Gulf Watch Alaska Long-term Monitoring Program Semi-annual Report

a) **Project Number–** 12120114 and 12120120

b) **Project Title–** Long-term Monitoring of Marine Conditions and Injured Resources and Services

c) **Principal Investigator's Name(s)** – Molly McCammon, Katrina Hoffman, Kris Holderied

d) **Time Period Covered by the Report–** Feb 1-July 31, 2013

e) **Date of Report –** August 30th, 2013

f) **Project Website –** www.gulfwatchalaska.org

g) Summary of Work Performed – The overarching goal of the Gulf Watch Alaska long-term monitoring program 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 *Exxon Valdez* oil spill (EVOS) injured resources and services. To accomplish this goal we are conducting a five-year ecosystem monitoring program in the spill-affected region, which is anticipated to be the beginning of a twenty year effort. Work on the program continues as originally proposed.

The program includes: 1) four monitoring components (environmental drivers, benthic, pelagic, lingering oil); 2) data management services; 3) integrated syntheses of our monitoring program data; 4) data recovery and syntheses of historical data; and 5) science outreach. The long-term monitoring program has six main objectives.

- Sustain and build upon existing time series in Prince William Sound, lower Cook Inlet and adjacent Gulf of Alaska coast.
- Provide scientific data, data products and outreach to management agencies and a wide variety of users.
- Develop improved monitoring for certain species and ecosystems.
- Develop science synthesis products to assist management actions, inform the public and guide the evolution of monitoring priorities for the next 20 years.
- Enhance connections between and integration of monitoring projects and between the Gulf Watch Alaska and Herring Research and Monitoring (HRM) program.
- Leverage partnerships with outside agencies and groups to integrate data from a broader monitoring effort than that funded by the Trustee Council.

The Gulf Watch Alaska program is composed of integrated program management, data services, science synthesis, and outreach efforts (five projects), as well as the 14 ecosystem monitoring projects. Most projects will occur every year, with a note provided below for those projects that will not occur every year.

a) Integrated program management, data services, outreach and science synthesis

i) Program coordination and logistics – Prince William Sound Science Center (PWSSC) and Alaska Ocean Observing System (AOOS)
ii) Outreach - AOOS
iii) Data management –AOOS/Axiom Consulting
iv) Historical data management and synthesis – National Center for Ecological Assessment and Synthesis (NCEAS) – EVOS TC Project# 12120120
v) Science coordination and synthesis – NOAA Kasitsna Bay Laboratory (KBL)
vi) Conceptual ecological modeling– Alaska Sea Life Center (ASLC)

b) Environmental drivers monitoring component
   i) Gulf of Alaska mooring (GAK1) monitoring – University of Alaska Fairbanks (UAF)
   ii) Seward line monitoring – UAF
   iii) Oceanographic conditions in Prince William Sound – PWSSC
   iv) Oceanographic monitoring in Cook Inlet – Alaska Department of Fish and Game (ADFG) / Kachemak Bay Research Reserve (KBRR)/ KBL
   v) Continuous plankton recorder –Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

c) Pelagic monitoring component
   i) Ability to detect trends in nearshore marine birds – USNPS Southwest Alaska inventory and monitoring Network (SWAN) – year 1 (no year 2 funding)
   ii) Long-term killer whale monitoring – North Gulf Oceanic Society (NGOS)
   iii) Humpback whale predation on herring – NOAA National Marine Fisheries Service (NMFS) Auke Bay Laboratory
   iv) Forage fish distribution and abundance – U. S. Geological Survey (USGS) Alaska Science Center
   v) Prince William Sound marine bird surveys – U.S. Fish and Wildlife Service (USFWS)

d) Benthic monitoring component
   i) Nearshore benthic systems in the Gulf of Alaska – USGS Alaska Science Center/ USNPS SWAN, Coastal Resources Associates
   ii) Ecological Communities in Kachemak Bay – UAF

e) Lingering oil component
   i) EVOS oil exposure of harlequin ducks and sea otters – USGS Alaska Science Center
   ii) Oil level and weathering tracking – NOAA/NMFS Auke Bay Laboratory

The fiscal year for the overall program, as determined by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC), runs from February 1 to January 31 each year. Many agencies have a fiscal year that runs from October 1 to September 30. The Program Management Team and principal investigators will work to accommodate differences in budget years and execute the program with the EVOSTC program year.

Program progress for reporting period:

Most of the work during this reporting period has focused on execution of the monitoring projects and improvement of public data accessibility, cataloging, and publication. We have also worked to develop integrated program synthesis tools and design and revise a program

website for outreach. Program administration and management has proceeded as expected. Specific accomplishments related to the program objectives include:

a) Successful completion of planned field work to date with field work for several projects still underway.
b) Cross specialty communication and participation with shared vessel time and staff time between projects and programs to accomplish this year's field work.
c) Documented and published 70 (19%) of the 370 historical, EVOS-funded data sets that have been identified, with an additional 26 data sets (7%) in process of publication.
d) Refined sampling protocol for forage fish data collection that improves sampling efficiency.
e) Development of time-series analysis framework and preliminary synthesis projects, in coordination with NPRB and HRM program principal investigators.
f) Substantial update and expansion of the program website (www.gulfwatchalaska.org), including the addition of a program news section, project summaries and access to the Gulf Watch Alaska program data portal.

Cross-program science synthesis (12120114-H)

A primary objective of the integrated Gulf Watch Alaska ecosystem monitoring program is to improve communication of monitoring information to resource managers and the public through a variety of synthesis products. As part of the synthesis process, we are reviewing findings from previous Gulf of Alaska research and monitoring programs and identifying monitoring data and metrics that could be used to validate previous study results and develop and test new hypotheses. Appendix 1 contains a table with the initial results from this review. We are planning a time series workshop to be conducted in conjunction with our November 2013 principal investigator meeting that will bring together interested scientists from the HRM and NPRB programs to discuss long term trends in ecological data from the Gulf of Alaska. During this reporting period we also coordinated with researchers with the North Pacific Research Board (NPRB) Gulf of Alaska Integrated Ecosystem Research Program (GOAIERP) to investigate use of a "report card" framework (Mueter et al. 2013) as a tool for analyses of long-term Gulf Watch Alaska monitoring data.

The 'trend card' could be used to facilitate the time series analysis discussion, as well as future science synthesis efforts. Trend cards are a visual tool that can help identify data gaps, allow initial investigation of proposed relationships in existing research hypotheses, and generate new hypotheses. The cards provide a means to examine relationships between physical drivers, species population trends and other ecological factors. We will use current and historical data in the Gulf Watch Alaska program, as well as large-scale North Pacific climate indices to develop the trend cards. The cards will be informed by hypotheses and information from the Gulf Watch Alaska conceptual ecological modeling effort, peer reviewed literature and reports from other Gulf of Alaska research and monitoring programs (e.g. Sound Ecosystem Assessment (SEA) program) and recent publications from other integrated programs, such as the NPRB Bering Sea Integrated Ecosystem Research Program (BSIERP). Figures 1 and 2 provide two trend card examples. These trend cards could be used to help address the research questions in our original proposal (McCammon et al. 2012) as well as some of the following hypotheses:

- Oscillating control (Coyle et al. 2011): are shifts in zooplankton production related to ecosystem shifts in species abundances and community composition favoring pelagic versus benthic communities?
- Match/mismatch (Durant et al. 2007): Two part question- a) does the timing in zooplankton production (community composition and abundances of key prey items) correspond to environmental patterns; and b) are there relationships with availability of specific zooplankton prey and predators that correspond to availability (timing and abundance)?
- Alternative hypotheses to explain linkages between environmental conditions and variability in zooplankton communities. The river/lake hypothesis (Eslinger at al. 2001), which is related to the Bakun upwelling index (Bakun 1973), associates changes in the PWS zooplankton community to the degree of upwelling. Alternatively, zooplankton abundances/composition can be driven by nutrient conditions, if the phytoplankton community is nutrient limited. One question might address which of these two hypotheses best explains the variability in plankton communities associated with environmental conditions.

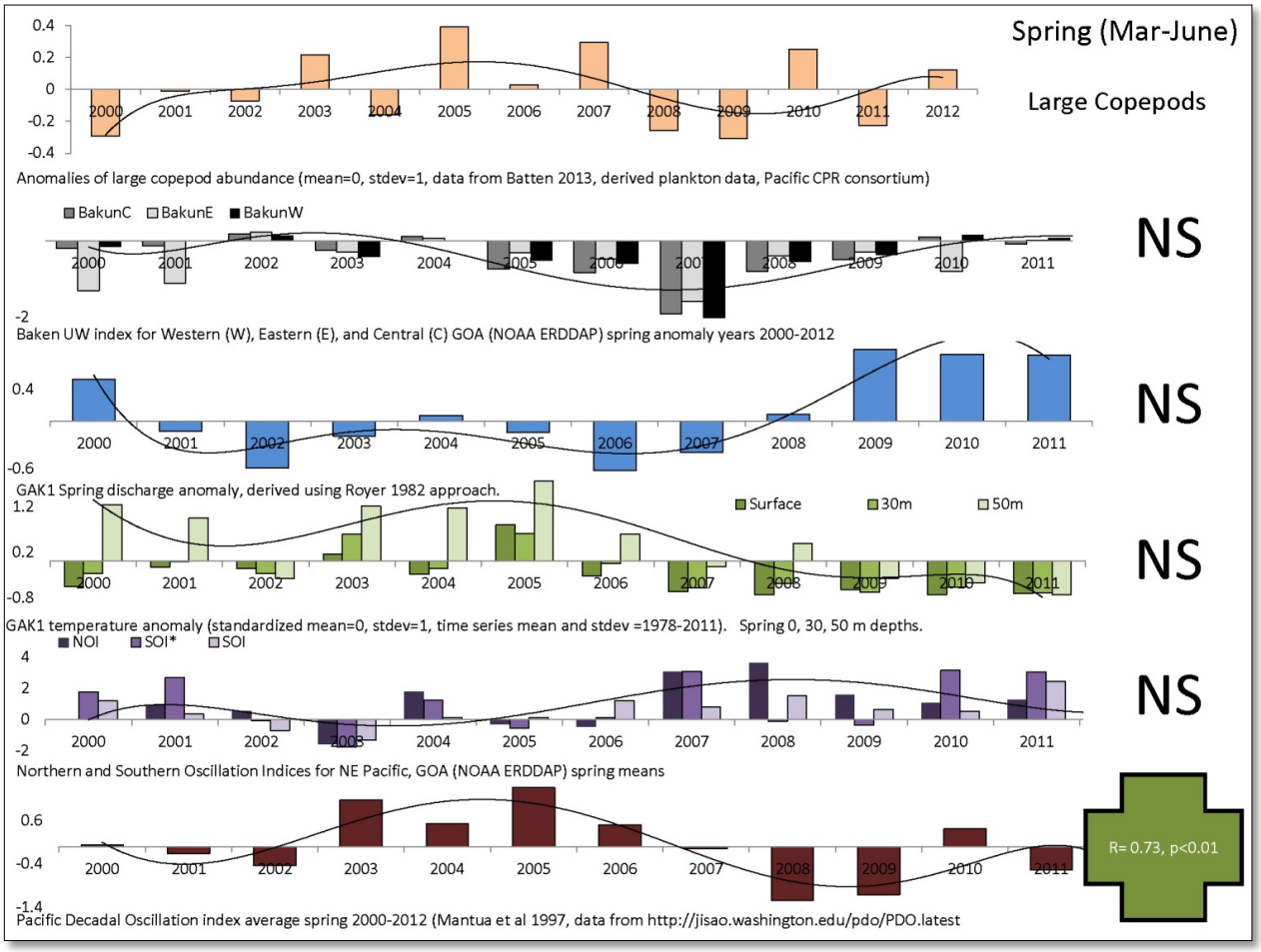

Figure 1. Example of a trend card for large copepod data and selected spring time (March-June). Data are anomalies of values to the full time series average for copepods, upwelling,

discharge, and temperature and the indices for the Northern and Southern oscillation and Pacific decadal oscillation. Significant Pearson correlation coefficients are reported; NS=non-significant.

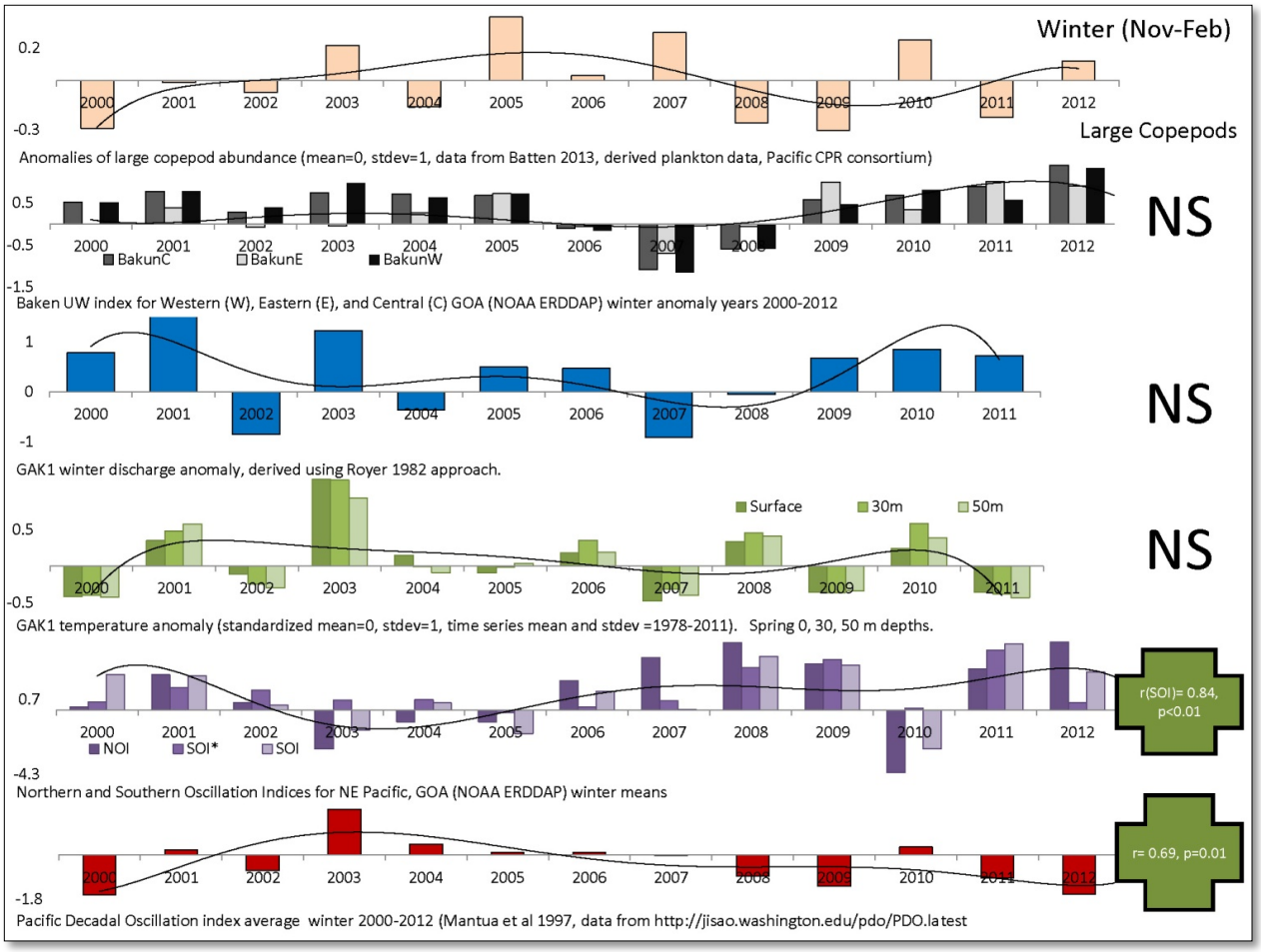

Figure 2. Example of a trend card for large copepod data and selected winter time (November through February). Data are anomalies of values to the full time series average for copepods, upwelling, discharge, and temperature and the indices for the Northern and Southern oscillation and Pacific decadal oscillation. Significant Pearson correlation coefficients are reported; NS=non-significant.

Summary of project level accomplishments:

Program coordination and logistics – Hoffman (PWSSC, 12120114-B): The program successfully submitted the Year 1 annual report and commenced Year 2 of the work, which is proceeding as proposed. Contract management proceeded as expected. We held principal investigator teleconferences in February and July 2013 and had more than seven management team meetings in the reporting period.

Outreach– Molly McCammon (AOOS, 12120114-B): The committee completed all of the products identified as the basic suite of outreach materials for the program: a new name (*Gulf Watch Alaska*, *The Long-term Monitoring program of the Exxon Valdez Oil Spill Trustee Council)*, logo, website domain, PowerPoint and poster templates, pop-up displays, display banners, brochure, presentation folder and bookmarks. In March 2013, a Gulf Watch Alaska slide show and information materials were presented to over 200 members of the public at "Ocean Fest" in Valdez, AK. The website (www.gulfwatchalaska.org) was substantially revised.

Data Management– McCammon/Bochenek (AOOS/Axiom, 12120114-D): From the beginning of the EVOS LTM Program Data Management project investigators have focused on establishing protocols for data transfer and metadata requirements and initiating the data salvage effort. Investigators have met on a regular basis with Matt Jones to coordinate future activities. PIs have participated in several PI meetings and are coordinating activities between the Herring and LTM programs. In addition, the AOOS research workspace has been rolled out to program PIs and their user and group profiles have been created. Several training seminars have been held via webinars, and PIs are beginning to use the system to organize and consolidate their project level data. Software engineers at Axiom have also been working to support the research workspace, resolving bugs and implementing new functionality in response to user feedback. Considerable progress has been made on the development of the Gulf Watch Alaska data portal.

Several hundred Geographical Information System (GIS) data layers, approximately 60 numerical modeling and remotely sensed observational grids and hundreds of real-time sensor feeds have been assimilated into the backend AOOS data management system to support the Gulf Watch Alaska program and complement the datasets produced by Gulf Watch Alaska PIs. Both Gulf Watch Alaska funded research data and these complementary information resources will be seamlessly exposed through the emerging Gulf Watch Alaska/Gulf of Alaska Large Marine Ecosystem data portal scheduled for release in early September 2013 and accessed through the revamped program website: www.gulfwatchalaska.org. This resource will accelerate synthesis efforts by consolidating and organizing critical information products describing the habitat, ecology and physical characteristics of the Gulf Watch Alaska geographical area while simultaneously providing a platform to showcase Gulf Watch Alaska efforts and data products through a publicly accessible geospatial data visualization and catalog system.

Historical data management and synthesis – Jones (NCEAS, 12120120): We have 19% of the data sets that were identified from historical EVOS funding with 7% more in process of publication. NCEAS staff provided training for the Morpho metadata generation tool use and

access information for the KNB Metacat portal for data publication to those Gulf Watch program principal investigators who were interested.

Science Coordination and Synthesis – Holderied (NOAA KBL, 12120114-H): During this reporting period we focused on science coordination with principal investigators, creating project level metadata, developing synthesis and visualization tools for integration within the program and public outreach, and assisting with development of the Ocean Workspace, program website and public data portal. Some of the initial program synthesis results are provided above. A full-time science coordinator, Tammy Neher, was hired under contract with NOAA Kasitsna Bay Laboratory in late March 2013 and is working with the program and data management teams on cross-program integration, science synthesis and coordination with outside entities. We have expanded science coordination efforts with the North Pacific Research Board Gulf of Alaska Integrated Ecosystem Research Program (GOAIERP), including sharing of retrospective data analyses by Dr. Franz Mueter (University of Alaska Fairbanks). We have also started a new collaboration on salinity data from satellite remote sensing data with the National Centers for Coastal Ocean Science of the NOAA National Ocean Service.

Conceptual Ecological Modeling – Hollmen (ASLC, 12120114-I): Analysis of input from November 2012 PI meeting and development of conceptual models is ongoing. We are currently developing a generic GOA conceptual ecosystem model using input gathered at the November 2012 PI meeting. The output will be a visual diagram representing key linkages based on PI input.

Gulf of Alaska mooring (GAK1) monitoring – Weingartner (UAF, 12120114-P): Field work has been completed on schedule to date and all samples are currently being processed. We have been working on relating long-term Seward sea-level variability to forcing mechanisms. The ultimate goal is to determine if we can use the long-term record in Seward as a proxy for transport in the Alaska Coastal Current. Our major findings are that tides and atmospheric pressure variations (the inverted barometer effect) are largely responsible for sea level variations.

Seward line monitoring – Hopcroft (UAF, 12120114-J): Sampling has been completed on schedule to date and all samples are currently being processed; one cruise is remains for 2013, October. Notable findings from the 2012 season include: upper 100m of along the Seward Line was 0.7°C colder in May than the 15-year mean and the progression of seasonal cycles for plankton was delayed. The spring bloom was partially captured, while the development rates of key zooplankton species were slowed.

Oceanographic conditions in Prince William Sound – Campbell (PWSSC, 12120114-E): Successful surveys of PWS have been conducted to date;with some work still in progress. Testing of the automated moored profiler (AMP) has continued through the summer, 2013 – additional test deployments were done in Nelson Bay and several problems ironed out. Some field challenges have occurred with the AMP profiler communications transmissions; Dr. Campbell is working with the local communications provider to find a solution.

Oceanographic monitoring in Cook Inlet – Doroff (ADFG KBRR) and Holderied (NOAA KBL, 12120114-G): Most of the oceanographic surveys have been completed on schedule to date.

Due to inclement weather in lower Cook Inlet, only the Kachemak Bay transects could be surveyed in February, 2013. We were able to host a U.S. Fish and Wildlife Service bird/mammal observer for all lower Cook Inlet sampling events. CTD data have been processed and are currently being loaded to the Research Workspace and reconfigured for the Axiom data portal. Public presentations were made in Seldovia and Homer, AK in July 2013 on results from the oceanographic monitoring and the use of data for paralytic shellfish poisoning and ocean acidification studies.

Continuous plankton recorder – Batten (SAHFOS, 12120114-A): Plankton surveys have been completed on schedule to date. Sampling is currently underway and has been completed as planned to date. Several sampling events are scheduled to complete the 2013 season.

Ability to detect trends in nearshore marine birds – Coletti (USNPS SWAN, 12120114-F): In mid-September of 2012, we met with subject matter experts to refine approaches and finalize the proposal for the bid process. The resulting proposal was finalized but further delays arose as NPS converted to a new financial system while simultaneously determining how best to deal with sequestration. This resulted in contracts that were not considered time sensitive to be delayed until June / July of 2013 for submission. The contract for analysis has been submitted through NPS contracting and is currently awaiting the bid process. We are anticipating that a contract will be awarded before the end of federal fiscal year 2013 and that a final report will be provided by June 1, 2014.

Long-term killer whale monitoring – Matkin (NGOS, 12120114-M): All surveys have been completed as planned. Final identification and sorting work was completed and the current killer whale photographic reference catalogue is up to date. Plotting and initial GIS analysis of trackline, encounter, and tagging data occurred and was summarized. Analysis of skin and blubber biopsy samples was completed and results analyzed and plotted. A long awaited publication on the life history and population dynamics of the southern Alaska resident killer whale population from 1984-2010 was finalized and accepted for publication by *Marine Mammal Science*.

Humpback whale predation on herring – (NOAA, NMFS Auke Bay Laboratory, 12120114-N): All surveys have been completed as planned. In April 2013, our team conducted a field trip to Prince William Sound Alaska to observe, photograph, and biopsy humpback whales prior to the spring herring spawning. Whales were observed feeding, mainly on schools of spawning herring or layers of plankton. Post survey, all observed photographs identifying individual whales were compared to existing catalogs for possible matches.

Forage fish distribution and abundance – (USGS Alaska Science Center, 12120114-O): We have worked on 2012 data processing, and created metadata in Morpho. These data sets have been loaded to the Research Workspace. We have completed all fish surveys as proposed and in 2013, and conducted exploratory work to investigate the feasibility of incorporating aerial spotting surveys in conjunction with the herring research program.

Prince William Sound marine bird surveys – Irons/Kuletz (USFWS Alaska Region, 12120114-K): Surveys were completed in 2012 as planned. This project had no field work scheduled in 2013, although we analyzed data and presented an oral paper on some of our results: Cushing, D.A.,

D.D. Roby, K.J. Kuletz, and D.B. Irons. 2013. Changes in abundance of *Brachyramphus* murrelets in Prince William Sound, Alaska, 1989-2012. Pacific Seabird Group Conference, Portland, OR.

Seabird abundance in fall and winter – Bishop (PWSSC, 12120114-C): Seabird observers were onboard cruises with the *Herring and Research Monitoring Expanded Adult Herring* and humpback whale surveys; however, at the request of the Humpback Whale PI, the seabird observer did not participate in the April 2013 *EVOS Humpback Whale* survey because it was a short-term, focused survey for biopsy sample collection. Two papers are accepted pending revisions: Dawson, Bishop, Kuletz and Zuur, "Using ships of opportunity to assess winter habitat associations of seabirds in subarctic coastal Alaska," by the journal *Arctic*. The manuscript: Bishop, Watson, Kuletz and Morgan, "Pacific herring consumption by marine birds during winter in Prince William Sound, Alaska," by the journal *Fisheries Oceanography*. Both of these manuscripts are based on work from EVOS-funded seabird monitoring in Prince William Sound conducted just prior to the beginning of the Gulf Watch Alaska Program.

Nearshore benthic systems in the Gulf of Alaska – Ballachey (USGS Alaska Science Center), Coletti (USNPS SWAN) and Dean (Coastal Resources Associates, 12120114-R): Our field work has been completed with no problems or concerns, and all project components are proceeding on schedule. Interesting findings include the discovery of a live oyster (*C. gigas*) that was found during a sampling trip to Johnson Bay (WPWS) in June 2013. The oyster was presumed to be at least 5 years old due to the perennial seaweeds growing on it as well as its size. Also notable is an overall observed reduction in mussels across our GWA sites that has been observed in data collected through 2012.

Ecological Communities in Kachemak Bay – Iken and Konar (UAF, 12120114-L): Field work for monitoring intertidal communities in Kachemak Bay was conducted successfully. Insufficient low tide level at Bishop's Beach and Bluff Point prohibited us from completing surveys of all tidal levels at those sites. At Bluff Point, an adjacent site to the original (2012) site was sampled in 2013 as that location was more accessible. Notable findings include a strong recruitment event in mussels observed at one site in Kachemak Bay but not others, indicating site-specific dynamics in recruitment, as well as the discovery that clam composition is site-specific in Kachemak Bay, confirming strong local dynamics in various regions of Kachemak Bay.

EVOS oil exposure of harlequin ducks and sea otters – Ballachey (USGS Alaska Science Center, 12120114-Q): Sea otters (n = 60) were captured and sampled in western PWS in summer 2012; blood samples from those otters have been analyzed over the past 6 months for biomarker and health assays using gene expression analyses; a final report is in preparation. Harlequin ducks were captured in PWS in March 2013 and liver biopsies collected for cytochrome P4501A (CYP1A) assays. Previous sampling, through March 2011, had shown higher CYP1A in ducks from oiled areas relative to those from unoiled areas.

Oil level and weathering tracking – Carls (NOAA/NMFS Auke Bay Laboratory, 12120114-S): Sample processing has focused on samples and data that contribute to long-term understanding of conditions in Prince William Sound and along the Gulf of Alaska. Hydrocarbon analyses and biomarker measurements have been completed for Gulf of Alaska samples and we are now writing the report (Irvine *et al*). Measurement of hydrocarbons in three species of

shrimp (pink, coonstripe and spot) is underway in the laboratory and will likely consume available processing time for several months.

h) Summary of Work to be Performed–

We are planning the following activities directed to the original program goals during the next six months:

a) Conduct monitoring efforts in accordance with program milestones.

b) Continue to review and add program data and related historic related data to the Gulf of Alaska data portal.

c) Conduct an in-person principal investigator meeting and time series analysis workshop, with a focus on enhancing integration of efforts within the program and with external partners.

d) Continue outreach and information dissemination efforts at community level events, workshops, and scientific meetings and through the revised website.

e) Continue to refine and coordinate sampling methods for specific projects.

f) Continue data assimilation and archiving efforts with the NCEAS programs.

g) Work closely with the Herring Research and Monitoring program to develop the program science synthesis reports and begin planning the 2015 workshop.

Summary of project level plans:

Program coordination and logistics – Hoffman (PWSSC, 12120114-B): Reporting remains on track for FY14 work plans and FY13 semi-annual reports. At the request of EVOSTC staff, we added a proposal for additional FY14 Lingering Oil project funds (PI: Esler) to the overall program. We have scheduled a Gulf Watch Alaska PI meeting for November 13-14, 2013. Where possible, PIs will also attend the Alaska Marine Science Symposium in Anchorage in January 2013. Planning and coordination of the year three synthesis workshop will commence in the last two quarters of FY13.

Outreach – Molly McCammon (AOOS, 12120114-B): The Outreach and Community Involvement Committee will meet to develop Phase II of the program's Outreach and Community Involvement plan. Expected activities include radio shows, lectures, community discovery labs, publications, and science symposia. We will use the Community Based Monitoring (CBM) Best Practices workshop planned by AOOS and Alaska Sea Grant as a forum to help facilitate discussion on potential use of CBM and local and traditional knowledge in the Gulf Watch Alaska Program.

Data Management – McCammon/Bochenek (AOOS/Axiom, 12120114-D): Axiom engineers will facilitate the ingestion of year 2 field season data into the Research Workspace over the next 6 months. The Gulf Watch Alaska data portal will be further cultivated with the addition of multiple datasets.

Historical data management and synthesis – Jones (NCEAS, 12120120): During the rest of this year we plan to continue our data collation efforts, attempting to assemble a complete collection of data sets from the various historical projects. We also will produce data

summaries in preparation for our synthesis efforts in years 3-5. We are currently working on finalizing the data catalog by adapting its user interface to match the Gulf Watch Alaska website, extending the search capabilities of the site, and integrating it with DataONE to provide long-term, persistent backup of the data holdings. In the fourth quarter of this grant year, we will begin the process of drafting a call for synthesis working groups to be conducted during years 3-5 of the project.

Science Coordination and Synthesis – Holderied (NOAA KBL, 12120114-H): In the next six months we will plan and conduct the annual in-person principal investigator meeting along with a time series analysis workshop that includes other Gulf of Alaska researchers. We will continue to assist the data management team to develop and test the live data portal. We will coordinate with principal investigators and data management team to make all 2012 project data and metadata available through the data portal and help load 2013 data on the Research Workspace. We will continue development of synthesis products, including trend cards.

Conceptual Ecological Modeling – Hollmen (ASLC, 12120114-I): No changes to the original work plan are expected. Key milestones in the upcoming six months include:

Design draft conceptual models

Gulf of Alaska mooring (GAK1) monitoring – Weingartner (UAF, 12120114-P): We will continue collecting CTD data on a quasi-monthly basis (up to 8 in 2014) and conduct the mooring operations at GAK 1 in March 2014. These are consistent with the approach described in the original proposal and there are no changes in sampling or analytical methods.

Seward line monitoring – Hopcroft (UAF, 12120114-J): Late summer cruise is scheduled for Sept 10-29. Analysis of 2013 samples will continue. Several manuscripts are being prepared for inclusion in an NPRB-led special issue.

Oceanographic conditions in Prince William Sound – Campbell (PWSSC, 12120114-E): No changes in project objectives, procedures or statistical methods, or study area are expected. Slight changes to the profiler deployment are anticipated; it is expected that it will be retrieved in October or November, and redeployed early in January.

Oceanographic monitoring in Cook Inlet – Doroff (ADFG KBRR) and Holderied (NOAA KBL, 12120114-G): In the next six months, we plan to continue monthly oceanography and plankton surveys on the mid-Kachemak Bay transect and to conduct a lower Cook Inlet survey in October 2013. Charter vessel contracts have been established for Cook Inlet sampling in February and April 2014. A data table and relational database structure have been developed for this project and will be coordinated with the data management team and other Gulf Watch Alaska principal investigators. We will provide oceanography and plankton data to the Research Workspace in coordination with the data management and science synthesis teams. Two of the NOAA Kasitsna Bay Lab 2013 Hollings Scholar summer interns will be using and analyzing project data for their senior honors projects during the 2013-2014 academic year at American University and Oberlin College.

Continuous plankton recorder – Batten (SAHFOS, 12120114-A): At this time there are no anticipated changes to the sampling schedule, with the 5th transect set to be sampled mid-

August, and the final transect to be sampled mid-September. Preliminary processing of samples will be ongoing for the remainder of the field season, and processing of remaining samples and QC of the spring samples has commenced and will also now be ongoing.

Ability to detect trends in nearshore marine birds – Coletti (USNPS SWAN, 12120114-F): Because of some unanticipated delays, our timeline for completion of analysis has shifted to a later date. We expect a contract to be awarded by the end of FY 13 and the analyses to be completed by June 2014.

Long-term killer whale monitoring – Matkin (NGOS, 12120114-M): There should be no significant deviance from the proposed basic study plan in the next report period. Some aspects of the plan are based on weather and the presence of specific individual whales and cannot be predicted, but there is no intention to change the project plan at this time.

Humpback whale predation on herring – Moran and Straley (NOAA, NMFS Auke Bay Laboratory, 12120114-N): Three surveys of PWS will be conducted during October and December 2013, and April 2014 to document whale abundance and target prey. An additional whale tagging survey may occur in conjunction with the non-lethal herring sample survey. We will begin working with Dr. Bree Witteveen, who maintains the humpback whale database for Kodiak, Barren and Shumagin Islands.

Forage fish distribution and abundance – Piatt and Arimitsu, USGS Alaska Science Center, 12120114-O): Our primary goal as proposed is to identify robust indices for monitoring forage fish populations over time and devise a sampling strategy for long-term monitoring of those indices. After a successful field trial in 2013, we will continue to explore ways to expand the aerial spotting surveys to aid in locating and sampling forage fish schools with hydroacoustics in the Sound. In the coming months we will analyze the hydroacoustic data we collected in conjunction with the Herring Research and Monitoring Program's aerial surveys in July 2013. We will work closely with Scott Pegau to devise a plan that benefits both programs.

Prince William Sound marine bird surveys – Irons/Kuletz (USFWS Alaska Region, 12120114-K): In the next 6 months the seabird biologist will be onboard during three EVOS cruises. Two cruises, scheduled for October and December 2013, are part of the *Humpback Whale systematic surveys*. The third cruise will be the *HRM Juvenile Herring Abundance Index* cruise scheduled for November 2013. In addition to cruises, data analyses are ongoing.

Seabird abundance in fall and winter – Bishop (PWSSC, 12120114-C): In the next 6 months, the seabird biologist will be onboard during three EVOS cruises. Two cruises, scheduled for October and December 2013, are part of the *Humpback Whale systematic surveys*. The third cruise will be the *HRM Juvenile Herring Abundance Index* scheduled for November 2013. In addition to cruises, data analyses are ongoing.

Nearshore benthic systems in the Gulf of Alaska – Ballachey (USGS Alaska Science Center), Coletti (USNPS SWAN) and Dean (Coastal Resources Associates, 12120114-R): We anticipate no changes to the work plan we initially submitted for the nearshore benthic component. We will be adding an additional PI to the project: Dr. Dan Esler, who has served as a PI on the lingering oil studies for almost two decades (including Project 12120114Q & 13120114Q) will be starting a full-time position with the USGS Alaska Science Center in August 2013, and will assume a

major role in the Gulf Watch Alaska nearshore benthic monitoring component in addition to continuing with lingering oil studies.

Ecological Communities in Kachemak Bay – Iken and Konar (UAF, 12120114-L): – We will participate in the PI meeting on 14-15 November 2013 in Anchorage. The 2013 data will be prepared for posting on the Research Workspace by December 2013. We are planning on presenting a poster at the Alaska Marine Science Symposium in January 2014. Field work is planned for May 2014 with dates TBD depending on the best low-tide cycle. Sampling in 2014 will include rocky intertidal, seagrass, *Lottia* size-frequency distribution, and *Mytilus* size-frequency distribution. No deviations from the original proposal are expected.

We anticipate continued sample collection and processing of sea otter scats from our long-term monitoring site. We will begin doing visual observations for sea otter prey in fall 2013. Database structures are still being developed and shared with U.S. Geological Survey for the forage observation data.

EVOS oil exposure of harlequin ducks and sea otters – Ballachey (USGS Alaska Science Center, 12120114-Q): We are proposing to resample harlequin ducks in PWS in March 2014 for collection of liver biopsies to be analyzed for CYP1A. A detailed description of the proposed work is provided as a separate Work Plan for Project 14120114Q.

Oil level and weathering tracking – Carls (NOAA/NMFS Auke Bay Laboratory, 12120114-S): The biggest future responsibility is extension of the hydrocarbon time series in Prince William Sound. We are requesting that plans to collect new field samples be delayed by one year, pushing the field effort to 2015. The purpose of the delay is to position the project to best respond to findings from the bioremediation project (Boufadel, 11100836), the lingering oil distribution modeling (Nixon, 12120117), and to consider new findings from Gulf Watch Alaska monitoring.

Appendix 1. Summary of findings from the studies conducted within the Gulf of Alaska, references for those studies and initial list of possible long term monitoring measures that could be used to validate previous study results and test new hypotheses.

Findings	**Reference**	**Possible monitoring measures**
2011 anomalous year, early W.Gulf of Alaska(WGOA) bloom, no Eastern GOA (EGOA) bloom. Low Upwelling(UW) WGOA, low Pacific decadal oscillation (PDO), low spring discharge (Q), high winter Q.	GOAIERP retrospective, Mueter et al. 2013	Gulf Watch regions for data: L. Cook Inlet, N.GOA, Prince William Sound (PWS). Metrics: ChlA/Phytoplankton community, UW, PDO, SOI Spring and winter discharge. Only have off shelf data from N. GOA. Compare regional variability for GW regions, also delineate off shelf vs. shelf from Seward Line (and Continuous Plankton Recorder (CPR) if possible)
GOA-wide: UW strongly, negative (neg) correlation (corr) to winter Q, PDO strong, neg. corr. to North Pacific index (NPI), Southern oscillation index (SOI). 58% of inter-annual variance in Chlorophyll A (ChlA) production attributable to PDO and UW.	GOAIERP retrospective, Mueter et al. 2013	
Variability in ChlA best explained by region	GOAIERP retrospective, Mueter et al. 2013	
Upwelling important to shelf production, particularly E. shelf	GOAIERP retrospective, Mueter et al. 2013	
Coast wide: rockfish growth positive corr. w. shelf ChlA	Vanessa Von Biela, AKAFS 2012 student presentation	We lack programmatic piece for this in GW. Shelf ChlA production can explain variability in fish growth/survival between years (short lived species -i.e. herring, salmon). Fish life histories related to regions of production: pelagic vs. benthic vs. neustonic, timing of ontogeny. Perhaps can partner with herring program...for fine scale regional variabilty in growth (i.e. bays of PWS). Also, pink salmon return data could be useful.
Sablefish recruitment increased w. higher ChlA production, UW	Brenden Coffin, student thesis in progress	
2011 bad years for pelagic Pcod/pollock, good for Rock/Sable* (neustonic)	GOAIERP retrospective, Mueter et al. 2013	
Capelin have nearly disappeared in GOA since later 80s	ADFG small mesh trawl data, Mueter et al 2013 retrospective	Some retrospective work on Capelin would be very helpful to consider what the ecological impacts of losing this species may have been
Physical forces respond to seasonal weather shifts, in particular, long term shifts in the intensity and location of the ALP during winter	GEM	UW, nutrient measures, ChlA and phytoplankton community
Pinks and Plankton: reduced nearshore plankton densities lead to dispersion from nearshore and increased predation -reduced survival.	Willette 2001 (SEA work special issue, Fisheries Oceanography)	Pink salmon survival, zooplankton community composition, timing, UW, nutrients, ChlA, phytoplankton community, predator community,

Pinks and Plankton: Zooplankton TYPE is important- reduction in large Calanoids led to increase dispersion from near shore and 5 times greater predation	Willette 2001 (SEA work special issue, Fisheries Oceanography)	other prey sources (i.e. forage fishes, large calanoids for pelagic fishes)
Pinks and Plankton: changes in predator community composition more strongly drove changes in survival than did timing of movements (obviously not mutually exclusive).	Willette 2001 (SEA work special issue, Fisheries Oceanography)	
Herring and Pinks: Juvenile herring abundance declines with winter plankton abundance	Cooney et al. 2001 (SEA work special issue, Fisheries Oceanography)	Pink salmon, forage fish, and herring size/abundance/energy density, plankton community
Herring and Pinks: Pink salmon predation increases with reduced forage fish abundances	Cooney et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Herring and Pinks: Age 0 herring and pinks use very different niches. Pinks use cool, early bloom near shore habitats dominated by diatoms/calanoids. Age-0 herring use warm, post bloom conditions in late summer/early fall	Cooney et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Herring life history (LH): Fall energy content linked to overwintering survival (low feeding in December, fasting).	Norcross et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Herring LH: High spatial variability in nearshore rearing habitats prey availability related to physical transport processes for zooplankton. Resulting in high spatial variability in fall energy content	Norcross et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Herring LH: timing of herring spawning related to temperature and weather -4 C and calm. This has become earlier through time.	Norcross et al. 2001 (SEA work special issue, Fisheries Oceanography)	Local spawning times, temperatures, and winds/rain/wave action
Herring LH: larval mortality mostly from egg removal, strong storms within weeks after spawning results in high mortality	Norcross et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Herring LH: larval survival higher in warm winters than cold, lots of *Thysanuessa* and *Metridia* copepods (high energy density) is good	Norcross et al. 2001 (SEA work special issue, Fisheries Oceanography)	Herring recruitment, winter temps, zooplankton community/abundance
Plankton in PWS: Large temporal and spatial variability. Copepods dominate, Calanus life stage important as are early emergence, catch beginning of phyto bloom, prey for early fish spp	Cooney et al. 2001 (SEA work special issue, Fisheries Oceanography)	Plankton communities, Aleutian Low Pressure (ALP)/PDO, UW, SST, herring and salmon survival data

Plankton in PWS: Two conditions A) cold - weak Aleutian Low Pressure (ALP), reduced GOA circulation, negative Sea Surface Temperatures (SST) anomalies, strong CA upwelling. B) warm- strong ALP, strong GOA circulation, increased coastal temps and percip, strom intensive -B is good for salmon, perhaps less so for herring	Hollowed and Wooster 1992	
Plankton in PWS: mechanisms- high storms, increased mixing, prolonged phyto bloom, transfer of biomass to pelagic. Alt> Calm spring, reduced, warm mixed layer, intense, short bloom, biomass shift to benthos	Cooney et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Plankton in PWS: When large copepods dominate communty in April/June, offsets pink salmon predation	Cooney et al. 2001 (SEA work special issue, Fisheries Oceanography)	
Plankton and oceanography: plankton populations vary with nutrient availability and currents that exchange biomass from GOA. Early, strong stratification=quick, intense phyto bloom, biomass transfer to benthic. Later, prolonged, stratification due to series of storm events=prolong bloom, biomass transfer to pelagic	Eslinger et al. 2001 (SEA work special issue, Fisheries Oceanography)	various measures of biomass (plankton, fish) and community composition, regional measure of stratification, wind, upper circulation, exchange between slope/shelf
90s: bottom up forcing drive nutrients, 80s: other factors (transfer btwn GOA -'river/lake' hypothesis) drove plankton production	Eslinger et al. 2001 (SEA work special issue, Fisheries Oceanography)	
PWS circulation: three factors that influence biomass were examines -surface layer stratification, upper layer circulation, exchange bwtn GOA and PWS	Vaughan et al. 2001 (SEA work special issue, Fisheries Oceanography)	