay Laboratory and University of Alaska Southeast (UAS)

Under the integrated predator-prey survey the humpback whale monitoring project will continue to evaluate the impact by humpback whale foraging on Pacific herring populations in PWS. Prey selection by humpback whales will be determined through acoustic surveys, visual observation, scat analysis, and prey sampling. Chemical analysis of skin and blubber biopsy samples will provide a longer term perspective on shifts in prey type and quality. Key findings through modeling consumption of herring by humpback whales in PWS show that whale predation can exert top-down controlling pressure equivalent to the impact of a directed fishery (Figure 10). Warmer water temperatures over the past two years combined with seabird and marine mammal die-offs, emphasize that the GOA is still undergoing major perturbations that impact species at the population level.

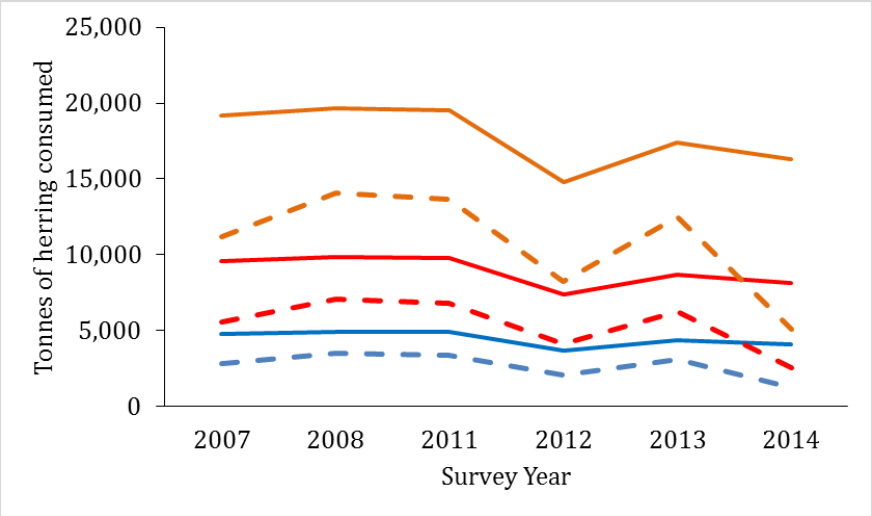


Figure 10. PWS time series 2007-2014. Modeled consumption of herring by humpback whales in PWS based on the observed diet composition for 50 (blue), 100 (red), and 200 (green) whales. Low estimates (dashed lines) exclude other fish and use Witteveen's consumption value of 338 kg/whale/day. High estimates (solid lines) treat other fish as herring and use Roman's daily consumption value of 471kg/whale/day.

Fall and Winter habitat use and distribution of seabirds in Prince William Sound – Mary Anne Bishop (PWSSC)

The fall-winter marine bird surveys in PWS will continue to build upon a 10-year time series of marine bird abundance (Figure 11) and habitat associations (2007-2017) and are further integrated with forage fish assessments of prey availability and humpback whale prey consumption and population monitoring. Of the marine birds that overwinter in PWS, nine species were initially injured by the EVOS, including three species that have not yet recovered or their recovery is unknown (pigeon guillemot, marbled murrelet, and Kittlitz's murrelet). Fall through winter are critical periods for survival as food tends to be relatively scarce or inaccessible, the climate more extreme, light levels and day length reduced, and water temperatures colder. Results from our bioenergetics model for marine birds in winter highlight the importance of herring to marine birds in PWS and suggest that predation by marine birds, as much as 10% (1,864 t) of the adult biomass, may have an important top-down effect on the PWS herring population.

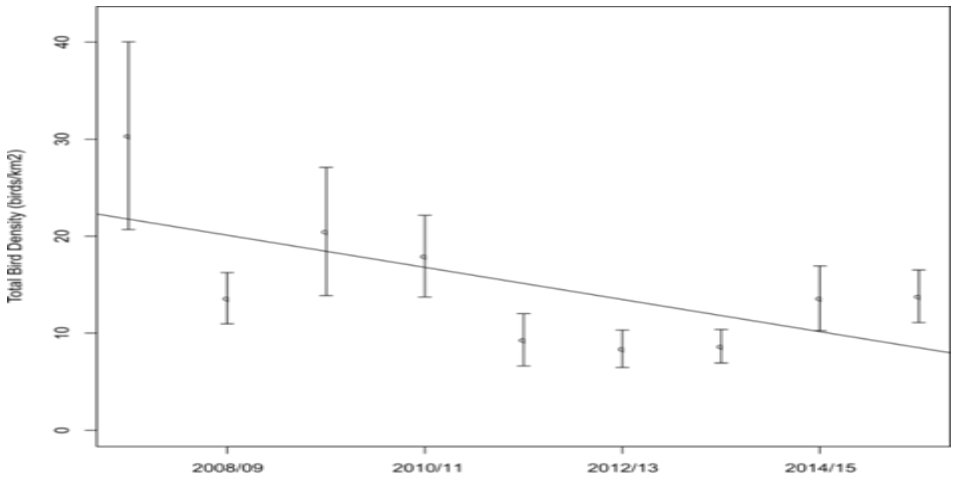


Figure 11. PWS winter time series 2007/08 – 2015/16. Average total marine bird densities, standard errors, and trend (slope = -1.66, p-value = 0.061) for nine survey winters.

NEARSHORE MONITORING COMPONENT

Nearshore systems in the Gulf of Alaska – Heather Coletti, Daniel Esler, Kim Kloecker, Dan Monson, Ben Weitzman, Brenda Konar, and Katrin Iken, National Park Service (NPS), USGS Alaska Science Center, and UAF

The Nearshore Component of GWA investigates and monitors the nearshore environment of the greater EVOS area, with focus on selected elements of the nearshore food web. The nearshore component provides ongoing evaluation of the status of more than 200 species, including many of those recovering from EVOS. The monitoring design includes spatial, temporal and ecological features that support inference regarding drivers of change through testing of alternative hypotheses. The overarching goal is to understand drivers of variation in the GOA nearshore ecosystem. Monitoring metrics include marine invertebrates, macroalgae, sea grasses, birds, mammals, and physical parameters such as temperature. In addition to taxon-specific metrics, monitoring includes recognized important ecological relations such as predator-prey dynamics, measures of nearshore ecosystem productivity, and contamination.

Harnessing the power of long-term datasets, the first years of the GWA Nearshore Component were combined with preceding time series, extending back in time to the mid-20th century, totaling over 50 years for some data streams. Building on this legacy has resulted in important insights and management-relevant findings. As an example, data on sea otter population dynamics have revealed that patterns of changes in abundance differ among regions. Changes in sea otter populations are driven largely by local conditions, although drivers may vary (e.g., recovery from the EVOS in PWS, recolonization following fur harvest in Katmai and Kachemak Bay, and prey availability in Kenai Fjords) (Figure 12). Preliminary FY17 observations indicate low sea star densities across all four regions, while nearshore bird surveys of common murre distributions have returned to pre die-off states.

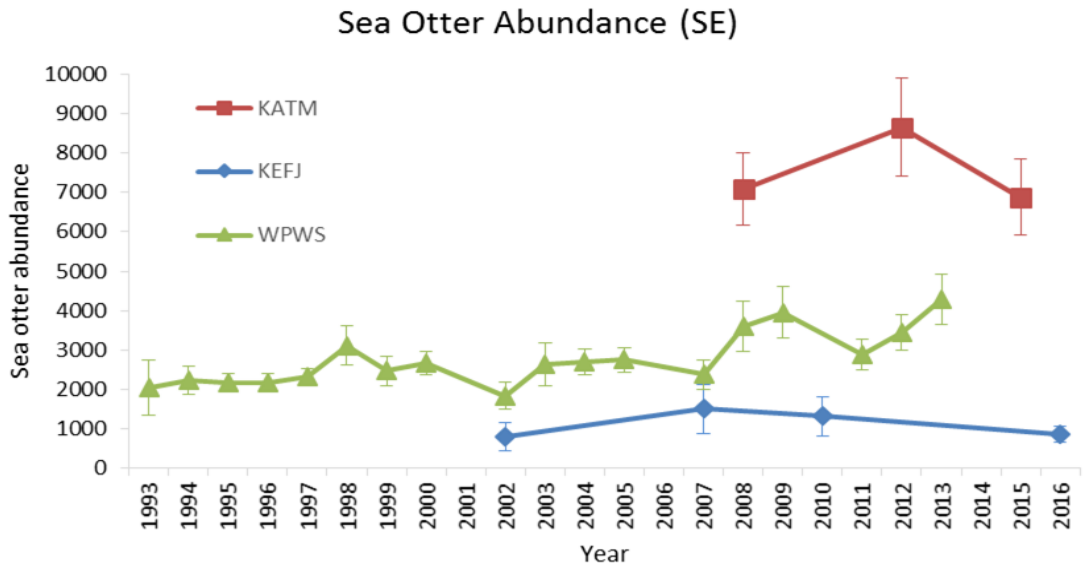


Figure 12. Time series for sea otters 1993-2016. Sea otter abundance in KATM, KEFJ and WPWS. Error bars indicate SE. Just an example of many metrics being monitored in the nearshore regional areas of the northern GOA.

2. COORDINATION AND COLLABORATION

A. Within an EVOSTC-funded Program

Please see individual project work plans for coordination and collaborations being carried out at the PI level.

Coordination and Collaboration Within GWA

The following outlines how the GWA leadership personnel will achieve coordination and collaboration activities within the GWA program (see also organizational chart, Figure 13):

Program Lead - will be responsible for overseeing coordination of individual program components, science synthesis and integration, and ensuring a coordinated monitoring program that meets project milestones and deliverables.

Science Coordinator - will provide program technical writing, review, and science coordination. The Science Coordinator also supports the GWA program's goals by coordinating information sharing between program PIs and other EVOSTC programs, most notably the HRM and Data Management programs.

Program Coordinator - will facilitate meetings, reporting, outreach, sharing, and publication of information from the various monitoring projects.

Program Lead, Science and Program Coordinators - individual project activities will continue to be conducted as a coordinated effort for all of the monitoring projects within the program.

Administration and Outreach: PWSSC - The Program Lead and Science and Program Coordinators will work closely with PWSSC staff to assist with overall administrative activities of the program, including developing reports and planning meetings and outreach events.

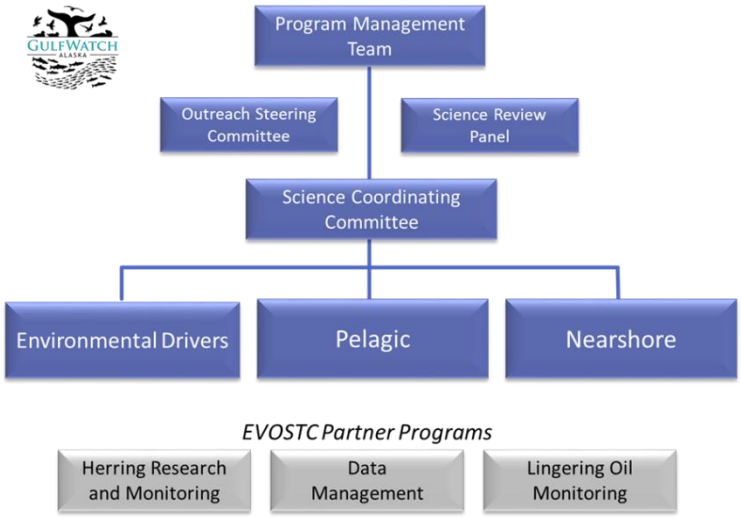


Figure 13. Organizational chart for GWA program and other EVOSTC programs. The Program Management Team consists of Program Lead, Administration and Outreach Lead, Science Coordinator and Program Coordinator who are responsible for coordination and collaborations across EVOSTC programs and with outside agencies and non-governmental organizations. The Science Coordinating Committee consists of the Science Coordinator and the three Component Leads.

Coordination and Collaboration Between Programs

With Herring Research and Monitoring Program

The following outlines how the GWA leadership personnel will achieve coordination and collaboration activities between the GWA and HRM programs:

- Data from GWA projects is provided to the HRM program for their use and analysis.
- The GWA team regularly engages the HRM program lead, Scott Pegau by phone, email, and in person.
- The HRM program lead is included on all GWA PI general correspondence. Likewise, the GWA PMT is included in all HRM general correspondence.
- The HRM program lead is invited to all PI teleconferences and meetings and given an opportunity to hear GWA PI updates and provide HRM updates to PIs.
- The GWA and HRM programs will collaborate on the 3-year synthesis workshop and report.

With Data Management Program

The GWA and Data Management programs are fully integrated and dependent on each other. The Program Lead and Science and Program Coordinators work closely with AOOS and Axiom data management staff to maintain data access tools, providing data and feedback in the data portal, and metadata generation tools. The Program Science and Program Coordinators will continue to work with all project PIs within the program to ensure new data are loaded to the portal, have undergone QA/QC measures, and have appropriate metadata available for public access.

With Potential Cross-Program Publication Groups

The Science Coordinator works with PIs from the GWA and HRM programs to identify, refine, and propose publication concepts for the Cross-program Publication Groups. If the EVOSTC chooses to fund a cross-program publication group, the science coordinator will facilitate work leading to manuscript submission to a journal.

B. With Other EVOSTC-funded Projects

The GWA program does not have specific goals or objectives to support EVOSTC-funded projects that are not part of a program. However, data, reports, and publications from GWA projects are available and the science and program coordinators are available to work with EVOSTC-funded projects where appropriate and applicable. Recent efforts included GWA program managers coordinating with field crews from the Pigeon Guillemot restoration study on Naked Island to collect additional forage fish samples to maintain pelagic component time series and share seabird diet data.

C. With Trustee or Management Agencies

The GWA program integrates ecosystem monitoring activities with the National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service (USFWS), US Geological Survey (USGS), Bureau of Ocean Energy Management (BOEM), and NPS. We also coordinate with Alaska Department of Fish and Game researchers and managers through coordination on synthesis activities with the HRM program. Recent efforts included GWA program managers making arrangements for a last minute staffing of a seabird/mammal observer on the first leg of NOAA's Gulf of Alaska Survey, which covers the majority of the GWA study area (Janet Duffy-Anderson, National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center (AFSC) Resource Assessment and Conservation Engineering Division, Recruitment Processes Alliance - EcoFOCI program).

GWA is also working with NOAA to develop and include GWA time series as indicators in ecosystem assessments and reports to the North Pacific Fisheries Management Council (Stephani Zador, NMFS AFSC Resource Ecology and Fisheries Management (REFM) Division, Resource Ecology and Ecosystem Modeling Program). In addition, the GWA PMT is collaborating with the North Pacific Research Board (NPRB) GOA Integrated Ecosystem Research Program (GOAIERP) synthesis and planning efforts (Olav Ormseth and Jamal Moss NMFS AFSC REFM - Status of Stocks and Multispecies Assessment Program; ABL-Ecosystem Monitoring and Assessment program), including planning a GOA focused workshop at the 2018 Ocean Sciences Meeting.

The GWA PMT also met with NOAA Alaska Region Protected Resources Division (Kate Savage and Sadie Wright) this year to coordinate reporting and sampling of marine mammal carcasses during GWA field operations. This coordination resulted in GWA PIs helping NOAA's marine mammal stranding network locate and obtain samples from four humpback whale carcasses so far in FY17.

3. PROJECT DESIGN – PLAN FOR FY18

A. Objectives for FY18

At the program-level, GWA has the following annual objectives:

1. Sustain and build upon existing time series in the EVOS-affected regions of GOA.

2. Provide scientific data, data products, and outreach to management agencies and a wide variety of users.
3. Develop science synthesis products to assist management actions, inform the public, and guide monitoring priorities for the next 15 years.
4. Enhance connections between GWA and HRM programs.
5. Leverage partnerships with outside agencies and groups to integrate data from broader efforts.

B. Changes to Project Design

No changes are anticipated to the program.

4. SCHEDULE

A. Program Milestones for FY18

At the program-level, tasks to continue or initiate in FY18 within each objective include:

Objective 1. Sustain and build upon existing time series in the EVOS-affected regions of GOA.

- *Facilitate completion of data collection for year 7*
- *Ensure year 6 data is loaded to Research Workspace for metadata and quality control.*
- *Update protocols and archive on Research Workspace.*
- *Archiving historic datasets such as recently added Middleton Island seabird studies.*

Objective 2. Provide scientific data, data products, and outreach to management agencies and a wide variety of users.

- *Publish all year 6 data to data portal.*
- *Update website for all projects and new resources.*
- *Utilize agency public relations resources to highlight GWA publications and findings.*
- *Standardize reporting to increase efficiency for PIs and provide consistent recognizable time-series summaries for managers and the public.*
- *Plan and support various outreach events as described in the Outreach project proposal.*

Objective 3. Develop science synthesis products to assist management actions, inform the public, and guide monitoring priorities for the next 15 years.

- *Plan for 3-year synthesis workshop and products.*
- *Develop working groups to evaluate future needs (gap analysis) for adapting to changing conditions.*
- Select potential cross program publication group(s).

Objective 4. Enhance connections between GWA and HRM programs.

- *Continue working collaboratively with HRM group, including participating in team meetings and work groups.*
- *Continue cross-program collaborations for sampling, shared vessel time, and information, such as occurs with the forage fish, humpback whale, and winter seabird projects.*
- *Collaborate with HRM post-doc on synthesis efforts.*

Objective 5. Leverage partnerships with outside agencies and groups to integrate data from broader efforts.

- *Collaborate and Coordinate with UAF oceanographers and new award from NSF Long-term Ecological Research program for the Northern GOA which enhances and expands on GWA monitoring efforts.*

- *Partner with NPRB and GOA IERP synthesis team to hold a GOA synthesis workshop.*
- *Identify additional GWA ecosystem indicators to be used in the NOAA Ecosystems Considerations report to the North Pacific Fisheries Management Council (GWA currently contributes time series from 3 projects annually, with the goal of 1 indicator for each project by FY21).*
- *Review synergies with all trustee agencies and evaluate how partnerships can be strengthened.*

Additional tasks associated with these objectives are detailed within the individual GWA project proposals.

B. Measurable Program Tasks for FY18

For consistency between all the projects, the program completion date for each year's monitoring work, publication of the previous year's work, and associated reporting activities for the program is proposed to be the end of the project fiscal year, January 31, unless otherwise noted.

FY 2018 (Year 7)

FY 18, 1st quarter	(February 1, 2018 - April 31, 2018)
February:	*Compile/edit Year 1 annual report for EVOSTC and semi-annual NOAA Report*
	PI data compliance prior year available to public
	Conduct quarterly program teleconference
March 1:	*Submit Year 1 annual report for EVOSTC and semi-annual NOAA Report*
FY 18, 2nd quarter	(May 1, 2018-July 30, 2018)
May:	*Complete updates to program website and outreach materials*
June-July:	*Conduct quarterly program teleconference*
FY 18, 3rd quarter	(August 1, 2018 – October 31, 2018)
August:	*Submit any contributions to NOAA Ecosystems Considerations Chapter, NPFMC*
August 23:	*Submit annual program work plans*
August 30:	*Submit semi-annual NOAA Report*
September:	*Respond to EVOSTC Science Review Panel Work Plan Q & A*
	Participate in EVOSTC annual Public Advisory Committee meeting
September 30:	*PI data compliance on workspace*
October:	*Conduct quarterly program teleconference*
FY 18, 4th quarter	(November 1, 2018- January 31, 2019)
November:	*Present to EVOSTC Science Review Panel*
Oct.-Nov.:	*Annual PI meeting and program review*
January:	*Presentation of GWA program/projects at AMSS; sidebar meeting with PIs*

5. PROJECT PERSONNEL – CHANGES AND UPDATES

Our FY17-21 proposal did not identify the Science Coordinator or the Program Coordinator, but did include CVs for qualified candidates for each position. We are pleased to announce that the qualified candidates for the positions are now working on the project. Dr. Robert M. Suryan is the Science Coordinator and Ms. Donna Robertson Aderhold is the Program Coordinator (see PM-I work plan for more details).

6. Budget

A. Budget Forms (See GWA FY18 Budget Workbook)

Please see completed program workbook for program summaries and for each project's five-year budget. No costs are associated with international travel or outreach events unrelated to the program. The following table provides an overall program budget summarized by category rather than project.

Proposed GWA program budget summary by category across all projects for FY 2017-2021. Numbers are presented in thousands.

Budget Category	FY 17	FY 18	FY 19	FY 20	FY 21	Total
Personnel	1,105.2	1,212.9	1,154.3	1,261.7	1,207.8	5,942.0
Travel	100.7	111.2	99.3	114.7	101.8	527.7
Contractual	610.7	696.8	649.4	640.5	594.6	3,192.1
Commodities	115.9	154.8	101.2	135.5	104.9	612.3
Equipment	56.6	83.9	49.1	38.2	32.4	260.2
Indirect Costs	101.5	102.6	103.8	105.0	107.7	520.7
Subtotal	**2,090.6**	**2,362.3**	**2,157.1**	**2,295.7**	**2,149.2**	**11,054.9**
General Admin. (9% of Subtotal)	188.1	212.6	194.1	206.2	193.4	994.9
Program Total	**2,278.8**	**2,574.9**	**2,351.2**	**2,496.9**	**2,342.7**	**12,049.9**
In-kind Funds	1,671.0	1,712.0	1,658.0	1,677.0	1,622.0	8,340.0

B. Changes from Original Proposal

No major changes to the program budget are being proposed for FY18. However, a minor adjustment to project 18120114-D (Continuous Plankton Recorder) was made to FY20 due to a formula error. The EVOSTC staff were made aware of the problem and approved the corrective adjustments to the project's FY18 Work Plan, including impacts to indirect costs. This will cause the overall program numbers to be slightly change and not match the original FY17-21 proposal package. A few projects had minor internal re-allocations which did not impact their overall budgets (projects 1820114-H and 1820114-J). Please see their Work Plans for details.

C. Sources of Additional Funding

Because of the diversity of agencies and organizations represented by the GWA program, we are able to leverage over $8 million in cost-share, in-kind, direct funds, and other support funding.

A significant highlight of acquiring additional funding has been within the Environmental Drivers Component for projects GAK 1 (18120114-I) and the Seward Line (18120114-L). The new National Science Foundation (NSF)-funded GOA Long-term Ecological Research (LTER) program (awarded in spring of 2017, after submission of FY17-21 EVOSTC proposal; $1,127K/year, plus ship-time) leverages, complements and enhances the GWA program activities. The LTER program will provide many years of additional significant research activities that will naturally blend and add value to the GWA program. For example, in addition to expanded capabilities and extent for oceanographic datasets, the first five-year block of the LTER program will fund at least three UAF graduate students who will spend time working with both GWA and LTER data collections.

Each project Work Plan provides more detail for these additional funds (also see project budget workbook forms).

7. RECENT PUBLICATIONS AND PRODUCTS

Publications from the GWA PMT coordinated special issue of Deep-Sea Research II "Spatial and temporal ecological variability in the northern Gulf of Alaska: What have we learned since the Exxon Valdez oil spill?" *See individual work plans for project specific publications.*

Batten, S.D., Raitsos, D.E., Danielson, S.,Hopcroft, R.R., Coyle, K. and McQuatters-Gollop, A. *In press*. Interannual variability in lower trophic levels on the Alaskan Shelf. *Deep Sea Research II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516302806.

Bodkin, J.L., H.A. Coletti, B.E. Ballachey, D. Monson, D. Esler, and T.A. Dean. *In press*. 2017. Spatial and temporal variation in Pacific blue mussel, Mytilus trossulus, abundance in the northern Gulf of Alaska, 2006-2015. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516302831.

Bowen, L., A.K. Miles, B.E. Ballachey, S. Waters, J.L. Bodkin, M. Lindeberg, and D. Esler. *In press*. Gene transcription patterns in response to low level petroleum contaminants in Mytilus trossulus from field sites and harbors in southcentral Alaska. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516302855.

Campbell, R. W. *In press*. 2017. Hydrographic trends in Prince William Sound, Alaska: 1960-2016. *Deep Sea Research Part II*.

Cushing, D., D. Roby, and D. Irons. *In press*. 2017. Patterns of distribution, abundance, and change over time in a subarctic marine bird community. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516301874.

Esler, D., B. E. Ballachey, C. O. Matkin, D. Cushing, R. Kaler, J. Bodkin, D. Monson, G. G. Esslinger, and K. Kloecker. *In press*. 2017. Timelines and mechanisms of wildlife population recovery following the Exxon Valdez oil spill. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516303502.

Konar, B. and K. Iken. *In press*. 2017. The use of unmanned aerial vehicle imagery in intertidal monitoring. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516301333.

Lindeberg, M. R., J. M. Maselko, R. A. Heintz, M. G. Carls, C. Fugate, and L. G. Holland. *In press*. 2017. Persistent *Exxon Valdez* oil on beaches in Prince William Sound 26 years later. *Deep-Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516304234.

McCammon, M., K. Hoffman, K. Holderied. D. R. Aderhold, and T. H. Neher. 2017. Long-term monitoring of marine conditions and injured resources and services. *Exxon Valdez* Oil Spill Restoration Program Final Report (Restoration Project 16120114), Alaska Ocean Observing System, Anchorage, Alaska.

McKinstry, C., and R. W. Campbell. *In press*. 2017. Seasonal variation in zooplankton abundance and communities in Prince William Sound, Alaska, 2009-2016. *Deep Sea Research Part II*.

Moran, J.R., Heintz, R.A., Straley, J.M. and Vollenweider, J.J., *In press*. 2017. Regional variation in the intensity of humpback whale predation on Pacific herring in the Gulf of Alaska. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516303125.

Moran, J. R., M. B. O'Dell, D. M. S. Dickson, J. M. Straley, and M. L. Arimitsu, *In Review*. 2017. Seasonal distribution of Dall's porpoise in Prince William Sound, Alaska. *Deep Sea Research Part II*.

Nixon, Z., and J. Michel. *In press*. 2017. A review of Distribution and Quantity of Lingering Subsurface Oil from the *Exxon Valdez* Oil Spill. *Deep-Sea Research II special issue*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064517300036.

Olsen, D. W., C. O. Matkin, R. D. Andrews, and S. Atkinson. *In Review*. 2017. Shifting Hot Spots: Seasonal and pod-specific shift in habitat use by resident killer whales in the Northern Gulf of Alaska. *Deep Sea Research II*.

Stocking, J., M. A. Bishop, and A. Arab. *In press*. 2017. Spatio-temporal distributions of piscivorous birds in a subarctic sound during the nonbreeding season. *Deep Sea Research II*. accepted July 2017.

Straley, J. M., J. R. Moran, K. M. Kevin Boswell, R. A. Heintz, T. J. Quinn II, B. Witteveen, and S. D. Rice. *In press*. 2017. Seasonal presence and potential influence of foraging humpback whales upon Pacific herring wintering in the Gulf of Alaska. *Deep Sea Research Part II*. Published online at http://www.sciencedirect.com/science/article/pii/S0967064516303174.

Published Datasets

Please see citations for 45 datasets in Section 7 of the PM I (18120114-A) project Work Plan.

Presentations

Lindeberg, M., K. Holderied, D. Aderhold, K. Hoffman, M. Arimitsu, H. Coletti, and R. Hopcroft. 2017. Gulf Watch Alaska: Results from five years of ecosystem monitoring in the northern Gulf of Alaska. Presentation. 2017 Alaska Marine Science Symposium, Anchorage.

Lindeberg, M., K. Holderied, D. Aderhold, K. Hoffman, M. Arimitsu, H. Coletti, and R. Hopcroft. 2017. Gulf Watch Alaska: Results from five years of ecosystem monitoring in the northern Gulf of Alaska. Presentation. 2017 NMFS Alaska Fisheries Science Center mini symposium.

Outreach

Aderhold, D. 2017. Gulf Watch Alaska monitors ecosystem health. Delta Sound Connections 2017-18. 16 pp. http://pwssc.org/wp-content/uploads/2017/06/DSC-2017-web2.pdf.

Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2017. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 1.1: spring quarter.

Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2017. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 1.2: summer quarter.

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McCammon, M., K. Holderied, and N. Bird. 2011. Long-term monitoring of Marine Conditions and Injured Resources and Services. Proposal to *Exxon Valdez* Oil Spill Trustee Council. 879 p. http://www.evostc.state.ak.us/Store/Proposal_Documents/2196.pdf

GWA, 2015. Long Term Monitoring program Year 3 Science Synthesis Report. *Exxon Valdez* Oil Spill Trustee Council. 247 p. http://www.evostc.state.ak.us/Store/ScienceSynthesisReports/10-12-2015_LTM_Gulf_Watch_Draft_Final_Synthesis.pdf

Lindeberg, M. R. 2016. Gulf Watch Alaska Program: Long-Term Monitoring of Marine Conditions and Injured Resources. FY17-21 Proposal to the *Exxon Valdez* Oil Spill Trustee Council. 57 p. http://www.evostc.state.ak.us/Store/ScienceSynthesisReports/LTM_Program_Proposal.pdf

ONLINE RESOURCES

Gulf Watch Alaska – http://www.gulfwatchalaska.org/

AOOS Gulf Watch Alaska Data Portal – http://portal.aoos.org/gulf-of-alaska.php

DataONE published datasets. Gulf Watch Alaska Research Workspace. Doi: 10.24431/rw1k113.