FY 22-31 *PROGRAM* PROPOSAL
LONG-TERM RESEARCH AND MONITORING PROGRAM

Does this proposal contain confidential information? ☐Yes ☒No

Program Number and Title

2222LTRM - Gulf Watch Alaska Long-Term Research and Monitoring Program of Marine Conditions and Injured Resources

Primary Investigator(s) and Affiliation(s)

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Date Proposal Submitted

August 13, 2021; budget numbers updated September 30, 2021 because of revised Killer Whale proposal

Program Abstract (maximum 300 words)

In response to the *Exxon Valdez* Oil Spill (EVOS) Trustee Council's (EVOSTC's) focus area, Long-Term Research and Monitoring (LTRM) of marine conditions and injured resources, we are proposing to combine the successful Gulf Watch Alaska (GWA) long-term monitoring program with the Herring Research and Monitoring program, known as GWA-LTRM. The overarching goal is to continue 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 the recovery of injured resources. Science synthesis is now integrated in a new synthesis and modeling component to increase our understanding of Gulf of Alaska (GOA) ecosystem processes and function.

The program has five primary objectives:

1. Sustain and build upon existing time series in the EVOS-affected regions of the GOA.
2. Provide scientific data, data products, synthesis products, and outreach to management agencies and other users.
3. Provide information that can be used by the Education and Outreach and Mariculture programs.
4. Leverage partnerships with outside agencies and groups to integrate data and expand capacity through collaborative efforts.
5. Ensure data are properly archived so that they can be accessed beyond the life of this program.

These objectives are a continuation of the Trustee Council's long-term programs started in 2012. Monitoring projects will curate and extend legacy datasets while research projects investigate mechanistic drivers of injured resources (e.g., understanding factors limiting herring recovery). The EVOSTC Data Management program will continue its role of ensuring data are properly archived and publicly available. The GWA-LTRM team includes scientists, managers, and administrators of the previous programs and remain experts in their fields with decades of experience studying the EVOS and GOA ecosystems. This team has demonstrated their ability to work collaboratively, resulting in many successes and elevating the impact of EVOSTC funded research.

EVOSTC Funding Requested* (must include 9% GA)

FY22	FY23	FY24	FY25	FY26	FY22-26 Total
$4,568,741	$5,261,051	$5,090,150	$5,348,120	$5,357,622	$25,625,683
FY27	**FY28**	**FY29**	**FY30**	**FY31**	**FY27-31 Total**
$5,960,841	$5,291,856	$5,420,313	$4,747,747	$4,826,312	$26,247,068
				FY22-31 Total	*$51,872,752*

**If the amount requested here does not match the amount on the budget form, the request on the budget form will considered to be correct.*

Non-EVOSTC Funds to be used, please include source and amount per source:

FY22	FY23	FY24	FY25	FY26	FY22-26 Total
$2,115,584	$2,136,812	$2,107,044	$2,138,910	$2,122,149	$10,620,499
FY27	**FY28**	**FY29**	**FY30**	**FY31**	**FY27-31 Total**
$2,095,906	$2,116,293	$2,162,371	$2,197,372	$2,205,886	$10,777,827
				FY22-31 Total	*$21,398,327*

Sources on non-EVOSTC funds and amount per source are provided in the project proposals.

1. EXECUTIVE SUMMARY

OVERALL PROGRAM GOALS

The overarching goal of the proposed Gulf Watch Alaska (GWA) - Long-Term Research and Monitoring (LTRM) program is to continue 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. The organization of the program includes the following: five research and monitoring components (environmental drivers, pelagic, herring, nearshore, and lingering oil), a data management component, a synthesis and modeling component (integrated with program projects), a program management team, and a science review panel (SRP).

The program has five primary objectives:

1. Sustain and build upon existing time series in the *Exxon Valdez* oil spill (EVOS)-affected regions of the Gulf of Alaska (GOA) and conduct research to understand limitations of recovery for injured resources.
2. Provide scientific data, data products, synthesis products, and outreach to management agencies and other users.
3. Provide information that can be used by the Education and Outreach and Mariculture programs.
4. Leverage partnerships with outside agencies and groups to integrate data and expand capacity through collaborative efforts.
5. Ensure data are properly archived so that it can be publicly accessed beyond the life of this program.

PROGRAM HISTORY

This proposal combines the existing GWA and Herring Research and Monitoring (HRM) teams into a single LTRM program. The EVOS Trustee Council (EVOSTC) initiated funding in 2012 for the GWA long-term monitoring program (EVOSTC program 16120114; McCammon et al. 2011) and the HRM program (EVOSTC program 16120111; Pegau and Bird 2011). In 2017, the same teams proposed continuations of the GWA (21120114; Lindeberg 2016) and HRM (21120111; Pegau 2016) programs, with Data Management (21170113; Janzen, 2016) as a separate program outside of GWA and HRM. The GWA leadership structure has not changed significantly over the life of the program with the exception of a needed Science Coordinator as the program was looking to expand cross-component science syntheses in years 2017-21.

The GWA program has been a consortium of 15 projects, 10 of which started before 2012 and several with data sets extending prior to the EVOS. Under crucial oversight by a program management team, the GWA 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. The GWA program was designed to monitor key metrics that play important roles in the ecology of GOA marine environments. These metrics include environmental drivers such as temperature and nutrient availability, pelagic populations of predators and prey, and metrics that represent the nearshore food web and ecosystem. Through this monitoring effort, scientists and resource managers have come to rely on data streams and syntheses products created through GWA (Lindeberg 2021).

The HRM program was designed to improve predictive models of herring stocks through observations and research. The program was comprised of a mix of monitoring projects and process studies. From 2012-2017 the focus of the process studies was overwintering condition of age-0 herring. In 2017 the emphasis was changed towards understanding disease dynamics and adult herring movement. Other aspects of the herring lifecycle were also examined during each period. In 2019, a lingering oil project focused on herring (21170115) that was initiated under the Lingering Oil Focus Area was brought into the HRM program (Pegau 2021a).

Data management has been provided by the Alaska Ocean Observing System (AOOS) and Axiom Data Science throughout the life of the programs. AOOS and Axiom program served the long-term research and monitoring programs through the development and use of the Research Workspace and formally publishing data through the Gulf of Alaska Data Portal and DataONE repository (Janzen et al. 2021).

Integrating numerous multi-disciplinary long-term monitoring projects under the GWA program has proven highly successful since implementation and is now a mature, functioning program moving toward expanding integration and linkages among the various components and with outside research, monitoring, and management programs. The HRM program uses complementary long-term monitoring aspects and process studies along with information from the GWA program to provide an understanding of mechanisms of change. The Data Management program has provided the support needed to ensure the data will be available to resource managers and the public far beyond the life of this program. Collectively, this group of scientists represents unsurpassed expertise and knowledge of the GOA ecosystem and spill-affected region.

Programmatic successes during the first ten years include (but are not limited to) the following (also see Table 1 in Section 2):

- Extension of long-term datasets on injured EVOS resources.

- Publication of findings in peer reviewed journals (over 200, see Table 1 and project proposals).
- Publication of science synthesis reports (Herring Research and Monitoring Team 2014, Hoem Neher et al. 2015, Pegau and Aderhold 2021, Suryan et al. 2021b).
- Creation of Research Workspaces where data, reports, metadata, and other files are shared across multiple federal agencies, universities, and private organizations. The Research Workspace provides a collaborative site for all principal investigators (PIs) to share information and discuss findings.
- Creation of a public Data Portal (http://portal.aoos.org/gulf-of-alaska.php). The Gulf of Alaska Data Portal provides public and resource management agency access to GWA and HRM program data that are reviewed following quality assurance and quality control procedures and include federally compliant metadata.
- Integration of program data into agency management activities (see project proposals).
- Development of a GWA program website (http://www.gulfwatchalaska.org/) and an HRM website (https://pwssc.org/research/) where information about long-term monitoring of the GOA and herring research are shared with the public. The websites are updated regularly with current scientific findings for each project.
- Outreach activities within the spill-affected area including local community presentations and school activities.
- A special issue peer-reviewed journal that synthesized findings of the first five years of monitoring. This was followed by four additional synthesis manuscripts published in the second five-year funding cycle, along with a second special journal issue in progress.

A CONTINUING PROGRAM

This proposal requests the continuation of the GWA and HRM programs, now combined into the GWA-LTRM program, through the next ten-year funding cycle, FY 2022-31. The GWA-LTRM program is now structured into six scientific components: 1) Environmental Drivers; 2) Pelagic Monitoring, 3) Herring Research and Monitoring, 4) Nearshore Monitoring, 5) Lingering Oil Monitoring, and 6) Science Synthesis and Monitoring. These components are supported by an Integrated Program Management Team and a Data Management component with oversight by a SRP and a science coordinating committee (SCC) (Fig. 1). Science synthesis, outreach, and community involvement services connect the program to the communities and resource managers. **This approach will allow us to achieve our overarching goal 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-LTRM Organizational Structure

Over the past 10-years the organizational structures of GWA and HRM have been effective and resulted in productive, integrated ecosystem monitoring and research programs. In response to the Invitation, a few minor changes have been made for the GWA-LTRM program structure (Fig. 1). We brought in the HRM program as a new component and added a new Synthesis and Modeling component to integrate scientific information across all projects.

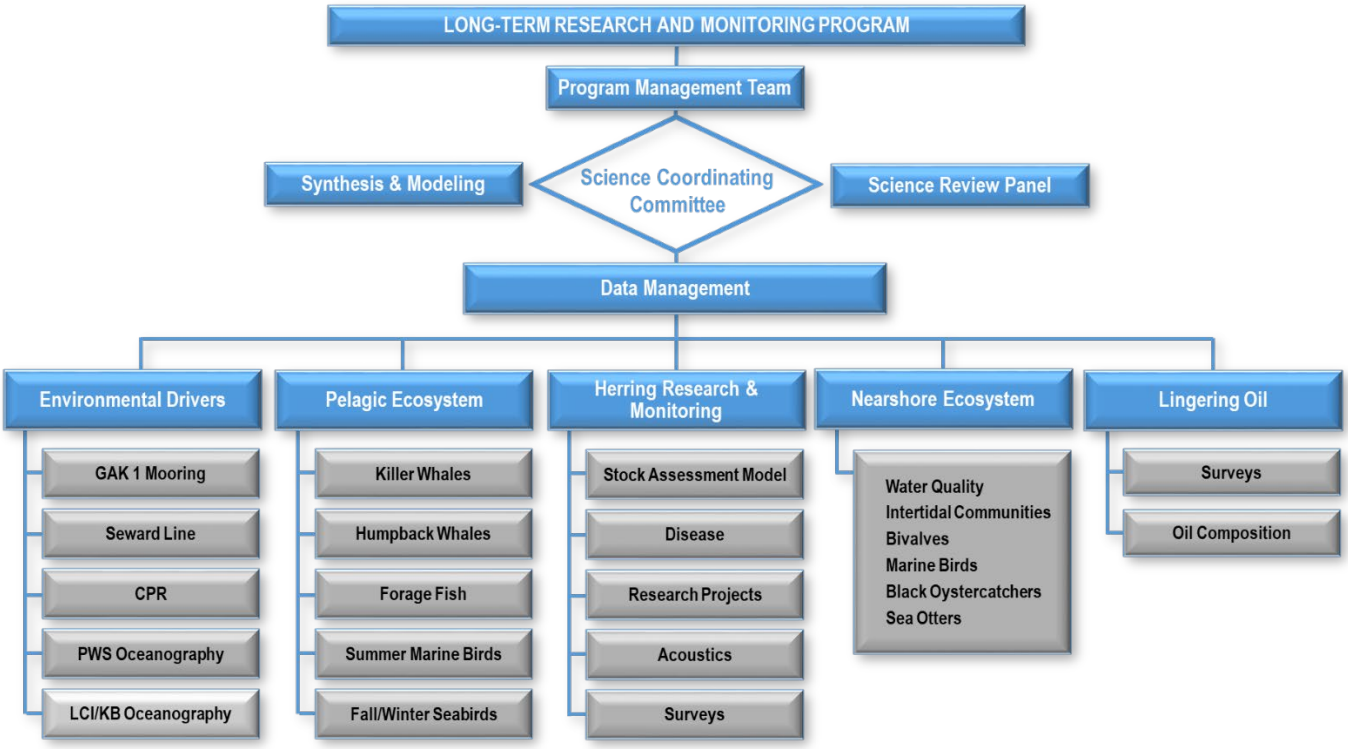

Figure 1. An organizational chart of the Gulf Watch Alaska - Long-Term Research and Monitoring program showing oversight, components, and individual projects.

Our plans for the next ten-year period include continuing the legacy of our long-term monitoring datasets, research projects, while adding several new research projects and expanding our knowledge of the GOA ecosystem and its changing conditions. The GWA-LTRM program "footprint" (Fig. 2) falls within the EVOSTC boundaries delineated in the Invitation. The monitoring and research areas for the program remain the same with one addition, a proposed HRM project will expand to include the Kayak Is. area as requested in the Invitation. The HRM program is also proposing several new projects in response to the Invitation. For FY 2022-2031, we are submitting 22 project proposals which includes three new herring project proposals. Detailed individual project proposals and the proposed ten-year budget plans are provided to EVOSTC staff members, as requested, in the program's Research Workspace.

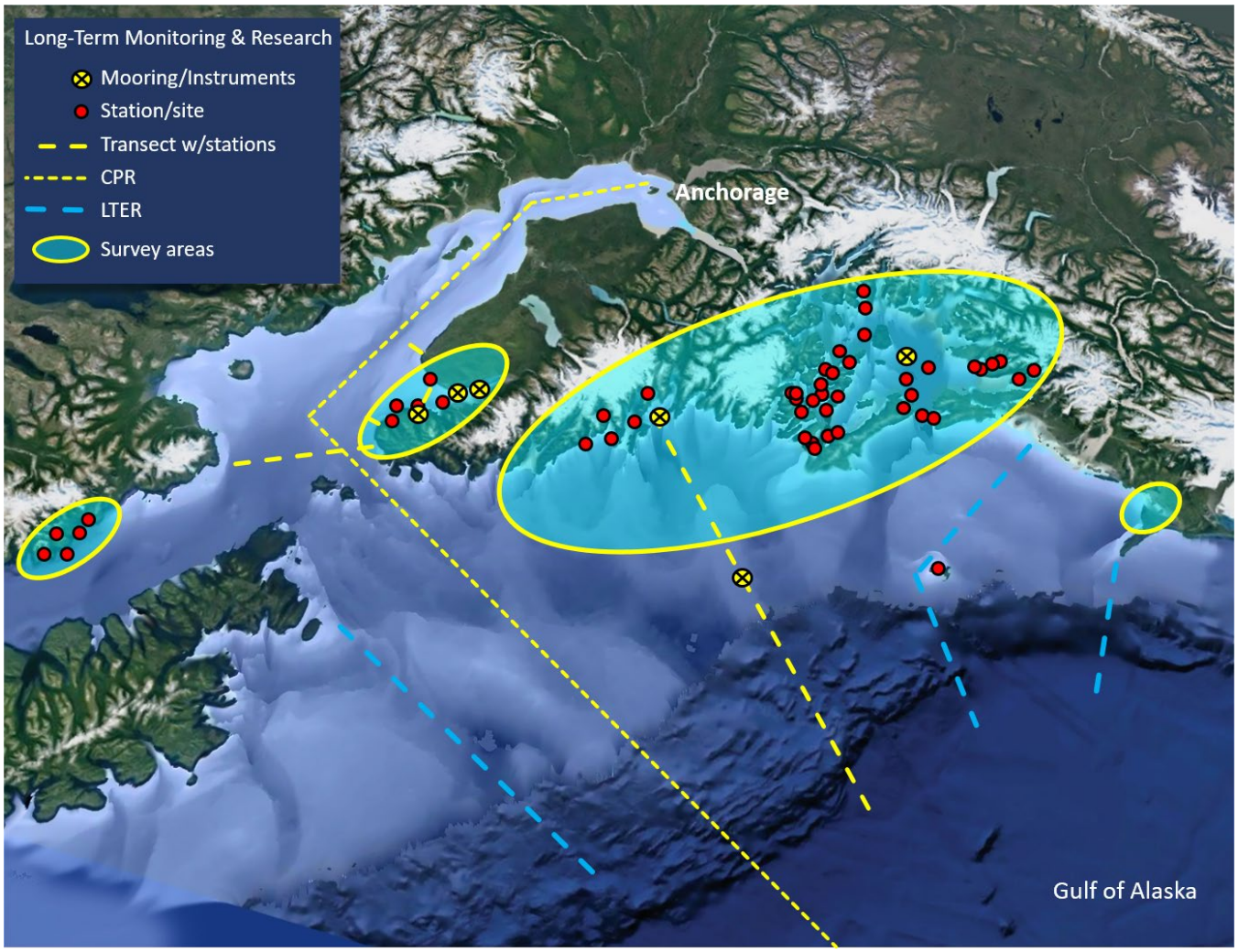

Figure 2. A map showing the general sampling locations for the Gulf Watch Alaska - Long-Term Research and Monitoring program and National Science Foundation Northern Gulf of Alaska Long Term Ecological Research (LTER) partner. The general bounding coordinates for this area are: 61.296626, -143.854980, 57.967331, -154.852295.

Brief summaries for each key program component are provided below. Please see individual project proposals for more details on specific projects.

Integrated Program Management and Administration

This substantial and diverse program relies on the strong foundation of an integrated program management team for its successes. The GWA-LTRM program will continue to be led by the successful partnership between the National Oceanic and Atmospheric Administration (NOAA) and Prince William Sound Science Center (PWSSC) that comprises the integrated program management team. The goal of the integrated program management team is to provide maximum benefit to GWA-LTRM collaborators, stakeholders, and other EVOSTC foci through the support of GWA-LTRM scientific projects, facilitate cooperation and synthesis among projects within and

across components, ensure individual project compliance, coordinate program outreach and community engagement activities, and ensure high-quality scientific reporting.

NOAA personnel will provide overall oversight of the program and the diverse projects within. NOAA personnel will also provide oversight for science synthesis efforts and compliance with data and reporting submissions. PWSSC personnel will provide administration of the NOAA grant to non-Trustee agencies and organizations, day to day program coordination, coordination of the SRP, logistics associated with PI meetings, and coordination and oversight of outreach and community involvement activities. HRM component coordination duties have been folded into the overall program administration. See Sections 4 and 5 for details on program administration and science management design and implementation.

Environmental Drivers Monitoring Component

The Environmental Drivers Component of the GWA-LTRM program will provide the spatial and temporal context for understanding change in the physical and chemical environment (Fig. 3). Abiotic environmental changes will mediate lower trophic level (phytoplankton and zooplankton) productivity changes and subsequently propagate upwards to the mid and upper trophic level consumers. Combined with measurements and analyses that incorporate other broad-scale ocean, atmosphere and cryosphere datasets, the Environmental Drivers Component positions itself to understand the ramifications of environmental perturbations such as El Niño and La Niña, the recent North Pacific warm water anomalies, longer-term trends of a warming climate, and altered species distributions and interactions. As in the earlier GWA programs, this observation network consists of five separate, but interconnected projects distributed across the spill-impacted GOA and are key to improving our understanding of the intersection of the Alaska Coastal Current with Prince William Sound (PWS), Resurrection Bay, and Lower Cook Inlet. Proposed projects include the following:

1. Continuous Plankton Recorder Monitoring (CPR)
   Clare Ostle, Marine Biological Association (MBA), and Sonia Batten, North Pacific Marine Science Organization (PICES) (Ostle and Batten 2021)
2. Long-Term Monitoring of Oceanographic Conditions in Prince William Sound
   Rob Campbell, PWSSC (Campbell 2021)
3. Oceanographic Station GAK-1 Long Term Monitoring of the Alaska Coastal Current
   Seth Danielson, University of Alaska Fairbanks (UAF) (Danielson and Weingartner 2021)
4. Long-term Monitoring of Oceanographic Conditions in Cook Inlet/Kachemak Bay, Alaska
   Kris Holderied, NOAA Kasitsna Bay Laboratory (KBL), and Steve Baird, University of Alaska Anchorage (UAA)/Kachemak Bay National Estuarine Research Reserve (KBNERR) (Holderied and Baird 2021)
5. Seward Line Monitoring
   Russ Hopcroft and Seth Danielson, UAF (Hopcroft et al. 2021)

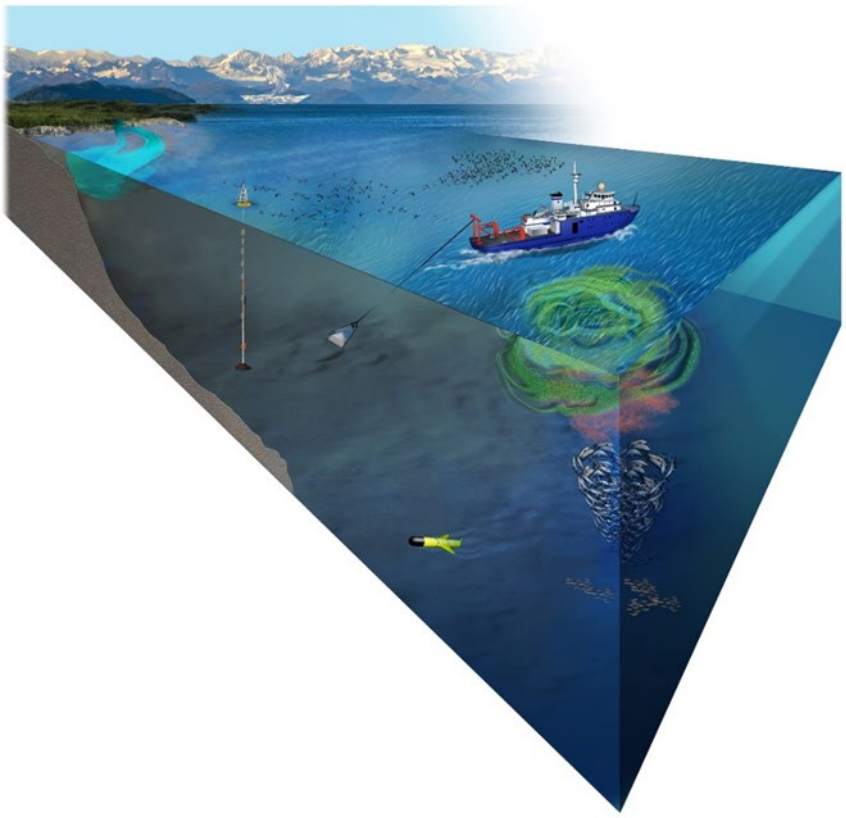

Figure 3. Gulf Watch Alaska - Long-Term Research and Monitoring Environmental Drivers Component conceptual graphic showing selected physical and biological oceanographic sampling throughout the Exxon Valdez oil spill area.

Pelagic Monitoring Component

The Pelagic Component team is proposing to continue monitoring key pelagic resources in PWS and the GOA. These five projects will continue to focus on species that play a pivotal role in the pelagic ecosystem as trophic indicators for short and long-term ecosystem change, including killer whales, humpback whales, forage fish, and marine birds (Fig. 4). The overall goals of the Pelagic Component are to (1) determine the population trends of key pelagic species groups in PWS and their abundance in adjacent shelf waters, and (2) improve our understanding of predator-prey relationships and their response to ecosystem changes. The following questions will shape the research of the pelagic team over the next decade: 1) What are the population trends of key pelagic species groups in PWS – killer whales, humpback whales, marine birds, and forage fish? 2) What are indicators of ecosystem flux in these middle- and upper-level predators (e.g., population changes, shifts in distribution or abundance, variation in condition of individuals, changes in predator/prey relationships)? and 3) How do these indicators interface with environmental drivers and nearshore coastal and shelf environments to inform a larger picture of ecosystem change?

1. Monitoring Long-Term Changes in PWS and Northern GOA Forage Fish
   Mayumi Arimitsu and John Piatt, U. S. Geological Survey (USGS) Alaska Science Center (Arimitsu and Piatt 2021)
2. Fall and Winter Habitat Use and Distribution of Seabirds in PWS
   Mary Anne Bishop and Anne Schaefer, PWSSC (Bishop and Schaefer 2021)
3. PWS Marine Bird Surveys
   Kathy Kuletz and Robert Kaler, U.S. Fish and Wildlife Service (USFWS) (Kuletz and Kaler 2021)
4. Long-term Killer Whale Monitoring
   Craig Matkin, Dan Olsen, and John Durban, North Gulf Oceanic Society (NGOS) (Matkin and Olsen 2021)
5. Monitoring of Humpback Whale Predation on Pacific Herring in PWS
   John Moran, NOAA National Marine Fisheries Service (NMFS), and Jan Straley, University of Alaska Southeast (UAS) (Moran and Straley 2021)

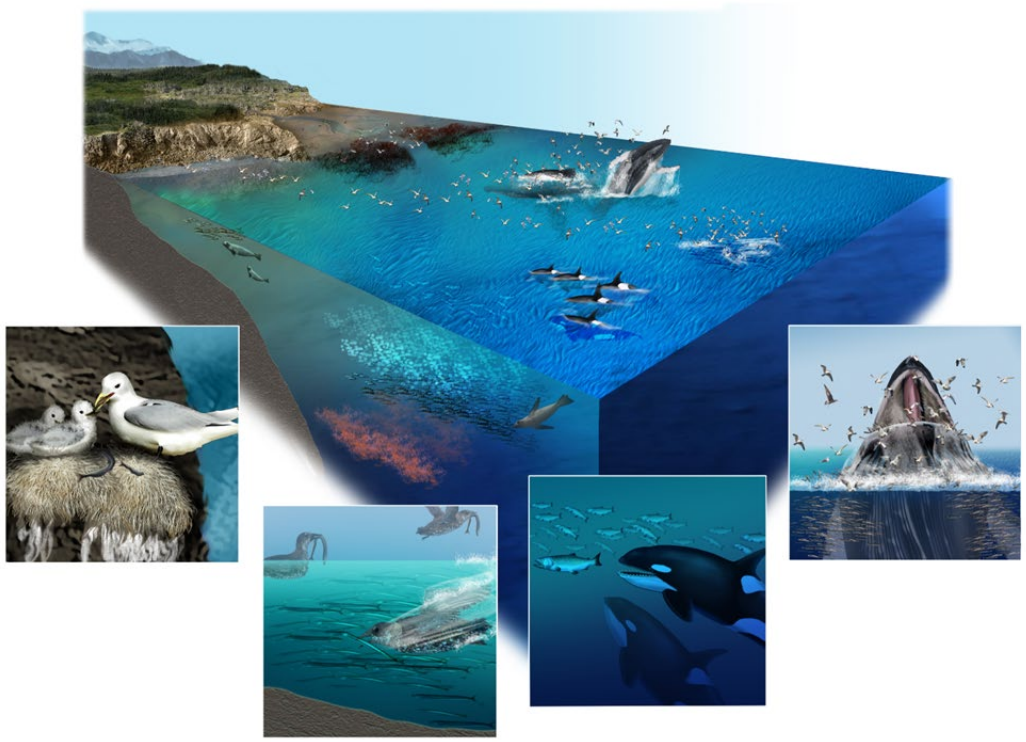

Figure 4. Gulf Watch Alaska - Long-Term Research and Monitoring Pelagic Component conceptual graphic showing key predators and their prey being monitored in the pelagic ecosystem impacted by the Exxon Valdez oil spill.

Herring Research and Monitoring Component

The HRM program is now a component of GWA and will improve efficiencies and maximize collaboration. The general approach remains the same as in the past (Pegau 2021a). We will use monitoring of population metrics and modeling to track the status of Pacific herring in PWS. Process studies focused on disease dynamics, movement, larval growth, and interactions with pink salmon will inform our understanding of topics that have

been considered as potential factors limiting herring recovery. Synthesis of herring dynamics with environmental driver (bottom-up forcing) and pelagic (top-down forcing) will tie the herring and other components together. The following questions will guide our efforts: 1) How is the herring population changing? 2) What factors may be driving those changes? 2) Are there detectable interactions between herring and pink salmon?

1. Annual Herring Migration Cycle: Movement between Kayak Island and PWS
   Alysha Cypher and Mary Anne Bishop, PWSSC (Bishop and Cypher 2021)
2. Modeling and Stock assessment of PWS Herring
   Trevor Branch, University of Washington (UW) (Branch 2021)
3. Herring Disease Program
   Paul Hershberger, U.S. Geological Survey and Maureen Purcell, USGS (Hershberger and Purcell 2021)
4. Surveys and Age, Sex, and Size Collection and Processing
   Jennifer Morelli, ADF&G (Haught 2021)
5. Adult Pacific Herring Acoustic Surveys in PWS
   Peter Rand, PWSSC (Rand 2021)
6. Variations in Growth of Larval Herring
   Alysha Cypher, PWSSC
7. Ecological interactions between Pacific herring and Pacific salmon in Prince William Sound, Alaska
   Peter Rand and Rob Campbell, PWSSC, Kristen Gorman, UAF, and Ron Heintz, Sitka Sound Science Center (SSSC)
8. Herring Workshops
   W. Scott Pegau, PWSSC
9. Aerial Forage Fish Surveys
   W. Scott Pegau, PWSSC
10. Genetic and Physiological Mechanisms of Virus and Oil Interactions in Pacific herring
    Andrew Whitehead, University of California Davis (UC Davis), and Paul Hershberger, USGS (Whitehead 2021)

Nearshore Monitoring Component

The Nearshore Component is a single project that allows for the integration of data, resources, and synthesis efforts across the spill-affected region. The Nearshore Component will continue to investigate and monitor the nearshore environment with a focus on selected elements of the nearshore ecosystem. More than 200 species dependent on nearshore habitats, many with well recognized ecological roles in the nearshore food web, are monitored annually within four regional blocks in the GOA (Fig. 5). Evaluation of change in these species over time in relation to well defined static and dynamic drivers allows accurate and defensible measures of change and supports management and policy needs addressing nearshore resources. The overarching goal of the Nearshore Component is to understand drivers of variation across the nearshore food web in the GOA. The foundational questions of the Nearshore Component include (1) What is the current structure of the GOA nearshore ecosystems, and what are the spatial and temporal scales over which change is observed? (2) Are observed changes caused by broad-scale environmental variation, or local perturbations? (3) Does the magnitude and timing of changes in nearshore ecosystems correspond to those measured in pelagic ecosystems? The design features of the Nearshore Component include a rigorous site selection process that allows statistical inference over various spatial scales (e.g., GOA and regions within the GOA) as well as the

capacity to evaluate potential impacts from more localized sources, and especially those resulting from human activities, including lingering effects of EVOS. In addition to detecting change at various spatial scales, design features incorporate both static (e.g., substrate, exposure, bathymetry) and dynamic (e.g., variation in oceanographic conditions, productivity, and predation) drivers as potential mechanisms responsible for change.

Nearshore Systems in the GOA

Heather Coletti, National Park Service (NPS), Dan Esler, USGS, Katrin Iken, UAF, Brenda Konar, UAF, Brenda Ballachey, USGS-retired, James Bodkin, USGS-retired, George Esslinger, USGS, Kim Kloecker, USGS, Mandy Lindeberg, NOAA Auke Bay Labs (ABL), Dan Monson, USGS, Brian Robinson, USGS, Sarah Traiger, USGS, and Ben Weitzman, USFWS (Coletti et al. 2021)

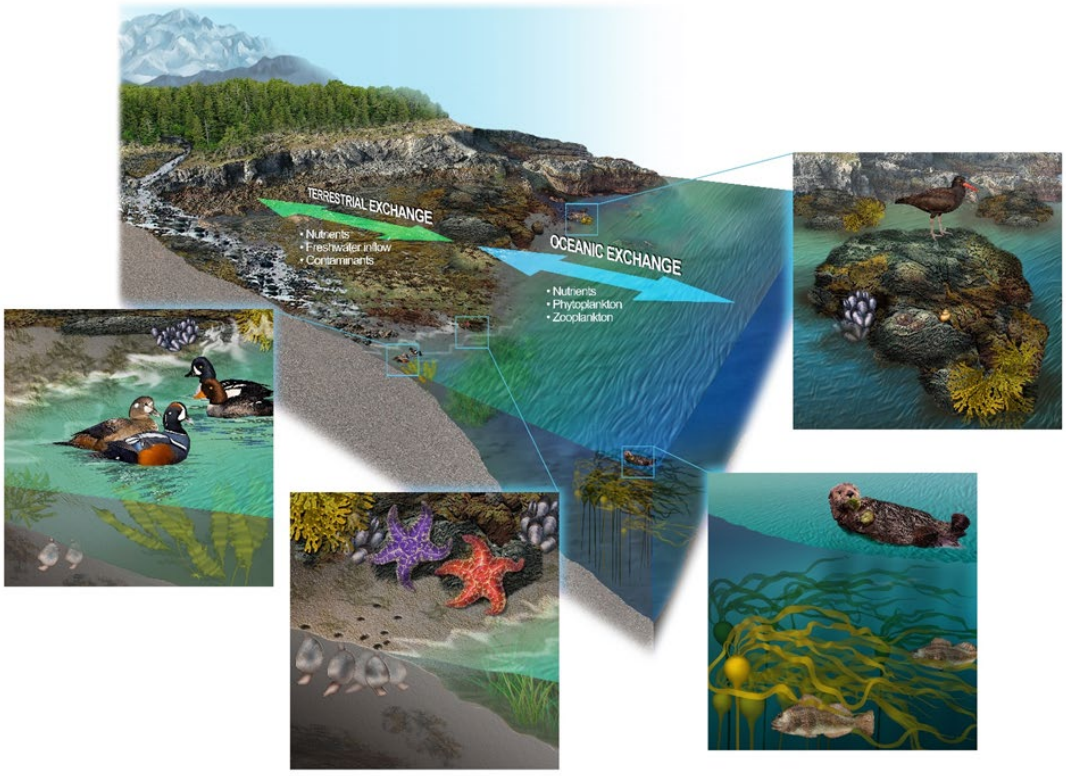

Figure 5. Gulf Watch Alaska - Long-Term Research and Monitoring Nearshore Component conceptual graphic showing key species being monitored in the nearshore ecosystem impacted by the Exxon Valdez oil spill.

Lingering Oil Monitoring Component

Of the nearly 11 million gallons of crude oil released during the 1989 EVOS, a small proportion remains sequestered within sediments of beaches with distinct characteristics throughout the spill area. This lingering oil, as it is known, has been a source of concern for federal and state governments and the public for more than 30 years. Significant efforts have been applied by the EVOSTC to document the extent of this issue, determine effects of lingering oil on natural resources, and identify potential mitigation or restoration options and their

pros and cons. To continue this legacy, the GWA-LTRM program will maintain a Lingering Oil Component for researching and monitoring lingering oil periodically. Under this component, lingering oil surveys will continue, adding to oil chemistry time-series, and new technologies in biochemistry will be utilized.

Long-term Monitoring of Lingering Oil in PWS
Dan Esler, USGS, and Mandy Lindeberg, NOAA (Lindeberg et al. 2018)

Data Management Component

The Data Management Component will be supported by the EVOSTC Data Management Program (22120113) and provide the critical support needed to ensure data collected in GWA-LTRM are properly organized, documented, and archived to make them available for use now and far into the future. This will be achieved through close collaboration of GWA-LTRM PIs with the extensive cyberinfrastructure and data management capacities of AOOS and Axiom Data Science. The Research Workspace will continue to be the main repository for data, with the data being made available through the Gulf of Alaska Data Portal (AOOS, 2021) and DataONE (DataONE, 2021) repository. The Data Management program will work closely with the PIs and PMT to ensure compliance with the EVOSTC's data policy (EVOSTC, 2021).

Science Synthesis and Modeling Component

The formalization of a Science Synthesis and Modeling Component for the GWA-LTRM is in response to the Invitation but has also been an ongoing activity for GWA and HRM long-term programs (Herring Research and Monitoring Team 2014, Hoem Neher et al. 2015, Pegau and Aderhold 2021, Suryan et al. 2021b). This component will allow the program to address key objectives and hypotheses of ecosystem change, recovery of injured resources, and potential effects on commercial, recreational, and subsistence resources. The primary focus of this component will be the integration of data between multi-disciplinary projects to improve our understanding of the ecosystems and the factors driving changes within them while helping to provide improved access to that information and understanding for resource managers, coastal planners, the research community, and the public. During the next 10 years, we aim to build and expand upon the synthesis efforts of the first 10 years. A key addition for the second 10-year period of GWA-LTRM is to fund five postdoctoral research fellows (hereafter postdocs) who will be dedicated to synthesizing the extensive data streams generated from the GWA-LTRM program and to integrate with large-scale ecosystem modeling efforts. The synthesis and modeling efforts will be managed by the GWA-LTRM Science Lead and advised by the program SRP. See Section 5 for more information on our approach for science synthesis and modeling.

GWA-LTRM Program Design & Success

Through the combined efforts of the GWA-LTRM program, we expect to be able to achieve our goal of providing 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. The GWA-LTRM consortium has been built from researchers who have decades of experience in their fields and have demonstrated their ability to work collaboratively, resulting in many successes within and outside the program. This type of integration across ecosystems and disciplines is unprecedented and will improve our understanding of the recovery of injured resources, especially during a period of rapid environmental change in the GOA. The program design connects everything from physical processes to biological responses across the GOA. Synthesis efforts are built into the scientific components with oversight by a program Science Lead, SCC, and SRP. By combining the scientific rigor

of the components, the data management, synthesis approaches, and outreach to the public and resource management agencies, we expect to create a lasting legacy of excellence in understanding injured resource recovery and ecosystem services for coastal communities in the GOA. Sections 4 and 5 provide additional information on program administration, design, and implementation.

2. RELEVANCE TO THE INVITATION

Responsiveness to the EVOSTC LTRM Focus Area

This program proposal directly addresses the EVOSTC FY 2022-2031 Invitation for Proposals (EVOSTC 2020) long-term monitoring of ecosystem conditions focus area and incorporates elements of the existing GWA and HRM programs. The GWA-LTRM program's study area falls within the EVOS region as outlined in the Invitation (Fig. 2) and specific areas are identified in the GWA-LTRM project proposals.

Our proposed program will advance work performed under previous EVOSTC Invitations (EVOSTC 2011, 2016, 2020), maintain and enhance long-term data collections, maximize EVOSTC funding, and develop science-based products that inform resource managers and the public. With oversight by a program management team, GWA-LTRM is designed as an integrated, ecosystem research and monitoring program curating decadal datasets in Environmental Drivers, Pelagic, HRM, Nearshore, and Lingering Oil components across marine ecosystems in the spill area. The HRM Component specifically focuses on the injured resource PWS herring (EVOSTC 2014) to better understand factors limiting their recruitment, their success, movements (including Kayak Island area), assessments of good growth years, top-down predation and disease, and other studies. We have officially added the Science Synthesis and Modeling Component identified in the Invitation as a natural next step for shifting the data collected by the program into an understanding of ecosystem change and recovery. The program will continue to have critical data management support (the same source for continuity, AOOS and Axiom Data Science) to ensure informational products are made available to the general science and natural resource management communities, both now and into the future. These data will be necessary for gaining an understanding of the effects of the spill, recovery status of affected resources and the potential for restoration and/or management actions.

Responsiveness to the EVOSTC Restoration Plan

The GWA-LTRM program is responsive to EVOSTC's 1994 Restoration Plan (EVOSTC 1994). The Plan identifies the continuing need for a sustained and interdisciplinary monitoring system to inform restoration needs and activities for injured resources and services. Specific language in the Plan cites the need for monitoring to "understand the physical and biological interactions that affect an injured resource or service, and may be constraining its recovery," recommends an "ecosystem approach," and recognizes that "an ecosystem approach to restoring injured resources and services may require restoration activities that address a resource's prey or predators, or the other biota and physical surroundings on which it depends..." The management strategy we propose to implement for the overall GWA-LTRM program maintains a priority for continuing long-term datasets of injured species (EVOSTC 2014) and to use an ecosystem approach to determine recovery from the EVOS or other perturbations.

Guidance from the EVOSTC (EVOSTC 2014) recognizes there are not sufficient funds to accomplish all necessary restoration and monitoring activities and that partnerships are necessary to meet EVOSTC goals. Specifically, the 1994 Restoration Plan (EVOSTC 1994) states that "restoration will take advantage of cost-sharing opportunities

where effective" and "priority shall be given to strategies that involve multi-disciplinary, interagency, or collaborative partnerships." During the first 10 years of GWA, the program was able to double the leveraging of EVOSTC funds, with more non-EVOSTC funds contributing to GWA than the EVOSTC (1.3 non-EVOSTC:1 EVOSTC for FY17-FY21). This is a reflection of the program maturing and a greater interest and investment by agencies and organizations as they recognized the sustained core support by the EVOSTC, the value of produced information to resource managers, and the opportunities for partnerships and collaborations. Our proposed monitoring program will continue to seek out leveraging opportunities with other monitoring and research programs.

The 1994 Restoration Plan (EVOSTC 1994) includes a policy that "restoration will include a synthesis of findings and results, and will also provide an indication of important remaining issues or gaps in knowledge." The GWA-LTRM program addresses this policy through its Science Synthesis and Modeling Component efforts that integrate results from the data collection projects. We will continue to build upon previous synthesis efforts (Herring Research and Monitoring Team 2014, Hoem Neher et al. 2015, Arimitsu et al. 2021, Danielson et al. In review, Pegau and Aderhold 2021, Suryan et al. 2021a, Suryan et al. 2021b, Weitzman et al. 2021) that synthesize data across projects and components.

We are also committed to the Plan's policy that "Restoration must reflect public ownership of the process by timely release and reasonable access to information and data." The GWA-LTRM program believes in providing information to recipients and colleagues in a transparent and timely fashion. We have a data management policy that addresses this directly (see Section 4 [Data and Reporting Policies subsection] and Section 6) and complies with the EVOSTC Data Policy (EVOSTC, 2021).

Expected Results of the GWA-LTRM Program

During the Trustee Council's FY22-31 funding period, the GWA-LTRM program will build on the strong foundation of scientific information transfer and products from the first 10 years of monitoring and research (Table 1).

Table 1. A summary of information transfer and data products for the Exxon Valdez Oil Spill Trustee Council long-term programs, Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) during the last two 5-year funding cycles (2012-2020).

Program	Information Transfer & Products	FY12-16	FY17-21
GWA	Peer reviewed publications	71	63
	Reports	88	81
	Popular articles	39	23
	Conferences & workshops	208	215
	Public presentations	22	39
	Developed data - Ecosystem Indicators	-	21
	Published datasets	45	47
	Maintained website	https://gulfwatchalaska.org/	

Program	Information Transfer & Products	FY12-16	FY17-21
HRM	Peer reviewed publications	28	55
	Reports	4	9
	Popular articles	28	56
	Conferences & workshops	36	92
	Public presentations	8	21
	Developed data - Ecosystem Indicators	-	3
	Published datasets	19	17
	Maintained website	https://pwssc.org/herring/	
GWA/HRM	Deep-Sea Research II Special Issue Journal	*Spatial and Temporal Ecological Variability in the Northern Gulf of Alaska: What have we learned since the Exxon Valdez oil spill?*	
	Deep-Sea Research II Special Issue Journal – *In progress*	*Understanding Ecosystem Processes in the Gulf of Alaska: Volume 3*	

Expected results from the GWA-LTRM program in the next 10 years will follow productivity trends presented in Table 1. The program will rely on the strong leadership of the PMT, the many research and monitoring projects within, data management, and synthesis efforts to reliably meeting goals and expectations. Please see the individual project proposals for details on anticipated project outcomes.

The GWA and HRM programs were designed 10 years ago in specific response to EVOSTC requests for research and monitoring of the spill affected ecosystem. Now combined, the GWA-LTRM program continues the following five primary objectives to support the EVOSTC's mission:

1. Sustain and build upon existing time series in the *Exxon Valdez* oil spill EVOS-affected regions of the GOA.
2. Provide scientific data, data products, synthesis products, and outreach to management agencies and other users.
3. Provide information that can be used by the Education and Outreach and Mariculture programs.
4. Leverage partnerships with outside agencies and groups to integrate data and expand capacity through collaborative efforts.
5. Ensure data are properly archived so that it can be publicly accessed beyond the life of this program.

3. PROGRAM PERSONNEL

GWA-LTRM senior personnel consist of the PMT, the SCC comprised of representatives from the five monitoring and research components (Environmental Drivers, Pelagic Ecosystem, HRM, Nearshore Ecosystem, and Lingering Oil), and the SRP (Table 2)(see also program organizational chart in Section 1 Fig. 1). Through past experiences over the last 10 years of this program, we have concluded that all of these roles are necessary for the integrated nature of this large ecosystem program. However, there are cost savings with at least half of these personnel providing in-kind salaries resulting in no cost to the Trustee Council. In addition to Table 2, we provide brief

descriptions of key personnel expertise and their roles. Brief biographies are also given for each SRP member demonstrating their expertise. Detailed professional and academic credentials for our PMT and SCC are provided in curriculum vitae located in Attachment 1.

*Table 2. Gulf Watch Alaska Long-Term Research and Monitoring key personnel listed by program group, name, affiliation, title, and the percentage of time that person will devote to the role. *indicates in-kind salary.*

GWA Leadership Group	Name	Affiliation	Title/Role	% time
Program Management Team (PMT)	Mandy Lindeberg	NOAA	Program Lead	50%*
	Katrina Hoffman	PWSSC	Administrative Lead	30%
	Robert Suryan	NOAA	Science Lead	10%*
	To Be Determined	NOAA	Science Coordinator	100%
	Donna Aderhold	PWSSC	Program Coordinator	75%
	Hayley Hoover	PWSSC	Outreach Coordinator	25%
Science Coordinating Committee (SCC)	Russell Hopcroft	UAF	Env. Drivers Lead	15%*
	Mayumi Arimitsu	USGS	Pelagic Lead	15%*
	Scott Pegau	PWSSC	HRM Lead	15%
	Heather Coletti	NPS	Nearshore Lead	15%*
	Daniel Esler	USGS	Lingering Oil Lead	10%*
Science Review Panel (SRP)	Michael Sigler	NOAA ret.	Science Review	volunteer
	Steve Okkonen	UAF	Science Review	volunteer
	Richard Brenner	ADF&G	Science Review	volunteer
	Terrie Klinger	UW	Science Review	volunteer
	Stanley (Jeep) Rice	NOAA ret.	Science Review	volunteer
	Sherri Dressel	ADF&G	Science Review	volunteer
	Steve Martel	Sea State Inc.	Science Review	volunteer

Program Management Team (PMT)

PMT personnel for GWA-LTRM will remain the same as the previous 5-year funding period, with two minor exceptions. The former Science Coordinator (R. Suryan, NOAA) will become the Science Lead and work closely with the new Science Coordinator, and we will have a new Outreach Coordinator (H. Hoover, PWSSC). NOAA personnel include Program Lead Mandy Lindeberg (in-kind contribution 0.5 full time equivalent [FTE]), Science Lead Rob Suryan (in-kind contribution 0.1 FTE), and a Science Coordinator who is to be determined (TBD) (1.0 FTE). PWSSC personnel include the Program Administrative Lead Katrina Hoffman (0.3 FTE), Program Coordinator Donna Aderhold (0.75 FTE), and Outreach Coordinator Hayley Hoover (0.25 FTE) (Fig. 6). These personnel will provide leadership and work closely with all program members as well as the addition of newly funded Trustee Council programs and projects (e.g., Mariculture and Education and Outreach awardees).

Program Lead: **Mandy Lindeberg**, *Senior Research Fisheries Biologist, NOAA ABL*
17109 Pt. Lena Loop Rd, Juneau, Alaska 99801
(907) 789-6616; mandy.lindeberg@noaa.gov

Mandy Lindeberg will serve as the GWA-LTRM Program Lead and the primary point of contact for the EVOSTC. She will ensure program coordination, collaborations and awareness with other agencies and monitoring initiatives in the region. Lindeberg has more than 25 years of experience conducting research in the GOA, has successfully been the GWA Program Lead throughout FY17-21 and will continue to lead the expanded GWA-LTRM program that combines GWA and HRM programs. Lindeberg will be responsible for overseeing coordination of GWA-LTRM program components, science synthesis and integration, and ensuring a coordinated monitoring program that meets project milestones and deliverables. She will oversee project synthesis efforts and coordinate preparation of scientific reports and papers for the EVOSTC and will work with investigators to support outreach efforts. She will also be responsible for coordinating efforts with other Trustee funded projects, other Trustee focus area programs, and non-Trustee organizations. The Program Science Lead, Administrative Lead, and all Coordinators (Program, Science, and Outreach) will report to Lindeberg.

Administrative & Outreach Lead: Katrina Hoffman, *President and CEO, PWSSC*
300 Breakwater Ave., P.O. Box 705, Cordova, Alaska 99574
(907) 424-5800 x225; khoffman@pwssc.org

Katrina Hoffman will serve as GWA-LTRM Administrative Lead. She has been in the role of Administrative Lead since the onset of the GWA program in 2012. She will be responsible for administration of the NOAA grant to non-Trustee agencies and organizations, coordination of the science review panel, logistics associated with PI meetings, and coordination and oversight of outreach and community involvement activities for the program. Hoffman will oversee timely submission of all project reports and monitoring of overall program spending. PWSSC will be responsible for financial administration of the non-Trustee Agency projects within the EVOSTC award through NOAA, including all sub awards, timely submission of financial and progress reports, and annual audit completion. Hoffman will oversee outreach and community involvement efforts that will be developed and implemented by PWSSC staff, Hayley Hoover.

Science Lead: Robert Suryan, *Program Manager, Research Fish Biologist, NOAA Auke Bay Laboratories*
17109 Pt. Lena Loop Rd, Juneau, Alaska 99801
(907) 789-6065; rob.suryan@noaa.gov

Rob Suryan will serve as the GWA-LTRM Science Lead. Suryan has more than 25 years of experience studying North Pacific ecosystems and has authored or coauthored over 60 publications during that time. He successfully coordinated science syntheses for the GWA program during FY17-21. The Science Lead will lead the Science Synthesis and Modeling Component and efforts to integrate and synthesize data collected under the program while also providing technical review, editing, research and writing of program documents. The Science Lead will work directly with the Science Coordinator, SRP, SCC, and postdocs to develop integrated data products that contribute to the broad understanding of environmental conditions that drive ecological functions. In addition, the Science Lead will seek partnerships between GWA-LTRM and external programs to leverage data and platforms and to increase the regional significance and prestige of the program.

Science Coordinator – Synthesis & Modeling: TBD, *NOAA Auke Bay Laboratories*
17109 Pt. Lena Loop Rd, Juneau, Alaska 99801

The GWA-LTRM Science Coordinator will work under the direction of the Science Lead and will be a full-time "term" position based in NOAA's Auke Bay Labs. The position will be advertised if the EVOSTC authorizes funding for the program and this position. The Science Coordinator will perform day to day activities related to the Science Synthesis and Modeling Component, including working with and helping coordinate postdocs across the program on synthesis activities, publications and reports, and other programmatic scientific activities. In addition to the Science Lead, the Science Coordinator will work closely with the Program and Administrative leads and the Program Coordinator on scientific meeting agendas, facilitating discussions, and more. As in the previous five-year funding cycle, the Science Coordinator position is a full-time position that cannot be hired until we know the program and position are funded. We are actively seeking candidates. We have started the process for advertising the position within NOAA so it can be filled as soon as possible.

Program Coordinator: Donna Aderhold, *PWSSC*
300 Breakwater Ave., P.O. Box 705, Cordova, Alaska 99574
907-244-4388; daderhold@pwssc.org

Donna Aderhold will serve as the GWA-LTRM Program Coordinator, a continuation of her role as GWA Program Coordinator during FY17-21. She has more than 30 years working on scientific and environmental regulatory projects throughout Alaska and has served as the Program Coordinator for the past five years. The Program Coordinator will work closely with PMT members to provide administrative assistance to the program and PIs with primary efforts toward compiling and quality checking program reports and budgets. Duties include assisting the Science Coordinator and the Administrative Lead with meeting and teleconference logistics, notifying PIs of due dates, tracking program accomplishments, facilitating communication between program groups, small working groups, and all program PIs. She will provide content and updates to internet and program outreach materials and assist with annual program planning and travel.

Outreach Coordinator: Hayley Hoover, *PWSSC*
300 Breakwater Ave., P.O. Box 705, Cordova, Alaska 99574
(907) 424-5800; hhoover@pwssc.org

Hayley Hoover will be the program's Outreach Coordinator. She will be responsible for ensuring the GWA-LTRM website is updated annually with new findings from each of the projects. She will interface with the EVOSTC Education and Outreach program and lead the efforts to build connections with native and local communities.

Science Coordinating Committee (SCC)

Formed at the outset of the GWA program, The SCC will continue to be the guiding science body for the GWA-LTRM program overseeing all project PIs and collaborators. The SCC will help ensure coordinated work to be performed is in line with the approved statements and goals of the projects and program. See their *curriculum vitae* located in Attachment 1.

Russell Hopcroft – Environmental Drivers Component Lead
Professor, UAF School of Fisheries and Ocean Sciences; 905 N. Koyukuk Dr., Fairbanks, Alaska 99775; (907) 474-7842; rrhopcroft@alaska.edu

Mayumi Arimitsu – Pelagic Component Lead
Research Ecologist, US Geological Survey- Alaska Science Center; 250 Egan Dr., Juneau, Alaska 99801; (907) 364-1593; marimitsu@usgs.gov

Scott Pegau – Herring Research and Monitoring Component Lead
Research Program Manager, Oil Spill Recovery Institute/PWSSC; Box 705, Cordova, AK 99574; 907-424-5800 x222; wspegau@pwssc.org

Heather Coletti – Nearshore Component Lead
Marine Ecologist, Southwest Alaska Network (SWAN), National Park Service; 4175 Geist Rd., Fairbanks, Alaska 99709; (907) 455-0675; heather_coletti@nps.gov

Daniel Esler - Lingering Oil Component Lead
Nearshore Marine Ecosystem Research Program Manager, US Geological Survey - Alaska Science Center; 4210 University Dr., Anchorage, Alaska 99508; (907) 786-7068; desler@usgs.gov

Science Review Panel (SRP)

The internal program SRP consists of seven distinguished scientists with extensive research and publication experience in fisheries, oceanography, and marine ecology as well as research program management expertise. Five members have had a long track record with the GWA and HRM programs and graciously volunteered to provide their expertise to the GWA-LTRM program. New to the program will be Stephen Okkonen, an oceanographer and Mike Sigler, a fisheries researcher.

Dr. Stephen Okkonen – *Oceanographer*
Steve received his Ph.D. in physical oceanography from UAF and B.S. in environmental sciences engineering from the University of Michigan. His research interests include interdisciplinary relationships among wind forcing, ocean circulation, and biological phenomena as well as the behavior and fate of carbon in the coastal ocean. Many years ago, Steve married into a commercial fishing family and has spent the past 40+ summers as a commercial fisherman in Cook Inlet.

Dr. Mike Sigler – *NOAA Alaska Fisheries Science Center (retired)*
Dr. Mike Sigler has more than 30 years of research experience in Alaska in Marine Ecology and Fisheries Stock Assessment. He currently teaches the class “Integrated Ecosystem Research and Management” at the Shoals Marine Lab in the Gulf of Maine and collaborates on research in Alaska (e.g., Chukchi Sea ice algae). Prior to retiring in 2017, he led the NOAA Alaska Fisheries Science Center, Habitat and Ecological Process Research Program, which included integrated ecosystem research programs in the Bering and Chukchi seas and ocean acidification research. He was Lead PI of the Bering Sea Integrated Ecosystem Research Program funded by the North Pacific Research Board, which won a U.S. Department of Commerce Gold Medal Award. Mike also has led Steller sea lion prey and predation studies, the Alaska sablefish stock assessment, and the Alaska sablefish longline survey. He has chaired stock assessment review panels for Alaska, New England, and West Coast fisheries, was an analyst for a National Research Council review of stock assessment methods, and has advised Azorean and New Zealand stock assessment scientists. His publications span several fish, seabird, and marine mammal species (e.g., Steller sea lion, Pacific sleeper shark, black-legged kittiwake) and trophic levels (e.g., seasonal phytoplankton blooms, deep sea coral). Mike has spent over 800

days at sea and has been chief scientist on over 30 research cruises in Alaska. He earned a B.S. with Honors and a M.S. from Cornell University and a Ph.D. from UW.

Dr. Richard Brenner – *Salmon Stock Assess. Biologist, ADF&G Division of Commercial Fisheries*
Dr. Brenner grew up in Southcentral Alaska where he worked on commercial fishing operations in PWS, Cook Inlet, Kodiak Island, and GOA. In 1989 he worked on EVOS, during which he collected oiled boom and delivered clean boom throughout PWS. Dr. Brenner received his bachelor and doctorate degrees in Biological Sciences from UAF and pursued postdoctoral research at the University of California Berkeley's Center for Stable Isotope Biogeochemistry. In 2007 Rich became a salmon and herring research biologist with ADF&G for PWS and the Copper/Bering River districts. In this role he has pursued investigations of fish population abundance, productivity, disease, diet, physiology, and dispersal behavior. Throughout his research, Rich has collaborated with current GWA investigators from NOAA, PWSSC, and USGS, as well as other researchers from universities, federal agencies, and non-profits. Rich continues investigations within the PWS region and in 2015 became a statewide salmon stock assessment biologist for ADF&G at the Juneau headquarters office.

Dr. Terrie Klinger – *Barer Professor of Sustainability Science**,** School of Marine and Environmental Affairs, UW*
Dr. Klinger received her Ph.D. in biological oceanography from Scripps Institution of Oceanography, her M.S. in botany from the University of British Columbia, and her B.A. in marine biology from the University of California, Berkeley. She is Professor of Marine and Environmental Affairs, Adjunct Professor of Aquatic & Fishery Sciences, and Co-Director of the Washington Ocean Acidification Center at UW. She serves on multiple science advisory panels, including the West Coast Ocean Acidification and Hypoxia Panel, the Northwest Straits Marine Conservation Initiative, and Communication Partnership for Science and the Sea. Her research focuses on use of empirical data to test the application of ecological theory to marine environmental policy and management. In particular, her interests are in the effects of multiple environmental stressors (habitat loss, biological removals and invasions, global change) on marine ecosystem function, and in the development of management strategies to reduce the impact of stressors on marine communities.

Dr. Stanley (Jeep) Rice – *Scientist Emeritus**,** NMFS Auke Bay Laboratory Program Manager*
Dr. Rice received his Ph.D. in comparative physiology and toxicology from Kent State University, and a B.S./M.S. in biological science from Chico State University. He started his career with NOAA in 1971 as a biologist and was assigned to work on the environmental impact statement for the pending Trans-Alaska Pipeline and to start a new program in oil toxicology that would be relevant to Alaska fisheries issues and form the cornerstone of lingering oil studies for the EVOSTC. He worked for over 40 years with NOAA's NMFS studying nearshore and marine ecosystems in the GOA and PWS. His many published works provide the foundation for the GWA program, focused on the impacts of EVOS on nearshore communities. Dr. Rice recently retired and continues to serve in an advisory capacity to researchers for the HRM program, GWA program, as well as students studying Alaskan nearshore ecology.

Dr. Sherri Dressel – *Statewide Herring Fisheries Scientist, Alaska Department of Fish and Game, Division of Commercial Fisheries*

Dr. Sherri Dressel received her Ph.D. in Fisheries Oceanography and M.S. in Statistics from the University of Alaska Fairbanks. She has worked for ADF&G since 2004 and has served as the Statewide herring fisheries scientist since 2012. In her current position, Dr. Dressel conducts herring stock assessments and provides statewide oversight on Pacific herring research, stock assessment, and harvest rate strategies. In addition, Dr. Dressel currently serves as co-chair of the Science and Statistical Committee of the North Pacific Fisheries Management Council and provides consultation on State and federal fisheries issues to Department and Division leadership. From 2008 to 2012, she served as the Biometrics Supervisor for the Commercial Fisheries Division in Southeast Alaska, overseeing the survey designs, sampling plans, and stock assessments for groundfish, herring, salmon, shellfish, and dive fisheries. She has served on national and international herring working groups and her research primarily focuses on Pacific herring and Alaska groundfish. She serves on the Dive Safety Board for ADF&G and is a member of the ADF&G scuba dive team for underwater research and monitoring.

Dr. Steve Martell – *Quantitative Fisheries Science at Sea State Inc.*

Dr Martell received his PhD from the University of British Columbia. His Academic career spans from 2002 to 2012 where he published in the fields of fisheries science, stock assessment, fisheries economics, and applied ecology. Dr Martell also conducted research on harvest policy for the International Pacific Halibut Commission before moving on to working as an independent scientist at Sea State Incorporated. He has served on the North Pacific Fisheries Management Council's Scientific and Statistical Committee from 2012 to 2016, and the Western Pacific Fisheries Management Councils' Scientific and Statistic Committee. In 2012, he was appointed to the Canadian Research Chair in Quantitative Fisheries Science, Natural Sciences and Engineering Research Council of Canada. His research interests focus on using real-time data to improve fisheries efficiency, improving stock-assessment information through industry collaboration and research, and effective harvest policies that quickly adapt to changes in ecosystem production and function.

4. PROGRAM ADMINISTRATION

Background

Prior to 2012, EVOSTC staff provided administrative support for funded projects. With the implementation of long-term monitoring programs by the Trustee Council, most administrative responsibilities were handed over to the programs where synergies and efficiencies were more easily developed. We propose to continue providing integrated program management and administration through a collaboration between NOAA and PWSSC. This approach has efficiently administered the long-term GWA and HRM programs for the past ten years, demonstrating our capabilities and expertise (Lindeberg and Hoffman 2021, Pegau 2021b).

As proposed, the GWA-LTRM program will be comprised of 22 projects involving 43 PIs from 5 federal and state agencies, 5 universities, and 8 non-profit scientific organizations. This diverse consortium of researchers requires the continued efforts and support of the PMT. Based on the past decade, a program this large and diverse cannot navigate and comply with EVOSTC policies and produce the highest quality deliverables without an experienced management team. For PIs to focus on their research rather than administration, oversight by a management team with specific skills in program management, fiscal administration, science oversight, and outreach and community involvement is essential to the program's success. The presence of a PMT has brought

the research and monitoring team together more collaboratively than would be possible through separate, individually funded projects.

The program management and administration of the GWA and HRM programs have clearly demonstrated their value and elevated the long-term programs beyond the sum of their parts. Key to the PMT's success has been our continued efforts to develop efficiencies and linkages inside and outside both programs. First and foremost, the Administrative Lead (PWSSC) takes on the fiscal responsibility for all non-Trustee agencies and organizations in the program through a single grant. Without this administrative role, multiple grants for individual projects would be required of a sponsoring agency, an inefficient and burdensome approach. The PMT has also successfully developed functional and operational linkages to promote cost effective solutions. This includes multi-project and across program collaborations such as sharing vessel platforms (e.g., the Integrated Predator-Prey survey), synchronizing schedules for concurrent data collection (e.g., HRM aerial surveys and GWA forage fish ground truthing), and utilizing colleague's scientific expertise (e.g., lower Cook Inlet/Kachemak Bay zooplankton samples processed by PWSSC PIs). The benefits of these linkages became even more evident as the PMT mitigated impacts to program research by COVID-19 pandemic restrictions. The multi-agency and organizational profile of the program meant some PIs were willing and familiar enough with each other's sampling protocols to collect data for others who were unable to travel. Finally, one of the greatest impacts of the PMT has been expanding partnerships and collaborations for the program. The PMT has worked with individual PIs in seeking support for projects that expand the program's data collection and analysis. Highlights include, but are not limited to, the following: Environmental Driver PIs were able to leverage the GWA program to expand their surveys through a National Science Foundation award, the GWA Science Coordinator orchestrated more than 20 ecosystem indicator contributions to the Alaska Fisheries Science Center's annual ecosystem status report to the North Pacific Fisheries Management Council, and the GWA Program Lead recently arranged for GWA to be listed as a priority in the Bureau of Ocean Energy Management's Environmental Studies Program Development Plan, opening opportunities for future funding. See Attachment 2 for a complete listing of leveraged partners at the project level.

The PMT members bring continuity to all aspects of the GWA-LTRM program. The following section details the basic structure, objectives, and guidelines for the operational activities of administering the program.

GWA-LTRM Integrated Program Management Team Organization

The Invitation calls for the LTRM program to "establish a Program Management Team to explicitly provide program coordination and oversight of science synthesis of data collected". The proposed PMT integrates management resources from NOAA and PWSSC personnel consisting of a Program Lead (NOAA, in-kind), Administrative Lead (PWSSC-based), Science Lead (NOAA, in-kind), Science Coordinator (NOAA-based), Program Coordinator (PWSSC-based), and Outreach Coordinator (PWSSC-based) (Fig. 6). This team has worked together effectively in this capacity for more than five years and has received high marks from the marine scientists participating in the program. See Section 3 for biographical sketches of individual PMT personnel. Curriculum vitae are included in Attachment 1.

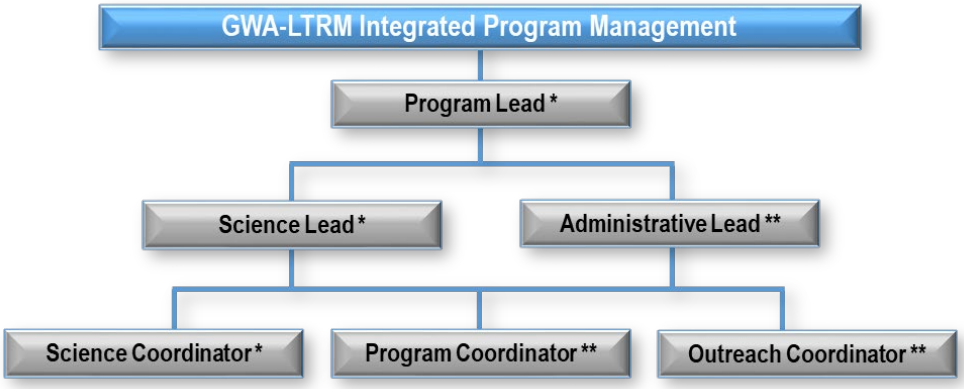

*Figure 6. Organizational chart showing integrated program management of the Gulf Watch Alaska – Long-Term Research and Monitoring (GWA-LTRM) program. * = National Oceanic and Atmospheric Administration personnel and ** = Prince William Sound Science Center personnel.*

GWA-LTRM Program Administrative Objectives

The Invitation requests an administrative structure that provides specific services for the LTRM program. Following this guidance and to meet the administrative goals of this large and diverse program, we have identified the following four overarching objectives for the PMT to ensure that all services are achieved:

1. Program Management - *Provide administrative assistance with primary efforts toward compiling reports and budgets, tracking progress and program accomplishments. Integrate data from all individual projects to inform the program's reports.*
2. Fiscal Administration - *Facilitate the most cost-effective and scientifically supportive stream of funding among the parties and projects involved in a manner that minimizes administrative costs.*
3. Science Oversight - *Develop integrated data products across the program that contribute to the broad understanding of environmental conditions that drive ecological functions.*
4. Outreach and Community Involvement - *Ensure effective and efficient uses of funds and leverage the right relationships to improve the impact and relevance of program data to Trustee Agencies and spill-affected communities.*

OBJECTIVE 1: PROGRAM MANAGEMENT

Program management will consist of facilitating communication, providing administrative assistance, implementing data and reporting policies, and evaluating program performance. These activities will be achieved with the following guidelines:

Communication Facilitation

Communicating program activities and progress are at the core of program management. PMT communication and coordination among PIs will be accomplished primarily through e-mail and quarterly audio and/or video teleconferences or webinars, and an annual in-person PI meeting. Representation by each project is expected at quarterly teleconferences and annual PI meetings. PIs will meet quarterly with the PMT and SCC to ensure

continuous communication and collaboration between program projects and monitoring components and to resolve any issues as they arise. These meetings normally last for two hours and require an additional day from the PMT and SCC for meeting organization. Annual PI meetings are planned, tentatively in October or November, for all investigators to share information. The PI meetings last three days with a mix of plenary and individual component sessions. The meetings provide an opportunity to update the group on field activities, scientific results, improve coordination among projects, discuss synthesis efforts, plan for the future, and provide outreach and public input opportunities.

Administrative Assistance

A primary role for the PMT is to aid compilation, review, and tracking of all deliverables to the EVOSTC (e.g., data, reporting, and budgets) in a timely and professional way. This includes program level deliverables by the PMT. These activities require a large portion of the PMT's time to ensure quality products for a program housing more than 40 PIs. For example, to date the PMT has efficiently managed and tracked an impressive volume of products: 217 peer reviewed publications, 182 reports, and 128 published and publicly available datasets (see Table 1 in Section 2). These will continue to be curated along with all new deliverables from the program over the next ten years.

Data and Reporting Policies

Information and data sharing protocols - all program PIs will adhere to the AOOS-Axiom data management plan (see Section 6), EVOSTC Data Policy (EVOSTC, 2021), and schedule for compliance. In general, all data will be posted on the Research Workspace after they are quality controlled following collection. Comprehensive metadata using Federal Geographic Data Committee (or International Organization for Standardization) standards will accompany each dataset. Data will be made available to the public as soon as possible or within one year following collection, whichever is sooner. The data management plan has a stepwise process for resolving data submissions that are not on schedule and the PMT can also assist in these situations. Anyone making public use of another team's data contacts the data collector and provides appropriate attribution and credit.

Standard operating procedures - Each PI will provide key sampling standard operating procedures for their project on the Research Workspace. If the PI of a project changes, the agreed upon sampling procedures will continue to be used by any new PI. The program Science Lead and SCC must agree upon any changes to standard protocols desired by a PI. Any changes must be noted at annual PI meetings and reported in annual reports to the EVOSTC.

Reporting and publishing - All GWA-LTRM PIs will be required to submit annual reports for internal program review before being submitted to the Council. EVOSTC forms must be used, and they shall be submitted on time following the beginning of the Council's fiscal year (February 1). A schedule of all reporting and internal program due dates will be sent out to all PIs. The PMT will coordinate collection and submission of all PI annual reports to the EVOSTC. The Science Lead, Science Coordinator, SRP, and SCC will work to organize a schedule for the science synthesis reports (FY24 and FY29) and potential special issue considerations. The Science Lead and Science Coordinator will help provide content for the science synthesis reports in FY24 and FY29, and related peer reviewed publications. These groups will also help with planning for final reports and the review process at the end of the program. See milestones and tasks tables in Section 9.

Publishing of research results in peer-reviewed literature is critical for the success of the program and the program's science leadership will work with PIs to promote collaborative publications. Scientists may publish in journals of their choice, or special issues including ones organized by the GWA-LTRM program.

Program Performance

Program review - Any successful program needs to evaluate its progress periodically, especially long-term programs. In previous years, the PMT has carried out annual deep dive meetings or "huddles" to review program accomplishments and issues of the previous year and evaluate management goals for the upcoming year. These meetings can last several days. The PMT asks the questions – is the program on track, are we meeting our goals and objectives, are we delivering products, etc. The PMT also sets the plan for the coming year, longer-term goals, and potential collaborations and partnerships for the program in the future. The SRP is also consulted for a program performance review and guidance for the future. This approach has been key and will continue for the GWA-LTRM program.

Non-compliance - participants in the GWA-LTRM program are encouraged to resolve disputes at the lowest internal level possible. Disputes that cannot be resolved through negotiation and compromise will be elevated for resolution either by the SCC or the PMT as appropriate. If corrective action is deemed advisable, the PMT will take the following escalating steps as they deem necessary and appropriate:

1. Inform the SCC of the need for corrective action
2. Negotiate corrective action directly with the PI(s)
3. If resolution is not practical, respective agencies and organizations involved will be consulted to determine an appropriate solution
4. If corrective action is not taken, the PMT will consider approaching EVOSTC staff for options and possible withholding of future funding until the problem is resolved.

Succession of personnel - this proposal is for 10 years and it is expected some members will depart before the end of the program. During the proposal writing process we asked that PIs develop mentorships and transition plans to the best of their abilities. Fostering project staff to take on more responsibility and encouraging postdocs to consider staying on with a project are a few ways of making a smooth transition. If needed, the PMT and SCC can help a departing PI's institution find a suitable replacement. Any changes to program leadership or investigators must be forwarded to the EVOSTC office and the NOAA contracting office for their approval.

Introduction of new projects - the GWA-LTRM program expects that in the next 10 years there could be opportunities to incorporate new projects funded by the EVOSTC. The GWA-LTRM program looks forward to the opportunities to integrate additional projects into the program. The PMT, SCC, and SRP will review new projects and evaluate how to best incorporate them into the structure of the program. They will also look for ways to integrate the new scientific information into the program and develop possible collaborations with other GWA-LTRM PIs.

OBJECTIVE 2: FISCAL ADMINISTRATION

Fiscal administration facilitates the most cost-effective and scientifically supportive stream of funding by providing a single contracting point of contact for all non-Trustee Agency organization projects, and supporting the science support aspects of the program, such as hosting meetings and facilitating the SRP.

The PWSSC can meet the Trustee Council's request to minimize administrative costs by waiving PWSSC's 35% overhead rate and accepting a fixed amount of funding (approximately 15% of the cost of non-Trustee Agency projects) to provide fiscal administration of the non-Trustee Agency projects within the program. The fixed funding covers administrative personnel salary and benefits and contractual costs such as the annual fiscal audit, insurance, and building maintenance costs that are normally covered through the 35% indirect rate. Fiscal management and reporting of non-Trustee Agency funded projects will be carried out by the PWSSC. Primary responsibilities will be to 1) award and manage all contracts and subawards for non-Trustee Agency organizations involved in this program, 2) submit timely financial reports such as SF-424A to NOAA, 3) submit timely narrative reports to both EVOSTC and NOAA, 4) complete an annual federal single audit and statement of financial position of PWSSC, and 5) monitor project spending.

PWSSC provides logistics and venues for program meetings, tele- and video-conferencing capabilities. Planning and execution of annual PI meetings can take up to a week of administrative, PMT, and SSC time. Because of the number of PIs involved in the program, we must lease meeting space and provide refreshments and lunch to maximize the time spent together. The PWSSC also provides oversight and travel support for the program's SRP to attend these meetings. PWSSC will coordinate all meeting logistics, including location, food, and webinar and teleconference capabilities. We also take the opportunity to meet during the Alaska Marine Science Symposium, as a chance to meet in person to advance program goals. These meetings are critical to success of the program as a whole. See milestones and task tables in Section 9.

Objective 3: Science Oversight

Science oversight ensures that the monitoring and research being conducted across the program is integrated, stays on track, and contributes to the understanding of the conditions that drive ecological function. At the helm of GWA-LTRM science oversight is the Science Lead. The Science Lead will lead the Science Synthesis and Modeling Component and work with the SCC, SRP, and project PIs, as well as other agencies and research organizations, to ensure the highest quality products are produced. The Science Lead will directly supervise the Science Coordinator and oversee the synthesis efforts that improve our understanding of injured resources and conditions driving their ecosystem. Section 5.A describes science management of the SRP and SCC. Section 5.D. describes the goals and objectives for the Synthesis and Modeling Component.

Objective 4: Outreach and Community Involvement

The ultimate goal for the program is to provide research and monitoring findings to the Trustee Council, agencies, resource managers, and the public. The PMT will facilitate effective and efficient outreach and community involvement activities within the GWA-LTRM program and will coordinate with the Education and Outreach EVOSTC focus area. Outreach and community involvement will be led by the PMT and facilitated by the program Outreach Coordinator. The majority of outreach at the program level will be focused on ensuring information about program activities and products are kept up to date on our website. The Outreach Coordinator duties will include active engagement with the EVOSTC's Education and Outreach program, program-directed engagement, and project-level engagement. The Outreach Coordinator also will serve as the primary liaison between the GWA-LTRM program and local and Alaska Native communities to develop impactful relationships. See Section 7 for more information about outreach and community involvement activities.

5. PROGRAM SCIENCE MANAGEMENT: DESIGN AND IMPLEMENTATION

A. Selection and implementation of an internal science panel

The GWA and HRM programs have maintained SRPs since the inception of the programs in 2012 and is a requirement listed in the Trustee Council's Invitation. The SRP ensures proper scientific design and objective evaluations, recommends possible revisions, and anticipates future needs or adaptations for the program. SRP members attend quarterly and annual PI meetings and provide critical insight into the ongoing work of the program. During meetings they engage actively with PIs and the PMT and their input is incorporated into program and project work. All members are willing volunteers but receive program support for travel and meeting expenses

SRP members are selected by the PMT and SCC based on their expertise in the diverse areas of study represented by long-term ecosystem research and monitoring in the marine environment. In preparing this proposal, the PMT reviewed SRP member contributions, queried current SRP members regarding their interest in continuing their SRP roles, and solicited qualified scientists to replace outgoing SRP members. Continuing SRP members were consulted to review proposals for this solicitation to ensure the scientific integrity and practicability of the methods proposed. We will engage the GWA-LTRM SRP regarding synthesis and modeling work and participation in Science Synthesis workshops with EVOSTC staff and EVOSTC Science Panel members. See Sections 3 for details on individual SRP personnel.

Another important part of the program's science design and implementation is the SSC. This committee is composed of the GWA-LTRM Component Leads: Science Synthesis and Modeling, Environmental Drivers, Pelagic Ecosystem, HRM, Nearshore Ecosystem, and Lingering Oil. As the guiding science body within the GWA-LTRM Program, the SCC will provide overall scientific leadership for program integration, data exchange and synthesis, and dispute resolution, and will assess the need for any program revisions. The SCC will help ensure coordinated planning of field and lab work to be performed in line with the approved statements of work and the goals of the overall program. The SCC will make sure the program is truly integrated, informs the management of injured resources, and is contributing to the restoration of the spill-impacted region and resources. They will also help plan annual PI meetings, help organize any special issue publications, represent the GWA-LTRM program at outside scientific and public meetings, proactively promote scientific partnerships with other programs as applicable, and help facilitate outreach opportunities. The SCC and the PMT will meet at least quarterly. See Section 3 for biographical sketches of individual SCC personnel. Curriculum vitae are included in Attachment 1.

B. Distribution of and addressing program science panel and EVOSTC work plan comments to the PIs

The Program Lead and Program Coordinator will work collaboratively to receive EVOSTC Science Panel comments and compile responses from the program PIs. Science Panel comments will be distributed to PIs and their respective component leads. Written responses by the PIs will be reviewed by the PMT and, if needed, SRP members with the appropriate expertise. Reviewers in the program will ensure responses are scientifically sound and directly address the Science Panel's questions and concerns.

C. Evaluation of progress

The PMT will carry out annual deep dive meetings or "huddles" over the course of several days to review program goals and accomplishments of the past year and plan for accomplishing future milestones and tasks. Part of the agenda at these meetings will be a review of program projects evaluating PI performance, EVOSTC

Science Panel feedback, and progress with their scientific goals and objectives. Projects that are underperforming will be evaluated and the PMT will enlist program resources for solutions e.g., expertise from the Science Lead, Science Coordinator, SCC, and SRP.

D. Science Synthesis and Modeling Component

GWA-LTRM is aptly timed and uniquely positioned to understand ecosystem-level changes during one of the most significant climate events in the GOA in recent decades. The first 10 years of GWA and HRM included the Pacific marine heatwave and six of the ten warmest years in the GOA over the past 120 years (Fig. 7), with climate models projecting continued warming and more frequent heatwaves globally (Oliver et al. 2018).

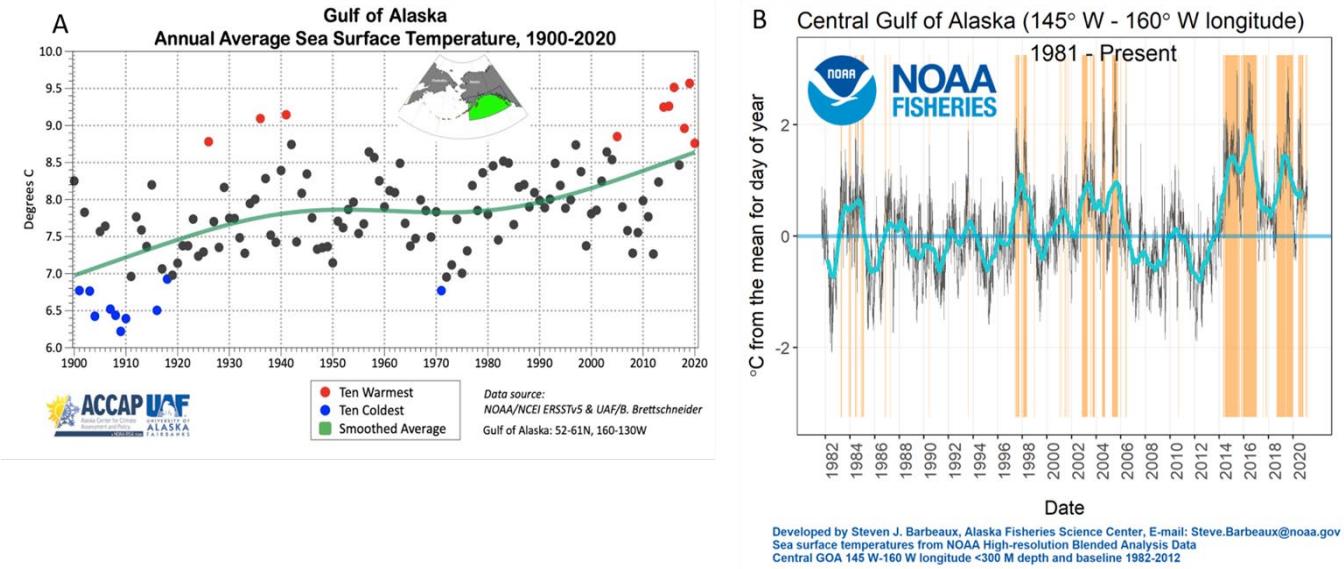

Figure 7. (A) Average annual sea surface temperature for the Gulf of Alaska over the past 120 years with the 10 warmest years marked in red and coldest in blue. (B) Daily ocean temperature anomaly (black) and running mean (cyan) with periods where marine heatwaves (Hobday et al. 2016) are quantitatively identified (yellow) in the Gulf of Alaska. Analysis and graphic by Steve Barbeaux, Alaska Fisheries Science Center.

Science synthesis efforts during GWA's and HRM's first 10 years included four science synthesis reports to the EVOSTC, plus 21 papers in a Deep-Sea Research II GWA special issue (Aderhold et al. 2018) in year five, and four highly integrated, cross-component synthesis publications in year ten (Arimitsu et al. 2021, Suryan et al. 2021a, Weitzman et al. 2021, Danielson et al. in review). The 10-year synthesis publications described the scale of thermal variability and phenology of the heatwave in the GOA and the effects on nearshore and offshore ecosystems from intertidal algae and zooplankton to forage fish, whales, and commercial fisheries. These included "winners" and "losers'' throughout the ecosystem (Fig. 8; Suryan et al. 2021a) and portfolio effects in the forage fish community that disrupted energy transfer from lower to upper trophic levels. Collectively this led to reproductive failures, unusual mortality events (Savage 2017, Piatt et al. 2020), fishery closures (Barbeaux et al. 2020), and novel biological community structures in the GOA that were distinct from the years prior to the heatwave (Fig. 9; Suryan et al. 2021a).

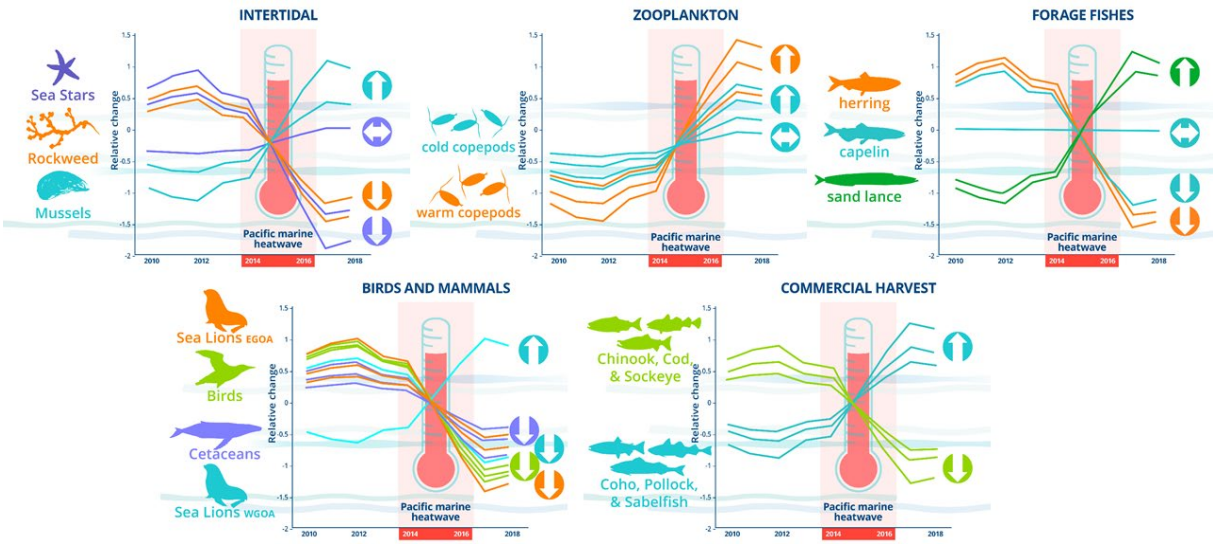

Figure 8. Stylized graphics of trends from dynamic factor analysis in key biological time series during the first 10 years of Gulf Watch Alaska for the main taxonomic groups (Suryan et al. 2021a). Graphics by Rebecca White, National Oceanic and Atmospheric Administration National Marine Fisheries Service.

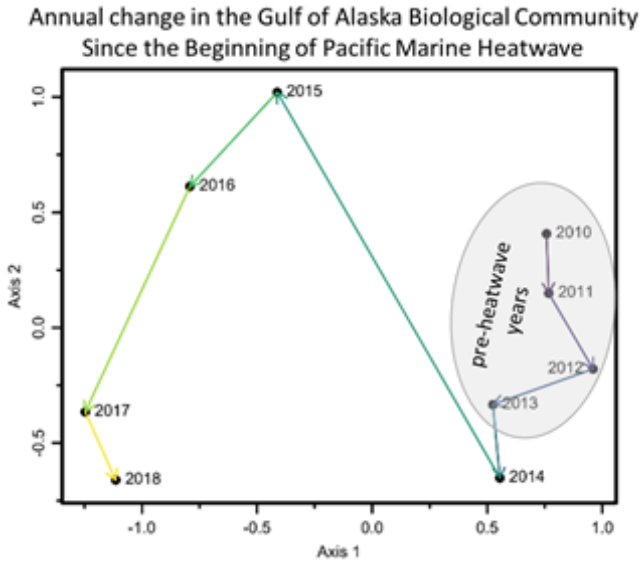

Figure 9. Non-metric multidimensional scaling (nMDS) showing how an annual composite score of the biological community structure in the Gulf of Alaska changed since the initiation of the Pacific marine heatwave in 2014. Data include 187 biological time series of abundance and performance metrics from phytoplankton to whales and commercial fishery harvests in the Gulf of Alaska (Suryan et al. 2021a).

The heatwave also affected species still recovering from the EVOS. For example, viral infection rate increased and the abundance of PWS herring declined to the lowest level since the oil spill, the recovering AB pod of killer whales appears to have lost multiple individuals setting the population back to levels immediately after the

EVOS, and the pigeon guillemot population declined in most areas of PWS. GWA-LTRM is uniquely positioned to assess whether injured resources will rebound and if the GOA ecosystem will return to pre-heatwave conditions.

During the next 10 years, we aim to build and expand upon the synthesis efforts of the first 10 years. A key addition for the second 10-year period of GWA-LTRM is to fund five postdocs who are dedicated to synthesizing the extensive data streams generated from the GWA-LTRM program and to further integrate with large-scale ecosystem modeling efforts of GWA-LTRM collaborators in the GOA. The synthesis and modeling efforts will address key objectives and hypotheses of drivers of ecosystem change, recovery of injured resources, and potential effects on commercial, recreational, and subsistence resources.

Synthesis and modeling will be directed by the GWA-LTRM PMT, guided by the Science Lead (R. Suryan) and Science Coordinator and will include integration across all levels of the program, from individual projects to components and providing products to stakeholders (Fig. 10). Each of the four GWA-LTRM data collection components (Environmental Drivers, Pelagic, HRM, and Nearshore) and the Synthesis and Modeling Component will have a 3-year postdoc mentored by a PI from the respective components. The Science Lead and each component evaluated their needs for the synthesis postdoc with the understanding that two syntheses are required in the ten-year life of the program. Based on their evaluation the Environmental Drivers, HRM, and Nearshore Ecosystem components will host their postdocs during the first 5-year period. Each of these components identified syntheses needs that can guide future work and collaborations or feed into the expected efforts of the cross-component synthesis. The Pelagic and Synthesis and Modeling components will host their postdocs during the second 5-year period (Table 3). Some of the Pelagic Component data are shorter in duration while focusing on longer-lived, upper trophic-level species (e.g., seabirds, whales) and will benefit from additional years of data collection. Furthermore, staggering postdoc involvement throughout allows synthesis efforts to build sequentially and ensures sufficient personnel resources for science synthesis throughout the 10 years. The Science Lead and Science Coordinator will provide continuity throughout the postdoc transition periods. General expectations of postdocs will be to give public and scientific presentations, contribute to the two required science synthesis reports, and produce peer reviewed publications by the end of each 3-year period.

Table 3. FY22-31 postdoctoral fellow plan for the Synthesis and Modeling Component. Gray highlighted years represent the years science synthesis reports are due.

Component	Agency /Org	PI	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Env. Drive.	UAF	Hopcroft	X	X	X							
Nearshore	USGS	Esler	X	X	X							
HRM	PWSSC	Cypher					X	X	X			
Pelagic	NOAA	Suryan								X	X	X
Cross-comp.	NOAA	Suryan						X	X	X		

We propose that the two EVOSTC science synthesis reports in the next 10-year period will follow the format established in our FY19 report, consisting of manuscripts focused on a particular theme that unifies cross-component collaboration. Also, similar to the previous synthesis reports, GWA-LTRM PIs and the SCC will identify which unifying themes, objectives, and hypotheses are most relevant to address during PI meetings prior to the science synthesis report years. Particular themes might include, but are not limited to (1) timing and

mechanisms of recovery from the Pacific marine heatwave, (2) spatial heterogeneity among nearshore and offshore ecosystems in response to environmental variability, and (3) the roles of top-down, bottom-up, and inter-specific competition in recovery of injured resources.

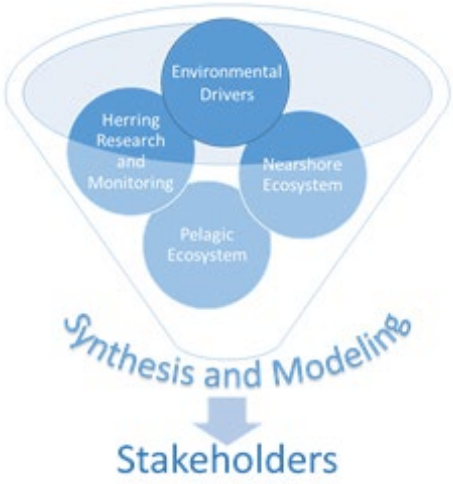

Figure 10. The Gulf Watch Alaska synthesis and modeling component provides integrated data products to stakeholders.

GWA-LTRM has and will continue to gain a wealth of statistical modeling expertise. During the previous 10 years, GWA investigators used a broad array of univariate and multivariate models to assess factors affecting PWS herring population with Bayesian age-structured stock assessment (BASA) and Random Forest models (Muradian et al. 2017, Trochta et al. 2020), to identify common trends among time series from phytoplankton to whales with dynamic factor analysis (DFA; Suryan et al. 2021a), to detect community variability with non-metric multidimensional scaling (nMDS; Weitzman et al. 2021), and to determine the spatial and temporal coherence of water temperatures throughout the GOA with empirical orthogonal functions (EOF; Danielson et al. in review) to name a few. These along with other statistical models will continue to be important tools as we further explore environmental drivers of biological variability at local and regional scales.

Furthermore, GWA-LTRM is partnering with other larger-scale, ecosystem modeling efforts in the GOA led by the National Science Foundation's Northern Gulf of Alaska Long-term Ecological Research site (NGA LTER), the Alaska Fisheries Science Center, and their many collaborators (Fig. 11). Ecosystem models employed include Ecopath with Ecosim mass-balance models (Dias et al. 2019), climate-enhanced multispecies stock assessment model (CEATTLE; Holsman et al. 2020), Alaska climate integrated modeling framework (ACLIM; Hollowed et al. 2020), North Pacific Ecosystem Model for Understanding Regional Oceanography (NEMURO; Fiechter et al. 2015), and Atlantis end-to-end ecosystem model (Link et al. 2010), among others. Our Synthesis and Modeling Component will facilitate inclusion of GWA-LTRM data into these larger-scale efforts focused on assessing climate impacts to fisheries and coastal communities, in part by using place-based integrated ecosystem assessment approaches (Rosellon-Druker et al. 2019, Rosellon-Druker et al. 2020). We will also adapt relevant models to address GWA-LTRM and EVOSTC objectives that include a more regional focus such as PWS and objectives specific to injured resources. Leveraging these existing analytical resources provides unparalleled opportunities to not only better understand mechanisms of ecosystem change from past events, such as a

marine heatwave, but also forecast future changes under various scenarios. In this respect, the next 10 years of GWA-LTRM will also provide valuable data to validate model outcomes and improve skill in forecasting.

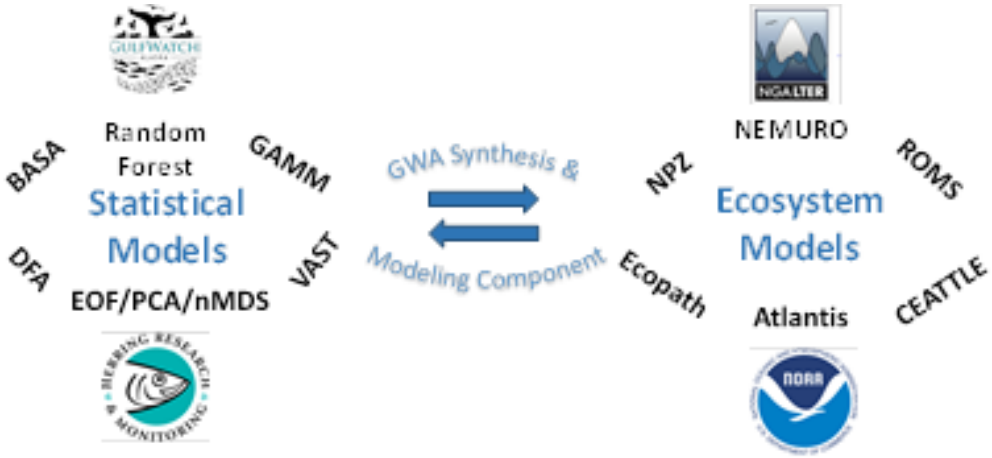

Figure 11. Gulf Watch Alaska and Herring Research and Monitoring (GWA-LTRM) investigators have used a wide variety of statistical models for synthesizing data across projects and components. The Northern Gulf of Alaska Long-term Ecological Research site and National Oceanic and Atmospheric Administration's Alaska Fisheries Science Center are leading development of a variety of ecosystem and food web end-to-end models with the goal of modeling and forecasting climate change effects on commercially important groundfish stocks, coastal industries, and ecosystem resilience. The GWA-LTRM Synthesis and Modeling Component will provide the bridge between these programs.

6. PROGRAM DATA MANAGEMENT

The EVOSTC requires a data management approach composed of methods covering the entire data lifecycle, from immediately after data collection, to long-term preservation, to discovery and reuse. The Data Management program proposal titled, Data Management for Long-term Research and Monitoring Program (22120113), responds directly to this and the Council's continued need for a cost-effective data management program that maintains continuity and builds upon the efforts of the prior EVOSTC data management investments.

The Data Management program represents a partnership between 1) AOOS, which will serve as the project manager and contribute its extensive data resources and infrastructure, and 2) Axiom Data Science, which will serve as the technical data management lead for the project. These partners have provided data management services for both GWA and HRM EVOSTC-funded programs since 2012. The AOOS-Axiom team will leverage the extensive cyberinfrastructure and data management capacities of both Axiom and AOOS for the needs of the GWA-LTRM program over the next ten years.

The ultimate goal of the Data Management program is data preservation and accessibility of that data to the scientific and resource management communities. This goal will be achieved through the following 7 objectives:

Objective 1. Initiate data management services and oversight the GWA-LTRM projects.

Objective 2. Standardize and provide access to data sets from the prior ten-year GWA and HRM Programs.

Objective 3. Facilitate, monitor, and evaluate regular data submissions and metadata generation in the Research Workspace.

Objective 4. Provide, maintain, and modify technical infrastructure for user groups to access information produced or processed by GWA-LTRM projects.

Objective 5. Publish and promote data collected by GWA-LTRM projects, making them available for research, management, and general audiences.

Objective 6. Execute management, user feedback and internal and external communications related to GWA-LTRM project data and data products.

Objective 7. Ensure long-term preservation and dissemination into publicly accessible repositories at the term completion.

In collaboration with the PMT, the Data Management program will require all PIs to adhere to the data management policies and procedures (see Attachment 1 of the Data Management proposal) including established timelines.

The Data Management program will provide critical data management tools and services to the GWA-LTRM PIs. Among these are the Research Workspace, a web-based data management platform, which will be maintained to upload, organize, and document data and author standards-compliant metadata, as well as to facilitate program administration. As in previous years, project data will be shared publicly (or 'published') through the AOOS GOA Data Portal (AOOS, 2021), where they are available to a network of resource managers, scientists, and the general public. In addition, project data will be archived into DataONE (DataONE, 2021) for long-term preservation and broad access across multiple data repositories, where each data set will be assigned a DOI and made discoverable through other federated DataONE nodes.

This data curation process has been designed to meet the requirements of the EVOSTC as specified in the Data Management sections in the EVOSTC Invitation for Proposals 2022-2031.

7. PROGRAM OUTREACH

As requested in the Invitation for Proposals, the focus of the outreach effort within the GWA-LTRM program is to ensure up-to-date information is provided through our website (https://gulfwatchalaska.org/). The website includes overviews of the various components and descriptions of the individual projects and their findings. The website is also an easy place to find synthesized research, general information, and publications and other information products developed by the program. The findings of the projects are updated each winter as the field data and new findings become available.

During the first year, we will need to incorporate the existing HRM program pages into the GWA website. The information within the existing HRM project pages matches that found in the GWA project pages, which will simplify the merging of the two websites. The HRM section will be structured in the same manner as the other GWA components.

We will continue to develop contributions for the NOAA Gulf of Alaska Ecosystem Status Report. These contributions provide a short synthesis of the project findings that can also be used to serve the outreach and education efforts of other agencies.

The program's Outreach Coordinator will serve as the primary liaison between the GWA-LTRM program, the larger Education and Outreach program, and local and Alaska Native communities. We want to ensure our outreach efforts complement rather than compete with activities proposed by the Education and Outreach program. The Outreach Coordinator's knowledge of the individual projects will enable them to provide materials to the Education and Outreach program, or direct that program to the appropriate researchers with the GWA-LTRM program. The outreach specialists will also serve as a liaison with local and Alaska Native communities.

The GWA-LTRM program is committed to involvement with local and Alaska Native communities. Our vision for this involvement includes active engagement with the Education and Outreach Focus Area, program-directed engagement through the outreach and community involvement activity led by the PMT, and project-level engagement. During the first year of the funding cycle, the GWA-LTRM program will reach out to the Education and Outreach program selected by the EVOSTC to determine their needs along with reaching out to local communities and Alaska Native organizations in the spill affected area to ask what engagement they would like from us and develop an approach that invites involvement of PIs from each project, including this one. Our intent as a program is to provide effective and meaningful community involvement that complements the work of the Education and Outreach Focus Area and allows communities to engage directly with scientists based on local interests.

We will continue to rotate the location of annual PI meetings to allow community involvement with the researchers. The public will be invited to participate in PI meetings. We expect this to be one mechanism to establish a two-way exchange of information between folks with local or traditional ecological knowledge and members of the GWA team. Similarly, PMT members and select PIs may engage, when appropriate, the leaders of local organizations in the spill-affected area who may have a direct interest in the data or products generated by GWA-LTRM (such as fishing groups or aquaculture associations).

We also recognize the many outreach products are created by agency in-kind contributions. This is through the creation of web articles, storymaps, and resource briefs, to name a few. We expect this support to continue and provide yet additional avenues for outreach and education e.g. NOAA's Alaska Fisheries Science Center newly hired Tribal Research Coordinator.

8. COORDINATION AND COLLABORATION

A. With the Alaska SeaLife Center or Prince William Sound Science Center

PWSSC has been and will continue to be a fully integrated partner in the GWA-LTRM program. The PWSSC provides administrative and fiscal leadership, SRP support, and outreach and community involvement coordination for the program as well as conducting research and monitoring projects (e.g., HRM component, fall/winter seabird surveys, and PWS oceanography).

The GWA-LTRM program intends to coordinate and collaborate with the Alaska SeaLife Center (ASLC) as opportunities arise. The PWSSC already has an established collaborative relationship with the ASLC. PWSSC

receives funding from AOOS through ASLC and sends funding through ASLC to Axiom and AOOS for their work on this project. PWSSC is also working with ASLC to submit an Education and Outreach focal area proposal.

B. Within the EVOSTC LTRM Program

The projects that comprise the GWA-LTRM program are fully integrated. The best evidence of coordination and collaboration is the 2020 science synthesis report (Suryan et al. 2020b) that included four chapters encompassing collaboration and data analysis across projects and components, including HRM, to evaluate the effects of the recent Pacific marine heatwave on the GOA ecosystem. This resulted in three peer-reviewed published papers and one currently in review. The new synthesis and modeling component will further stimulate coordination and collaboration within the program.

We welcome the inclusion of the HRM program into the GWA-LTRM program. This transition will be seamless because of the close collaboration we have had with these programs during the first 10 years of the program. Please see individual GWA-LTRM project proposals for more details on coordination and collaboration within the program.

C. With Other EVOSTC-funded Projects (not within the LTRM Focus Area)

During the first 10 years of the GWA program we have successfully coordinated data sharing and support for individual projects funded by the EVOSTC. For example, GWA-LTRM PIs Kuletz and Kaler (21120114-M) are assisting on two of these projects 1) Status and trends of EVOS injured seabirds in the Kenai Peninsula coast and Kachemak Bay (PI Hollmen, 21210128) and 2) Pigeon Guillemot Restoration Research in Prince William Sound (PI Irons, 21110853). The Gulf Watch Ocean Acidification Sampling project (PI Hetrick, 21200127) is collaborating with GWA-LTRM PI Campbell (21120114-G) to acquire samples in PWS. These projects naturally fall into the category of long-term monitoring and could have a future with the GWA-LTRM program. For the FY22-31 funding period the GWA-LTRM program will continue coordination and collaboration with other EVOSTC-funded projects as appropriate.

D. With Proposed EVOSTC Mariculture Focus Area Projects

The projects within the proposed GWA-LTRM program collect a wide range of data that may be of interest to and be used by Mariculture Focus Area projects. Of particular interest to the Mariculture Focus Area may be oceanographic and nearshore measurement data. GWA and HRM data are made publicly available annually and we encourage use of the data. In addition, we would consider facilitating meetings between projects in both foci to share and discuss findings and areas of collaboration.

GWA Nearshore co-PI Konar is a member of a team that will be submitting an EVOSTC Mariculture focus area proposal. She is leading the Benthic Impacts component of the proposal, coordinating sampling in Kachemak Bay, Kodiak, and PWS. She is also interacting with other mariculture proposal components to ensure that they are aware of the data streams and activities of the GWA nearshore monitoring component. She is, therefore, well positioned to ensure future communication between the two projects. Because most mariculture efforts occur in nearshore waters, the conceptual link and information exchange between the two projects is natural.

E. With Proposed EVOSTC Education and Outreach Focus Area Projects

The GWA-LTRM welcomes the addition of the Education and Outreach Focus Area. We anticipate improvements in our ability to communicate GWA-LTRM findings and engage with Alaska Native communities through

coordination with specialists in the areas of education and outreach while we focus on our specialty, scientific data collection.

During the proposal development phase, we invited Laurie Stuart of ASLC to a PI meeting to gain understanding of the Education and Outreach proposal they are developing and explore how our programs could effectively interface during the next 10 years. We intend for our community outreach activities to be complementary to, and not duplicative of, efforts undertaken by the Education and Outreach program. Additionally, PIs from our program will engage as needed by the Education and Outreach program, providing expertise and participating in trainings as appropriate. Working together, the programs will improve overall engagement outcomes while ensuring that local communities and Alaska Native communities are not overwhelmed by requests for outreach with scientists.

F. With Trustee or Management Agencies

The proposed GWA-LTRM program team and individual project collaborators include members from multiple Trustee Agencies: NOAA, USFWS, USGS, NPS, and ADF&G. GWA-LTRM projects annually contribute to NOAA's Gulf of Alaska Ecosystem Status Report that is used as part of the stock assessment and fishery management process for the agency. Our data are publicly available, and we present at scientific conferences to share findings with scientists and managers. Since the formation of the GWA and HRM programs in 2012, the PMT and individual projects have focused on developing partnerships with agencies and organizations working in the GOA and other related marine environments. As an example, Attachment 2 lists successful partnerships of GWA and HRM projects in FY20. We will continue to seek opportunities to coordinate and collaborate with other agencies and organizations providing useful information to scientists, resource managers, and local communities. Please see individual project proposals for more detail.

G. With Native and Local Communities

The GWA program is committed to involvement with local and Alaska Native communities. Our vision for this involvement will include active engagement with the Education and Outreach Focus Area, program directed engagement through the outreach and community involvement activity led by the PMT and Outreach Coordinator, and project-level engagement. During the first year of the funding cycle (FY22), the GWA-LTRM program will reach out to local communities and Alaska Native Tribes and organizations in the spill affected area to ask what engagement they would like from us and develop an approach that involves PIs from each project. Our intent as a program is to provide effective and meaningful community involvement that complements the work of the Education and Outreach Focus Area and allows communities to engage directly with scientists based on local interests, needs, and capacity.

9. PROGRAM SCHEDULE

Project milestones and tasks by fiscal year and quarter, beginning February 1, 2022. Fiscal Year Quarters: 1= Feb. 1-April 30; 2= May 1-July 31; 3= Aug. 1-Oct. 31; 4= Nov. 1-Jan 31.

Milestone/Task	FY22				FY23				FY24				FY25				FY26			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Mgmt Planning																				
Annual program planning	X				X				X				X				X			
Web-Outreach review		X				X				X				X				X		
Data compliance			X				X				X				X				X	
Milestone: Fiscal Administration																				
Issue subaward contracts	X				X				X				X				X			
Annual audit				X				X				X				X				X
Milestone: Component field work																				
Environmental Drivers	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pelagic Ecosystem	X	x	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Herring Research & Monitoring	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X	
Nearshore Ecosystem	X	X			X	X			X	X			X	X			X	X		
Lingering Oil										X										
Milestone: Synthesis & Modeling																				
Ecosystem Report & Profile contributions			X				X				X				X				X	
GOA modeling data assimilation & validation								X	X								X	X		
Manuscripts - Science Coordinator										X									X	
Manuscripts – Postdoc, Env. Drivers												X								
Manuscripts – Postdoc, Nearshore												X								
Milestone: Project Data Mgmt																				
Data/metadata to Workspace				X				X				X				X				X
Prior year data available to public					X				X				X				X			
Program published datasets																				X
Milestone: Meetings																				
Quarterly PI teleconferences	X	X	X		X	X		X	X	X		X	X	X		X	X	X		X
Annual PI meetings				X			X				X				X				X	
Trustee Council/PAC (PMT)			X				X				X				X				X	
AMSS				X				X				X				X				X
Milestone: Outreach																				
Maintain public website				X				X				X				X				X
Program newsletter	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Delta Sound Connections		X				X				X				X				X		
Milestone: Community Involvement																				
Develop plan with communities		X			X															
Implement plan					X				X				X				X			
Coordinate with E&O Program	X				X				X				X				X			
Deliverables – Reporting																				

Milestone/Task	FY22				FY23				FY24				FY25				FY26			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
NOAA Grant semi-annual reports		X		X		X		X		X		X		X		X		X		
Annual reports					X				X				X				X			
Synthesis draft report to EVOSTC												X								
Final synthesis report to EVOSTC														X						

Milestone/Task	FY27				FY28				FY29				FY30				FY31			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Mgmt Planning																				
Annual program planning	X				X				X				X				X			
Web-Outreach review		X				X				X				X				X		
Data compliance			X				X				X				X				X	
Milestone: Fiscal Administration																				
Issue subaward contracts	X				X				X				X				X			
Annual audit				X				X				X				X				X
Milestone: Component field work																				
Environmental Drivers	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Pelagic Ecosystem	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Herring Research & Monitoring	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X	
Nearshore Ecosystem	X	X			X	X			X	X			X	X			X	X		
Lingering Oil										X										
Milestone: Synthesis & Modeling																				
Ecosystem Report & Profile contributions			X				X				X				X				X	
GOA modeling data assimilation & validation								X	X								X	X		
Manuscripts – Science Coordinator										X									X	
Manuscripts – Postdoc, HRM								X												
Manuscripts – Postdoc, Syn. & Modl.												X								
Manuscripts – Postdoc, Pelagic																				X
Milestone: Project Data Mgmt																				
Data/metadata to Workspace				X				X				X								X
Prior year data available to public	X				X				X				X				X			
Program published datasets																				X
Milestone: Meetings																				
Quarterly PI teleconferences	X	X	X		X	X		X	X	X		X	X	X		X	X	X		X
PI meetings				X			X				X				X				X	
Trustee Council/PAC (PMT)			X				X				X				X				X	
AMSS				X				X				X				X				X
Milestone: Outreach																				

Milestone/Task	FY27				FY28				FY29				FY30				FY31			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Maintain public websites				X				X				X				X				X
Program newsletter	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Delta Sound Connections		X				X				X				X				X		
Milestone: Community Involvement																				
Review/update plan with communities	X																			
Continue to implement plan	X				X				X				X				X			
Coordinate with E&O Program	X				X				X				X				X			
Deliverables - Reporting																				
NOAA semi-annual reports			X		X		X		X		X		X		X		X		X	
Annual reports	X				X				X				X							
Synthesis draft report to EVOSTC												X								
Final synthesis report to EVOSTC														X						
Final program report																				X

10. BUDGET

A. Program Level Budget Forms (Attach)

Below is a summary of the overall program budget by category. The accompanying workbook provides spreadsheets with individual project details and summaries by project and category. Please see Section 10.C. below for budget information for NOAA and PWSSC integrated program management budgets.

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5-YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$2,221,185	$2,527,416	$2,559,898	$2,675,325	$2,790,522	$12,774,347	$0
Travel	$174,687	$197,143	$188,272	$197,688	$191,082	$948,872	$0
Contractual	$1,068,428	$1,215,936	$1,127,458	$1,309,226	$1,210,757	$5,931,805	$0
Commodities	$288,036	$297,047	$231,167	$232,828	$197,970	$1,247,047	$0
Equipment	$195,051	$294,543	$213,357	$152,904	$153,391	$1,009,246	$0
Indirect Costs (rate will vary by project)	$222,118	$250,567	$305,710	$316,562	$317,903	$1,412,860	$0
SUBTOTAL	$4,169,505	$4,782,652	$4,625,862	$4,884,532	$4,861,624	$23,324,176	$0
General Administration (9% of subtotal)	$375,255	$430,439	$416,328	$439,608	$437,546	$2,099,176	N/A
PROGRAM TOTAL	**$4,544,761**	**$5,213,091**	**$5,042,190**	**$5,324,140**	**$5,299,171**	**$25,423,352**	
Other Resources (In-Kind Funds)	**$2,115,584**	**$2,136,812**	**$2,107,044**	**$2,138,910**	**$2,122,149**	**$10,620,499**	

Budget Category:	Proposed FY 27	Proposed FY 28	Proposed FY 29	Proposed FY 30	Proposed FY 31	5-YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$3,024,117	$2,828,935	$2,928,865	$2,519,678	$2,535,512	$13,837,107	$0
Travel	$202,804	$175,240	$183,161	$169,749	$163,513	$894,468	$0
Contractual	$1,337,244	$1,142,024	$1,229,144	$1,110,262	$1,159,205	$5,977,879	$0
Commodities	$307,543	$222,618	$199,552	$205,115	$174,460	$1,109,289	$0
Equipment	$210,885	$142,028	$116,034	$118,001	$122,242	$709,190	$0
Indirect Costs (rate will vary by project)	$351,005	$320,694	$292,633	$209,551	$215,896	$1,389,780	$0
SUBTOTAL	$5,433,599	$4,831,539	$4,949,389	$4,332,356	$4,370,829	$23,917,712	$0
General Administration (9% of subtotal)	$489,024	$434,838	$445,445	$389,912	$393,375	$2,152,594	N/A
PROGRAM TOTAL	**$5,922,623**	**$5,266,377**	**$5,394,835**	**$4,722,268**	**$4,764,203**	**$26,070,306**	
Other Resources (In-Kind Funds)	**$2,095,906**	**$2,116,293**	**$2,162,371**	**$2,197,372**	**$2,205,886**	**$10,777,827**	

Budget Category:	TEN YEAR TOTAL
Personnel	$26,611,453
Travel	$1,843,339
Contractual	$11,909,684
Commodities	$2,356,336
Equipment	$1,718,436
Indirect Costs (rate will vary by project)	$2,802,639
SUBTOTAL	$47,241,888
General Administration (9% of subtotal)	$4,251,770
PROJECT TOTAL	**$51,493,658**
Other Resources (In-Kind Funds)	**$21,398,327**

B. Sources of Additional Program Level Funding

Non-EVOSTC Funds to be used, please include source and amount per source:

FY22	FY23	FY24	FY25	FY26	FY22-26 Total
$2,115,584	$2,136,812	$2,107,044	$2,138,910	$2,122,149	$10,620,499
FY27	**FY28**	**FY29**	**FY30**	**FY31**	**FY27-31 Total**
$2,095,906	$2,116,293	$2,162,371	$2,197,372	$2,205,886	$10,777,827
				FY22-31 Total	*$21,398,327*

Non-EVOSTC funds associated with the GWA-LTRM program are from multiple agencies and organizations representing a wide range of sources from in-kind labor, institutional infrastructure, research vessels, use of existing equipment, specialized gear, and matched funding received from other institutions. Please see individual projects for a more thorough listing of additional resources and funding, including documentation and letters of commitment.

Please also note, the University of Alaska prohibits officially documenting leveraged resources coming from or through the university when not specifically required by the funding organization. Therefore, budgets for GWA-LTRM projects through the University of Alaska will not report or track any in-kind/match/cost share on GWA-LTRM projects. However, we would like to acknowledge that a significant amount of cost sharing has been leveraged by UAF investigators that greatly benefits the GWA-LTRM program (e.g., ~$1.5M/yr for oceanography).

C. Integrated Program Management Budget Forms

Below we provide information regarding the integrated program management budgets for NOAA and PWSSC found in the EVOSTC program budget form (Excel workbook).

NOAA

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$126,331	$130,369	$133,606	$136,925	$140,326	$667,557	
Travel	$18,650	$18,930	$19,435	$19,940	$20,445	$97,400	
Contractual	$0	$0	$0	$0	$0	$0	
Commodities	$18,000	$13,500	$13,500	$13,500	$13,500	$72,000	
Equipment	$0	$0	$0	$0	$0	$0	
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	
SUBTOTAL	$162,981	$162,799	$166,541	$170,365	$174,271	$836,957	
General Administration (9% of subtotal)	$14,668	$14,652	$14,989	$15,333	$15,684	$75,326	N/A
PROJECT TOTAL	$177,649	$177,451	$181,530	$185,698	$189,955	$912,283	
Other Resources (In-Kind Funds)	$104,212	$106,817	$109,488	$112,225	$115,031	$547,773	

Budget Category:	Proposed FY 27	Proposed FY 28	Proposed FY 29	Proposed FY 30	Proposed FY 31	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE	TEN YEAR TOTAL
Personnel	$263,812	$267,385	$391,048	$274,802	$277,770	$1,474,817		$2,142,374
Travel	$21,850	$21,230	$21,735	$22,240	$22,745	$109,800		$207,200
Contractual	$0	$0	$0	$0	$0	$0		$0
Commodities	$18,500	$13,500	$17,000	$13,500	$13,500	$76,000		$148,000
Equipment	$0	$0	$0	$0	$0	$0		$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0		$0
SUBTOTAL	$304,162	$302,115	$429,783	$310,542	$314,015	$1,660,617		$2,497,574
General Administration (9% of subtotal)	$27,375	$27,190	$38,680	$27,949	$28,261	$149,456	N/A	$224,782
PROJECT TOTAL	$331,536	$329,306	$468,463	$338,491	$342,276	$1,810,073		**$2,722,356**
Other Resources (In-Kind Funds)	$117,906	$120,854	$123,875	$126,972	$130,147	$619,754		**$1,167,527**

NOAA - Personnel costs for the NOAA budget includes full-time salary for the Science Coordinator in all years, three years of funding for the Synthesis and Modeling Component postdoc in FY27-29 and three years of funding for the Pelagic Component postdoc in FY29-31 (see also Section 10.D Table 5). The addition of two postdoc positions during the FY27-31 funding period cause personnel costs for NOAA to significantly increase. The GWA-LTRM Science Lead will supervise these two postdocs and coordinate with the Pelagic Component Lead and PIs depending upon data synthesis priorities at that time. Travel funds will be used by the Program Lead, Science Lead, Science Coordinator, and postdocs for travel to GWA-LTRM PI meetings, Alaska Marine

Science Symposium, and related conferences. Commodities include annual software fees, required computers for the Science Coordinator and postdocs, and supplies to support the program.

Non-EVOSTC funds are agency in-kind, representing salary contributions of permanent employees. Over the 10-year period, NOAA will make the following in-kind contributions for GWA-LTRM Program and Science Leads: Lindeberg (FTE = 0.5/yr; $831.2K over 10 yrs) and Suryan (FTE = 0.1/yr; $170.3K over 10 yrs). See the NOAA letter of commitment in Attachment 3. NOAA funds included as in-kind or as contributions are for planning purposes only and nothing contained in this proposal shall be construed as binding NOAA to expend in any one fiscal year any sum in excess of its appropriations or funding in excess or what it has received for the collaborative work outlined in this proposal or involving the Federal government in any obligation to pay money before funds have been appropriated for that purpose unless otherwise allowed by law.

PWSSC

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$343,050	$353,330	$363,940	$374,865	$382,475	$1,817,660	
Travel	$12,400	$12,400	$12,690	$13,390	$13,390	$64,270	
Contractual	$121,800	$123,550	$126,190	$127,840	$129,490	$628,870	
Commodities	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	
Equipment	$0	$0	$0	$0	$0	$0	
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	
Indirect waived							
SUBTOTAL	$487,250	$499,280	$512,820	$526,095	$535,355	$2,560,800	
General Administration (9% of subtotal)	$43,853	$44,935	$46,154	$47,349	$48,182	$230,472	N/A
PROJECT TOTAL	$531,103	$544,215	$558,974	$573,444	$583,537	$2,791,272	
Other Resources (In-Kind Funds)						$0	

Budget Category:	Proposed FY 27	Proposed FY 28	Proposed FY 29	Proposed FY 30	Proposed FY 31	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE	**TEN YEAR TOTAL**
Personnel	$397,650	$409,510	$421,780	$434,400	$447,520	$2,110,860		$3,928,520
Travel	$13,550	$13,550	$13,710	$14,410	$14,410	$69,630		$133,900
Contractual	$132,540	$134,690	$137,340	$139,000	$140,660	$684,230		$1,313,100
Commodities	$11,100	$11,100	$11,100	$11,100	$11,000	$55,400		$105,400
Equipment	$20,000	$0	$0	$0	$0	$20,000		$20,000
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0		$0
Indirect waived								
SUBTOTAL	$574,840	$568,850	$583,930	$598,910	$613,590	$2,940,120		$5,500,920
General Administration (9% of subtotal)	$51,736	$51,197	$52,554	$53,902	$55,223	$264,611	N/A	$495,083
PROJECT TOTAL	$626,576	$620,047	$636,484	$652,812	$668,813	$3,204,731		**$5,996,003**
Other Resources (In-Kind Funds)						$0		**$0**

PWSSC - Personnel costs include 3.5 months a year for Katrina Hoffman as the Administrative Lead, 9 months a year for Donna Aderhold for Program Coordination, 3 months a year for Hayley Hoover as the Outreach Coordinator (does not exceed $30K/yr), and 2 months a year for Scott Pegau as the HRM Component Lead. Travel funds are requested for PWSSC and the SRP to travel to a PI meeting each year. PWSSC is waiving its 35% indirect rate on projects and is directly budgeting salary for administrative staff, contractual items for operating PWSSC, and supplies to support the program. This approach reduces administrative costs for the program.

PWSSC is a soft-money funded 501c3 non-profit corporation, which raises funds for operations through grants, contracts, and donations.

D. Key Budget Summaries

Integrated Program Management

Integrated program management includes crucial coordinated work by NOAA and PWSSC to successfully run the GWA-LTRM program over the long-term. Program administration is divided into four principle objectives: program management, fiscal administration, scientific oversight, and outreach and community involvement (see Section 4 for descriptions). Table 4 provides a summary of administrative costs by each objective and the percentages of those costs within the integrated program management budget, and for the program as a whole. The purely administrative functions of the program represent 11% of program costs. This includes resources for annual fiscal audits as part of receiving EVOSTC funds and NOAA grant responsibilities.

Table 4. Breakdown of the Integrated Program Management (IPM) budget by objective for the National Oceanic and Atmospheric Administration (NOAA) and Prince William Sound Science Center (PWSSC) over the 10-year funding period, FY22-31.

Administrative Objectives	NOAA	PWSSC	IPM Total	% Total of IPM	% Total of Program
1) Program Management	$101,328	$2,806,062	$2,907,390	36%	6%
2) Fiscal Administration	$0	$2,454,011	$2,454,011	30%	5%
					11%
3) Program Science Oversight	$2,396,247	$17,200	$2,413,447	30%	5%
4) Outreach/Community Involvement	$0	$223,647	$223,647	3%	0.5%
SUBTOTAL	$2,497,575	$5,500,920	$7,998,494		16.5%
GA (9% of subtotal)	$224,782	$495,083	$719,864		
PROJECT TOTAL	$2,722,356	$5,996,003	$8,718,359		

Postdoctoral Fellows

We are proposing to include five postdocs to support the program science oversight objective of integrated program management and the Science Synthesis and Monitoring Component (see Section 5 for details). The postdocs have been imbedded into projects represented by each of the components and have been spread across the 10-year funding cycle to support synthesis efforts (Table 5). A standard of $120K/yr for 3 years maximum has been allocated for each postdoc as stipulated in the EVOSTC Invitation (Pg. 13). This includes travel funds for events such as fieldwork, training, workshops, PI meetings and professional meetings for each position. NOAA's portion of the integrated program management project will host the postdoc for the Pelagic component and a postdoc for cross-component synthesis efforts during the second five years of the funding cycle. This explains why the NOAA personnel budget significantly increases between FY27-31.

Table 5. FY22-31 postdoctoral fellow budget plan for the Synthesis and Modeling Component. All numbers are in thousands. Gray highlighted years represent the years science synthesis reports are due.

Component	Agency /Org	PI	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	Total
Env. Drive.	UAF	Hopcroft	$120	$120	$120								$360
Nearshore	USGS	Esler	$120	$120	$120								$360
HRM	PWSSC	Cypher					$120	$120	$120				$360
Pelagic	NOAA	Suryan								$120	$120	$120	$360
Cross-comp.	NOAA	Suryan						$120	$120	$120			$360
		subtotal	$240	$360	$360	$120	$0	$120	$120	$240	$120	$120	$1,800

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Hoem Neher, T., B. Ballachey, K. Hoffman, K. Holderied, R. Hopcroft, M. Lindeberg, M. McCammon, and T. Weingartner. 2015. Quantifying temporal and spatial ecosystem variability across the northern Gulf of Alaska to understand mechanisms of change. Science Synthesis Report for the Gulf Watch Alaska Program (*Exxon Valdez* Oil Spill Trustee Council Program 14120114 and 14120120). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

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Hollowed, A.B., K.K. Holsman, A.C. Haynie, A.J. Hermann, A.E. Punt, K. Aydin, J.N. Ianelli, S. Kasperski, W. Cheng, A. Faig, K.A. Kearney, J.C.P. Reum, P. Spencer, I. Spies, W. Stockhausen, C.S. Szuwalski, G.A. Whitehouse, and T.K. Wilderbuer. 2020. Integrated Modeling to Evaluate Climate Change Impacts on Coupled Social-Ecological Systems in Alaska. 6.

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Lindeberg, M.R., M.G. Carls, and J. Maselko. 2018. Lingering Oil: Extending the Tracking of Oil Levels and Weathering (PAH Composition) in PWS through Time. *Exxon Valdez* Oil Spill Long-term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project 16120114-S), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Lindeberg, M.R. and K. Hoffman. 2021. Program Management. FY20 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 20120114-A & B.

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Pegau, S. 2016. Herring Research and Monitoring. Five-year proposal (FY17-21) to the *Exxon Valdez* Oil Spill Trustee Council. 285 p.

Pegau, W.S. 2021a. Herring Research and Monitoring. FY20 annual report to the *Exxon Valdez* Oil Spill Trustee Council, program 20120111.

Pegau, W.S. 2021b. Herring Research Program – Program Coordination. FY20 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 20120111-A.

Pegau, W.S., and D.R. Aderhold. 2021. Herring Research and Monitoring science synthesis. Herring Research and Monitoring Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 20120111). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Pegau, S., and N. Bird. 2011. Herring Research and Monitoring. Five-year proposal (FY12-16) to *Exxon Valdez* Oil Spill Trustee Council. 688 p.

Piatt, J.F., J.K. Parrish, H.M. Renner, S.K. Schoen, T.T. Jones, M.L. Arimitsu, K.J. Kuletz, B. Bodenstein, M. García-Reyes, R.S. Duerr, R.M. Corcoran, R.S.A. Kaler, G.J. McChesney, R.T. Golightly, H. A. Coletti, R. M. Suryan, H. K. Burgess, J. Lindsey, K. Lindquist, P. M. Warzybok, J. Jahncke, J. Roletto, and W. J. Sydeman. 2020. Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLoS ONE 15:e0226087.

Rand, P.S. 2021. Adult Pacific Herring Acoustic Surveys in Prince William Sound. FY20 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 20120111-G.

Rosellon-Druker, J., M. Szymkowiak, K.Y. Aydin, C.J. Cunningham, E.A. Fergusson, S. Kasperski, G.H. Kruse, J.H. Moss, M. Rhodes-Reese, K.S. Shotwell, E. Spooner, and E.M. Yasumiishi. 2020. Participatory place-based

integrated ecosystem assessment in Sitka, Alaska: Constructing and operationalizing a socio-ecological conceptual model for sablefish (*Anoplopoma fimbria*). Deep-sea Research Part II-topical Studies in Oceanography. doi:10.1016/j.dsr2.2020.104912.

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Suryan, R.M., M.L. Arimitsu, H.A. Coletti, R.R. Hopcroft, M.R. Lindeberg, S.J. Barbeaux, S.D. Batten, W.J. Burt, M.A. Bishop, J.L. Bodkin, R.E. Brenner, R.W. Campbell, D.A. Cushing, S.L. Danielson, M.W. Dorn, B. Drummond, D. Esler, T. Gelatt, D. H.Hanselman, S.A. Hatch, S. Haught, K. Holderied, K. Iken, D.B. Iron, A.B. Kettle, D.G. Kimmel, B. Konar, K.J. Kuletz, B.J. Laurel, J.M. Maniscalco, C. Matkin, C.A.E. McKinstry, D.H. Monson, J.R. Moran, D. Olsen, W.A. Palsson, W.S. Pegau, J.F. Piatt, L.A. Rogers, N.A. Rojek, A. Schaefer, I.B. Spies, J.M. Straley, S.L. Strom, K.L. Sweeney, M. Szymkowiak, B.P. Weitzman, E.M. Yasumiishi, and S.G. Zador. 2021a. Ecosystem response persists after a prolonged marine heatwave. Scientific Reports 11:6235 https://doi.org/10.1038/s41598-021-83818-5.

Suryan, R.M., M.R. Lindeberg, and D.R. Aderhold, eds. 2021b. The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Gulf Watch Alaska Long-Term Monitoring Program Final Science Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 19120114). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Trochta, J.T., T.A. Branch, A.O. Shelton, and D.E. Hay. 2020. The highs and lows of herring: A meta-analysis of patterns and factors in herring collapse and recovery. 21:639-662.

Whitehead, A. 2021. Genomic mechanisms that underlie lack of recovery of Prince William Sound herring following the 1990s collapse. FY20 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 20170115.

Weitzman, B., B. Konar, K. Iken, H. Coletti, D. Monson, R. Suryan, T. Dean, D. Hondolero, and M. Lindeberg. 2021. Changes in rocky intertidal community structure during a marine heatwave in the northern Gulf of Alaska. Frontiers in Marine Science 8.

Web Resources:

Gulf Watch Alaska long-term monitoring program - http://www.gulfwatchalaska.org/

Herring Research and Monitoring Program - https://pwssc.org/herring/

AOOS Data Portal - http://portal.aoos.org/gulf-of-alaska.php

DataONE archived datasets - https://www.dataone.org/

ATTACHMENT 1 - Curriculum Vitae for Program Management Team

PROGRAM LEAD

MANDY R. LINDEBERG

Fisheries Research Biologist IV
NOAA NMFS Alaska Fisheries Science Center, Auke Bay Laboratories
17109 Pt. Lena Loop Rd, Juneau, Alaska 99801
Phone: (907) 789-6616; FAX: (907) 789-6094
mandy.lindeberg@noaa.gov

RELEVANT PROFESSIONAL EXPERIENCE

Long-Term Marine Ecosystem Monitoring (2011 - Present): Currently providing leadership to the Gulf Watch Alaska (GWA) Program as Program Lead to 28 principal investigators (2017-21). Previous roles included GWA Pelagic Component Lead (2013-16), GWA co-Principal Investigator for the Nearshore Component (2011-21), and GWA co-Principal Investigator for the Lingering Oil Component (2011-21). In leading the Gulf Watch Alaska program during the past four years, the program has thrived producing: 24 key ecosystem indicators to resource managers (NPFMC) on an annual basis, 63 peer reviewed journal publications, 45 published datasets, 81 scientific reports, over 250 presentations at professional conferences, and a diversity of outreach efforts (e.g. website, newsletters, agency social media, and traditional ecological knowledge exchange with remote spill-affected communities).

Oil Spill Research in the marine environment (1990 - Present): Extensive experience with oil spill research for over 30 years. Research includes investigations of damage assessment, recovery of injured resources, long-term ecosystem monitoring of nearshore flora and fauna, and lingering *Exxon Valdez* oil in the marine environment. Also participated in the injury assessment of the Deepwater Horizon oil spill under NRDA's Submerged Aquatic Vegetation TWIG. Recently, a collaborator in a four-year assessment for BOEM in a NEPA analysis associated with the Oil & Gas Leasing Program in Cook Inlet (2015-18).

Coastal Habitat Mapping (2004 - Present): A core steering committee member for over 17 years and lead biologist for the successful Alaska *ShoreZone* coastal habitat mapping project and online tools for agencies, educators, and the public.

Essential Fish Habitat (2005 - Present): Conducting research on essential fish habitat under the Magnuson-Stevens Act, focusing on nearshore marine forage fish and promoting the development of online tools for a statewide catch database (Alaska Nearshore Fish Atlas).

Specialized Expertise (1990 - present): Scientific expertise lies with coastal ecology, specializing in the taxonomy and ecology of seaweeds throughout Alaska's coastal regions. Author of two popular books: *A Field Guide to Seaweeds of Alaska* and co-author of *A Handy Field Guide to Nearshore Fishes of Alaska*.

MOST RELEVANT PUBLICATIONS

Aderhold, D. G. R, M. R. **Lindeberg**, K. Holderied, and S.W. Pegau. 2018. Introduction: Spatial and temporal ecological variability in the northern Gulf of Alaska: What have we learned since the *Exxon Valdez* oil spill? Deep-Sea Research Part II Special Issue. doi:10.1016/j.dsr2.2017.11.015.

Bowen, L., B. Ballachey, A. K.Miles, J. Bodkin, M. **Lindeberg**, and D. Esler. 2018. Mussels and Oil: Gene transcription patterns as a new approach for evaluation of injury and recovery following the *Exxon Valdez* oil spill. Deep Sea Research II Special Issue. http://www.sciencedirect.com/science/article/pii/S0967064516302855.

Konar, B., T .J. Mitchell, K. Iken, H. Coletti, T. Dean, D. Esler, M. **Lindeberg**, B. Pister, B. Weitzman. 2019. Wasting disease and static environmental variables drive sea star assemblages in the Northern Gulf of Alaska. JEMBE. Vol. 520. ISSN 0022-0981. https://doi.org/10.1016/j.jembe.2019.151209.

Lindeberg, M. R., J. Maselko, C. Fugate, L. Holland, and M. G. Carls. 2017. Persistent *Exxon Valdez* oil on beaches in Prince William Sound 26 years later. Deep Sea Research II Special Issue. http://www.sciencedirect.com/science/article/pii/S0967064516304234.

Short, J. W., K. R. Springman, M. R. **Lindeberg**, L. G. Holland, M. L. Larsen, C. A. Sloan, C. Khan, P. V. Hodson, and S. D. Rice. 2008. Semipermeable membrane devices link site-specific contaminants to effects: Part II – A comparison of lingering *Exxon Valdez* oil with other potential sources of CYP1A inducers in Prince William Sound, Alaska. Mar. Environ. Res. 66:487-498.

Short J. W., G. V. Irvine, D. H. Mann, J. M. Maselko, J. J. Pella, M. R. **Lindeberg**, J. R. Payne, W. B. Driskell, and S. D. Rice. 2007. Slightly weathered *Exxon Valdez* oil persists in Gulf of Alaska beach sediments after 16 years. Environ. Sci. Technol. 41:1245-1250.

Short, J. W., J. M. Maselko, M. R. **Lindeberg**, P. M. Harris, and S. D. Rice. 2006. Vertical distribution and probability of encountering intertidal *Exxon Valdez* oil on shorelines of three embayments within Prince William Sound, Alaska. Environ. Sci. and Technol. Vol. 40, 3723-3729.

Short, J. W., M. R. **Lindeberg**, P. M. Harris, J. Maselko, J. J. Pella, and S. D. Rice. 2004. An estimate of oil persisting on beaches of Prince William Sound, 12 years after the *Exxon Valdez* oil spill. Environ. Sci. and Technol. Vol 38: 19-25.

Suryan, R. M., M. Arimitsu, H. Coletti, R. R. Hopcroft, M. R. **Lindeberg**, S. Batten, M. A. Bishop, R. Brenner, R. Campbell, D. Cushing, S. Danielson, D. Esler, T. Gelatt, S. Hatch, S. Haught, K. Holderied, K. Iken, D. Irons, D. Kimmel, B. Konar, K. Kuletz, B. Laurel, J.M. Maniscalco, C. Matkin, C. McKinstry, D. Monson, J. Moran, D. Olsen, S. Pegau, J. Piatt, L. Rogers, A. Schaefer, J. Straley, K. Seeeney, M. Szymkowiak, B. Weitzman, J. Bodkin, and S. Zador. *In review*. Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska. Scientific Reports.

Weitzman, B., B. Konar, K. Iken, H. Coletti, D. Monson, R.M. Suryan, T. Dean, D. Hondolero, and M.R. **Lindeberg**. *In review*. Changes in rocky intertidal community structure during a marine heatwave in the northern Gulf of Alaska. Frontiers in Marine Science.

OTHER SIGNIFICANT PUBLICATIONS

Johnson, S. W., A. D. Neff, and M. R. **Lindeberg**. 2015. A handy field guide to the nearshore fishes of Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-293, 211 p.

Lindeberg, M. R. and S. C. Lindstrom. 2019. Assessment and Catalog of Benthic Marine Algae from the Alaska Peninsula, May 2016. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-389, 501p.

Lindeberg, M. R. and S. C. Lindstrom. 2015. Field Guide to Seaweeds of Alaska. *Updated and reprinted*. Fairbanks, Alaska: Alaska Sea Grant College Program. University of Alaska Fairbanks. 188 p. ISBN 978-1-56612-156-9. doi.10.4027.fgsa.2010.

Springman, K. R., J. W. Short, M. **Lindeberg**, and S. D. Rice. 2008. Evaluation of bioavailable hydrocarbon sources and their induction potential in Prince William Sound, Alaska. Mar. Environ. Res. 66:218- 220. doi: 10.1021/es100176k.

EDUCATION

B.S. 1989, Marine Biology, Western Washington University, Bellingham, Washington.

COLLABORATIONS

Apeti, Dennis (NOAA NOS); Coletti, Heather (NPS); Coon, Catherine (BOEM); Iken, Katrin (UAF); Jones, Tahzay (NPS); Konar, Brenda (UAF); Lewis, Steve (Alaska Regional Office, NMFS); Lindstrom, Sandra (UBC); Pister, Benjamin (NPS); Saupe, Sue (Cook Inlet RCAC); Stickle, William (LSU); Weitzman, Ben (NOAA NOS).

ADMINISTRATIVE LEAD

KATRINA C. HOFFMAN

Prince William Science Center
907-424-5800 x225 (office); khoffman@pwssc.org
PO Box 705, Cordova, AK 99574

RELEVANT PROFESSIONAL EXPERIENCE

Prince William Sound Science Center; President and CEO and
Oil Spill Recovery Institute; Executive Director (November 2011-present)

Manage research, education, development, communications, and administration staff dedicated to advancing community resilience and the understanding and sustainable use of ecosystems. Administrative PI of EVOSTC-funded Gulf Watch Alaska (2012-present) and the ADF&G-funded Interactions of Hatchery and Wild Pink and Chum Salmon ('12-'20). Facilitate collaborations to improve the quality of research, education, and community benefit programs in the bioregion. Direct funds to improve oil spill response and recovery and knowledge of Arctic and sub-Arctic ecosystems where oil spills may occur. Serving as Advisory Board Chair, Alaska Ocean Observing System ('17-present); Vice Chair ('16-'17); member (2011-'16); Director, North Pacific Research Board (2011-present).

Washington Sea Grant, Coastal Resources Specialist (2007-2011)

Secured $777K federal grant to coordinate an international sustainable shoreline development initiative. Chaired Sustainable Coastal Communities Action Team for West Coast Governors' Alliance on Ocean Health; led creation of tri-state work plan focused on economic development, sustainable aquaculture, sustainable fisheries, non-consumptive tourism and recreation, green ports, and clean marinas. Created quarterly science-based trainings for ~350-member Shoreline and Coastal Planners Group. Co-developed nationally recognized climate adaptation training with the NERR Coastal Training Program. Coordinated Washington State Geoduck Aquaculture Research Program conference.

NEPTUNE Project, **Grant Writer and Research Assistant, University of Washington** (**2006-2007)**

Wrote education component of the largest federal grant ever awarded to UW at the time ($126 million from NSF) to build and administer a seafloor cabled observatory, the regional cabled array of the Ocean Observatory Initiative (formerly known as NEPTUNE). Graduate thesis assessing the education potential of observatory-related engineering software.

University of Washington, Instructor and Teaching Assistant (2006)

Managed 25 visiting scholars for semester-long graduate seminar at UW School of Marine and Environmental Affairs; co-designed syllabus, maintained course web site, grades and communications. Lead instructor for marine resources unit in Program on the Environment summer course. Developed and taught lecture materials and fieldwork to students from Japan and China in a summer intensive sustainable development institute.

Occidental College, Grant Administrator, Program Coordinator, Resource Teacher (2003-2005)

Lead instructor and administrator of $990,000 HHMI grant to train middle school and high school teachers and students about the nature of scientific research using oceanography and marine ecology. Led multi-week professional development courses for ~90 science teachers, conducted classroom site visits & master instruction; led ~180 research cruises on Santa Monica Bay. Directed students in fieldwork to generate long-term, web-based data sets; guided research projects based on student-gathered data. Regularly used: CTD; secchi disk; trawl nets; Van Veen grab; nutrient analysis; video microscopy.

Mira Costa High School, Science Teacher (2001-2003)

Instructor of Marine Science and College Preparatory Biology to 9th-l2th graders. Quadrupled enrollment in marine science course and served as sole curriculum developer. Developed and coordinated annual 8-month long field-based marine ecology research projects. Arranged student service-learning experiences at numerous marine facilities.

Raised over $18,000 to facilitate four multi-day tall ship-based oceanographic field trips. Directed $10,000 grant for purchase of classroom aquarium system.

Monterey Bay Aquarium Research Institute, Assistant Researcher (2000)
Conducted biological and chemical oceanography research aboard a NOAA Tropical Atmosphere Ocean monitoring cruise in the Equatorial Pacific. Collected data to: monitor plankton productivity; determine the effect of phenomena such as El Nino on biological processes; measure oxygen isotopes; measure dissolved organic nutrients. Research methods include 14C incubations, nutrient and chlorophyll analysis.

University of California Berkeley, Research Technician (**1997-1998)**
Conducted algae genomics and protein biochemistry research using cell and molecular techniques (e.g. gel electrophoresis, DNA sequencing; recombinant DNA; algal culture maintenance and harvesting) to determine the structure and function of uncharacterized proteins in the photosynthetic pathway.

Monterey Bay Aquarium Research Institute, Research Intern (1997)
Conducted ship- and lab-based research on primary productivity of Monterey Bay with Drs. Raphael Kudela and Francisco Chavez using 14C photosynthesis vs. irradiance curves, Pulsed Amplitude Modulation fluorometry, diode array spectrophotometry, chlorophyll and nutrient analysis methods. Maintained *Pseudo-nitzschia* cell cultures and chemostats.

RECENT PUBLICATIONS

Lindeberg, M., and **K. Hoffman**. 2020. Program Management I – Program coordination and science synthesis and Program Management II – Administration, science review panel, PI meeting logistics, outreach, and community involvement. *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Annual Report (*Exxon Valdez* Oil Spill Trustee Council Project: 19120114-A and B), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Lindeberg, M., and **K. Hoffman**. 2019. Program Management I – Program coordination and science synthesis and Program Management II – Administration, science review panel, PI meeting logistics, outreach, and community involvement. *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Annual Report (Restoration Project: 18120114-A and B), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Lindeberg, M., and **K. Hoffman**. 2018. Program management I—Program coordination and science synthesis and program management II—Administration, science review panel, PI meeting logistics, outreach, and community involvement. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, projects 17120114-A and B.

Hoffman, K., and M. McCammon. 2017. Program coordination, logistics, and outreach. *Exxon Valdez* Oil Spill Trustee Council Restoration Project Final Report (Restoration Project: 16120114-B), Prince William Sound Science Center, Cordova, Alaska.

EDUCATION

University of Washington, School of Marine and Environmental Affairs; M.M.A. (2007)
Chapman University: California Clear Teaching Credential, Biological Sciences (2004)
Oberlin College: B.A. Biology and B.A. Environmental Studies (1997)

COLLABORATORS

Aderhold, Donna (PWSSC); Arimitsu, Mayumi (USGS); Bochenek, Rob, (Axiom); Buckelew, Stacey (Axiom); Coletti, Heather (NPS); Danielson, Seth (UAF); Esler, Dan (USGS); Gorman, Kristen (UAF); Hopcroft, Russ (UAF); Josephson, Ron (ret. ADF&G); Knudsen, Eric; Lindeberg, Mandy (NOAA), McCammon, Molly (AOOS); Morse, Kate (CRWP); Morton, Kes (OTN-Dalhousie); Rand, Pete (PWSSC); Riemer, Tara (ASLC); Suryan, Rob (NOAA); Walker, Seth (curate.org)

SCIENCE LEAD

ROBERT M. SURYAN

Program Manager - Recruitment, Energetics, and Coastal Assessment
NOAA NMFS Alaska Fisheries Science Center, Auke Bay Laboratories
17109 Pt. Lena Loop Rd, Juneau, Alaska 99801
(907)789-6065, rob.suryan@noaa.gov

RELEVANT PROFESSIONAL EXPERIENCE

Research Interests: Long-term ecological investigations in marine environments working nationally and internationally. Primary interests include: marine ecosystem processes, food webs, foraging ecology, spatial ecology, population dynamics, human-resource interactions. Participation in long-term ecological research efforts include Alaska Predator Ecosystem Experiment (EVOSTC), Bering Sea Integrated Ecosystem Research Program (NPRB), annual contributor to State of the California Current, Gulf Watch Alaska (EVOSTC)

Professional Appointments (selected)

Research Fish Biologist, Prog. Mgr.	NOAA Fisheries	2020-present
Research Ecologist	NOAA Fisheries	2018-2020
Associate Professor - Senior Research	Oregon State University	2012-2018
Assistant Professor - Senior Research	Oregon State University	2006-2012
NOAA Fisheries Oceanography Fellow	Oregon State University	2003-2006
Graduate Research Assistant	Oregon State University	2001-2006
Wildlife Biologist/Co-Prin. Invest.	U.S. Fish and Wildlife Service	1996-2001

Academic Appointments (current)

Affiliate Faculty: Wildlife Biology Program, University of Montana	2020-present
Courtesy Associate Professor: Department of Fisheries and Wildlife, Oregon State University	2018-present
Affiliate Faculty: College of Fisheries and Ocean Sciences, University of Alaska Fairbanks	2016-present

MOST RELEVANT PUBLICATIONS

Suryan, R.M. et al. 2021. Ecosystem response persists after a prolonged marine heatwave. Scientific Reports https://doi.org/10.1038/s41598-021-83818-5. **(EVOS-GWA)**

Arimitsu. M.L. et al. including **R.M. Suryan**. 2021. Heatwave-induced synchrony within forage fish portfolio disrupts energy flow to top pelagic predators. Global Change Biology DOI:10.1111/gcb.15556 **(EVOS-GWA)**

Wietzman, B. et al. including **R.M. Suryan**. 2021. Changes in rocky intertidal community structure during a marine heatwave in the northern Gulf of Alaska. Frontiers in Marine Science 8 10.3389/fmars.2021.556820 **(EVOS-GWA)**

Piatt, J.F et al. including **R.M. Suryan**. 2020. Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLoS ONE 15:e0226087.

Thompson, A.R. et al. including **R.M. Suryan.** 2018. State of the California Current 2017-2018: Still not quite normal in the north and getting interesting in the south. California Cooperative Oceanic Fisheries Investigations Reports 59:1-66. https://calcofi.org/publications/calcofireports/v59/Vol59-SOTC2018_1-66.pdf **(annual contributor 2012-2018)**

Suryan, R.M., K.J. Kuletz, S.L. Parker-Stetter, P.H. Ressler, M. Renner, J.K. Horne, E.V. Farley, E.A. Labunski. 2016. Temporal shifts in seabird populations and spatial coherence with prey in the southeastern Bering Sea. Marine Ecology Progress Series 549:199-215. **(NPRB-BSIERP)**

Hazen, E.L., **R.M. Suryan**, J.A. Santora, S.J. Bograd, Y. Watanuki , R.P. Wilson. 2013. Scales and mechanisms of marine hotspot formation. Marine Ecology Progress Series 487:177-183.

Benoit-Bird, K.J., Battaile', B., S.A. Heppell, B. Hoover, D.B. Irons, N. Jones, K. Kuletz, C.A. Nordstrom, R. Paredes, **R.M. Suryan**, C.M. Waluk, A.J. Trites. 2013. Prey patch patterns predict habitat use by top marine predators with diverse foraging strategies. PLoS ONE 8(1):e53348. **(NPRB-BSIERP)**

Paredes R., A.M.A. Harding, D.B. Irons, D.D. Roby, **R.M. Suryan**, R.A. Orben, H. Renner, R. Young, A. Kitaysky. 2012. Proximity to multiple foraging habitats enhances seabirds' resilience to local food shortages. Marine Ecology Progress Series 471:253-269. **(NPRB-BSIERP)**

Suryan, R.M., D.B. Irons, E.D. Brown, P.G.R. Jodice, and D.D. Roby. 2006. Site-specific effects on productivity of an upper trophic-level marine predator: Bottom-up, top-down, and mismatch effects on reproduction in a colonial seabird. Progress in Oceanography 68:303-328. **(EVOS-APEX)**

OTHER SIGNIFICANT PUBLICATIONS

Gladics, A.J., **R.M. Suryan,** R.D. Brodeur, L.M. Segui, L.Z. Filliger. 2014. Constancy and change in marine predator diets across a shift in oceanographic conditions in the northern California Current. Marine Biology. 10.1007/s00227-013-2384-4

Suryan, R.M. and K.N. Fischer. 2010. Stable isotope analysis and satellite tracking reveal inter-specific resource partitioning of non-breeding albatrosses (*Phoebastria* spp.) off Alaska. Canadian Journal of Zoology 88:299-305

Jodice, P.G.R., D.D. Roby, K.R. Turco., **R.M. Suryan**, D.B. Irons, J.F. Piatt, M.T. Shultz, D.G. Rosenau, A.B. Kettle, J.A. Anthony. 2006. Assessing the nutritional stress hypothesis: the relative influence of diet quantity and quality on seabird productivity. Marine Ecology Progress Series 325:267-279 **(EVOS-APEX)**

Suryan, R.M., D.B. Irons, M. Kaufman, J. Benson, P.G.R. Jodice, D.D. Roby, and E.D. Brown. 2002. Short-term fluctuations in forage fish availability and the effect on prey selection and brood-rearing in the black-legged kittiwake (*Rissa tridactyla*). Marine Ecology Progress Series 236:273-287. **(EVOS-APEX)**

Suryan, R.M., D.B. Irons, and J. Benson. 2000. Prey switching and variable foraging strategies of black-legged kittiwakes and the effect on reproductive success. Condor. 102:375-385. **(EVOS-APEX)**

EDUCATION

Humboldt State University	Wildlife Management	B.S. 1989
Moss Landing Marine Laboratories	Marine Science	M.S. 1995
Oregon State University	Wildlife Science	Ph.D. 2006

COLLABORATORS

J Adams (U.S. Geological Survey), M.L. Arimitsu (USGS), S.J. Barbeaux (NOAA), S.D. Batten (PICES), W.J. Burt (U of Alaska Fairbanks), M.A. Bishop (Prince William Sound Science Center), J.L. Bodkin (USGS), R.E. Brenner (ADF&G), R.W. Campbell (PWSSC), H.A. Coletti (National Park Service), D.A. Cushing (Pole Star Ecological Research), S.L. Danielson (UAF), M.W. Dorn (NOAA), B. Drummond (U.S. Fish and Wildlife Service), D. Esler (USGS), E Farley (NOAA), T Gelatt (NOAA), D.H. Hanselman (NOAA), S.A. Hatch (Institute for Seabird Research and Conservation), S. Haught (ADF&G), E Hazen (NOAA), K. Holderied (NOAA), R.R. Hopcroft (UAF), J. Horne (U of Washington), K. Iken (UAF), R.S.A. Kaler (USFWS), D.B. Iron (USFWS), A.B. Kettle (USFWS), D.G. Kimmel (NOAA), B. Konar(UAF), K.J. Kuletz (USFWS), B.J. Laurel (NOAA), M.R. Lindeberg (NOAA), J.M. Maniscalco Alaska SeaLife Center), C. Matkin (North Gulf Oceanic Society), C.A.E. McKinstry (PWSSC), D.H. Monson (USGS), J.R. Moran (NOAA), D. Olsen (NGOS), W.A. Palsson (NOAA), J. K. S Parker-Stetter (NOAA), J. Parrish (UW), W.S. Pegau (PWSSC), J.F. Piatt (USGS), D Roby (USGS), H. M. Renner (USFWS), P. Ressler (NOAA), L.A. Rogers (NOAA), N.A. Rojek (USFWS), A. Schaefer (PWSSC), S. K. Schoen (USGS), S Shaffer (San Jose State University), I.B. Spies (NOAA), J.M. Straley (U. Alaska Southeast), S.L. Strom (Western Washington U), K.L. Sweeney (NOAA), W. J. Sydeman (Farallon Institute), M. Szymkowiak (NOAA), B.P. Weitzman (NOAA), E.M. Yasumiishi (NOAA), and S.G. Zador (NOAA)

PROGRAM COORDINATOR

DONNA ROBERTSON ADERHOLD

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RELEVANT PROFESSIONAL EXPERIENCE

Project and Program Coordination

- Program Coordinator for the Gulf Watch Alaska program responsible for coordinating proposals, annual reports, work plans, and synthesis reports to the *Exxon Valdez* Oil Spill Trustee Council for their Long-Term Monitoring program (2016-present)
- Coordinator and lead guest editor for publication of a special issue of Gulf Watch Alaska and Herring Research and Monitoring scientific papers in the journal Deep Sea Research Part II (2016-2018)
- Project Manager for numerous environmental assessments and regulatory permitting projects associated with proposed development projects throughout Alaska (1997-2016)
- Coordinator of multi-disciplinary scientific teams in the development of biological sections of environmental impact statements in compliance with the National Environmental Policy Act (1999-2016)
- Facilitator for a symposium and co-editor in publication of a book on marine mammal survey and assessment methods (1997-1998)
- Co-investigator for a study of foraging ecology of lesser snow geese during fall migratory staging on the Arctic National Wildlife Refuge as part of a series of Congressionally mandated studies evaluating the potential impacts of oil development on the refuge (1990-1996)

Leadership Accomplishments, Experience, and Training

- Alaska Salmon Fellow, cohort 2, an 18-month leadership program of the Alaska Humanities Forum exploring systems change within the Alaska salmon and people system (2018-2020)
- Marine Planning and Science Practice Group Leader for HDR's Environmental Science and Planning Business Class, championing the skills of the company's marine science practitioners to HDR's upper management and supporting business develop nationally within the marine sciences (2013-2016)
- Alaska Wildlife and Marine Science Team Leader for HDR, responsible for business development, staff hiring, and staff oversight (2007-2016)
- Principal Associate for HDR, a designation HDR provides to senior level staff who exemplify their area of expertise and provide mentoring and support within the company (2009-2016)
- Recipient of Leadership and Team awards in HDR's Pathfinders awards program (2008-2014)
- Project Management and Leadership training through HDR and MACTEC (2003-2015)
- Elected to Homer City Council (2015-present)

Professional Positions

Gulf Watch Alaska Program Coordinator	PWSSC & NOAA Kasitsna Bay Lab	2016-Present
Senior Wildlife Ecologist/Marine Science Practice Group Leader	HDR	2007-2016
Principal Environmental Scientist	HLA/MACTEC	1999-2007
Wildlife Biologist/Project Manager	Western Ecosystems Technology	1997-1999
Research Wildlife Biologist	USFWS/USGS BRD	1990-1996
Graduate Research Assistant	Texas A&M University	1987-1990
Biological Technician	Yukon Delta NWR	1988

RELEVANT AND OTHER SIGNIFICANT PUBLICATIONS

Aderhold, D.G.R, M.R. Lindeberg, K. Holderied, and S.W. Pegau. 2018. Introduction: Spatial and temporal ecological variability in the northern Gulf of Alaska: What have we learned since the *Exxon Valdez* oil spill? Deep-Sea Research Part II Special Issue. doi:10.1016/j.dsr2.2017.11.015.

Hupp, J.W., **D.G. Robertson**, and A.W. Brackney. 2002. Section 9: snow geese. Pp. 71-74 in Arctic refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0001.

Hupp, J.W., A.B. Zacheis, R.M. Anthony, **D.G. Robertson**, W.P. Erickson, and K.C. Palacios. 2001. Snow cover and snow goose *Anser caerulescens caerulescens* distribution during spring migration. *Wildlife Biology* 7(2):65-76.

Hupp, J.W., **D.G. Robertson**, and J.A. Schmutz. 2000. Recovery of tall cotton-grass following real and simulated feeding by snow geese. *Ecography* 23(3):367-373.

Garner, G.W., S.C. Amstrup, J.L. Laake, B.J.F. Manly, L.L. McDonald, and **D.G. Robertson**. 1999. *Marine mammal survey and assessment methods*. A.A. Balkema, Rotterdam, Netherlands, 287pp.

Garner, G.W., L.L. McDonald, and **D.G. Robertson**. 1999. Comparison of aerial survey procedures for estimating polar bear density: results of pilot studies in northern Alaska. Pp 37-51 in, Garner, G.W., S.C. Amstrup, J.L. Laake, B.J.F. Manly, L.L. McDonald, and D.G. Robertson (eds) *Marine mammal survey and assessment methods*. A.A. Balkema, Rotterdam, Netherlands.

Hupp, J.W. and **D.G. Robertson**. 1998. Forage site selection by lesser snow geese in an arctic tundra ecosystem. *Wildlife Monographs* 138:1-40.

Robertson, D.G., A.W. Brackney, M. A. Spindler, and J. W. Hupp. 1997. Distribution of autumn staging lesser snow geese on the northeast coastal plain of Alaska. *Journal of Field Ornithology* 68(1):124-134.

Hupp, J.W., R.G. White, J.S. Sedinger, and **D.G. Robertson**. 1996. Forage digestibility and intake by lesser snow geese: effects of dominance and resource heterogeneity. *Oecologia* 108:232-240.

EDUCATION

M.S., Wildlife and Fisheries Sciences, Texas A&M University, 1991

B.S., Wildlife and Fisheries Sciences, North Carolina State University, 1987

COLLABORATORS

Arimitsu, Mayumi (USGS); Baird, Steve (KBNERR); Batchelder, Hal (PICES); Batten, Sonia (PICES); Bishop, Mary Anne (PWSSC); Branch, Trevor (UW); Brenner, Rich (ADF&G); Buckelew, Stacey (Axiom); Campbell, Robert (PWSSC); Danielson, Seth (UAF); Coletti, Heather (NPS); Esler, Daniel (USGS); Haught, Stormy (ADF&G); Heintz, Ron (SSSC); Hershberger, Paul (USGS); Hoffman, Katrina (PWSSC); Holderied, Kris (NOAA); Hopcroft, Russell (UAF); Iken, Katrin (UAF); Janzen, Carol (AOOS); Kaler, Robert (USFWS); Klinger, Terrie (UW); Konar, Brenda (UAF); Kuletz, Kathy (USFWS); Lindeberg, Mandy (NOAA); Matkin, Craig (NGOS); Moran, John (NOAA); Ostle, Clare (MBA); Pegau, Scott (PWSSC); Rand, Pete (PWSSC); Rice, Stanley (Jeep) (NOAA, retired); Straley, Jan (UAS); Whitehead, Andrew (UC Davis)

COMPONENT LEAD: ENVIRONMENTAL DRIVERS

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RELEVANT PROFESSIONAL EXPERIENCE

- Steering Groups – Gulf Watch Alaska, Gulf of Alaska Integrated Research Program, Census of Marine Life's (CoML) Arctic Ocean Biodiversity (ArcOD) & Census of Marine Zooplankton (CMarZ), Executive Committee member - Northeast Pacific GLOBEC, US member – Plankton Experts Lead, Circumpolar Biodiversity Monitoring Program, ICES Zooplankton Ecology Group
- Editorial Board – Marine Biodiversity (Springer), Plankton and Benthic Research (Japan)
- Reviewer: manuscripts reviewed for ~15 primary journals, proposals for 6 funding agencies, NSF OPP & BO panel member.
- Submersible & ROV Experience - Johnson-Sea-Link, Ventana, Tiburon, Global Explorer (~120 dives total)
- Research Cruise Experience - ~1300 sea days on cruises up to 45 days duration aboard vessels ranging in size from 15-120 m.

MOST RELEVANT PUBLICATIONS

Suryan, R. M. and 47 others. *(Accepted).* Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska. Nature Sci. Rep.

Litzow, M. A., M. E. Hunsicker, E. J. Ward, S.C. Anderson, J. Gao, S. McClatchie, S. Zador, S. Batten, S. Dressel, J. Duffy-Anderson, E. Fergusson, **R.R .Hopcroft**, B.J. Laurel, & R. O'Malley. 2020. Evaluating ecosystem change as Gulf of Alaska temperate exceeds the limits of preindustrial variability. *Prog. Oceanogr.* **186**:102393.

Doyle, M. J., S.L. Strom, K.O. Coyle, A.J. Hermann, C. Ladd, A.C. Matarese, S.K. Shotwell, & **R.R. Hopcroft.** 2019. Early life history phenology among Gulf of Alaska fish species: strategies, synchronies, and sensitivities. *Deep-Sea Res. II.* **165**: 41-73.

Coyle, K.O., A.J. Hermann, & **R.R. Hopcroft**. 2019. Modeled spatial-temporal distribution of production, chlorophyll, iron and nitrate on the northern Gulf of Alaska shelf relative to field observations. *Deep-Sea Res. II*. **165**: 163-191.

Roncalli, V., M.C. Cieslak, M. Germano, **R.R. Hopcroft**, & P.H. Lenz. 2019. Regional heterogeneity impacts gene expression in the sub-arctic zooplankter *Neocalanus flemingeri* in the northern Gulf of Alaska. *Commun. Biol.* **2:**324

Batten, S.D., D.E. Raitsos, S. Danielson, **R.R. Hopcroft**, K.O. Coyle & A. McQuattors-Gollop. 2018. Interannual variability in lower trophic levels on the Alaskan Shelf. *Deep-Sea Res. II*. **147**: 58-68.

Sousa, L., K.O. Coyle, R.P. Barry, T.J. Weingartner, & **R.R. Hopcroft**. 2016. Climate-related variability in abundance of mesozooplankton in the northern Gulf of Alaska 1998-2009. *Deep-Sea Res. II.* **132:** 122-135.

Li, K.Z., A.J. Doubleday, M.D. Galbraith, & **R.R. Hopcroft**. 2016. High abundance of salps in the coastal Gulf of Alaska during 2011: a first record of bloom occurrence for the northern Gulf. *Deep-Sea Res. II.* **132:** 126-145.

Doubleday, A. & **R.R. Hopcroft.** 2015. Seasonal and interannual patterns of larvaceans and pteropods in the coastal Gulf of Alaska, and their relationship to pink salmon survival. *J. Plankton Res.* **37**:134-150.

Coyle, K.O., G.A. Gibson, K. Hedstrom, A. Hermann, & **R.R. Hopcroft.** 2013. Zooplankton biomass, advection and production on the northern Gulf of Alaska shelf from simulations and field observations. *J. Mar. Sys.* **128**: 185-207.

OTHER SIGNIFICANT PUBLICATIONS

Mundy, P., and 22 others. 2010. Status and trends of the Gulf of Alaska Coastal region, 2003-2008. pp. 142-195. *In:* S.M. McKinnell & M. Dagg (ed.) Marine Ecosystems of the North Pacific Ocean; 2003-2008. *PICES Spec. Pub. 4. 393p.*

Pinchuk, A.I., K.O. Coyle & **R.R. Hopcroft**. 2008. Climate-related variability in abundance and reproduction of euphausiids in the northern Gulf of Alaska in 1998-2003. *Prog. Oceanogr.* **77**:203-216.

Liu, H. & **R.R. Hopcroft**. 2008. Growth and development of *Pseudocalanus* spp. in the northern Gulf of Alaska. *J. Plankton Res.* **30**: 923-935.

Pinchuk, A.I. & **R.R. Hopcroft**. 2007. Seasonal variations in the growth rate of euphausiids (*Thysanoessa inermis*, *T. spinifera*, and *Euphausia pacifica*) from the northern Gulf of Alaska. *Mar. Biol.* **151**: 257-269

Liu, H. & **R.R. Hopcroft**. 2006. Growth and development of *Neocalanus flemingeri/plumchrus* in the northern Gulf of Alaska: validation of the artificial cohort method in cold waters. *J. Plankton Res.* **28**: 87-101.

EDUCATION

University of Guelph, Ontario, Canada	Marine Biology	B.Sc. 1983
University of Guelph	Marine Ecology	M.Sc. 1988
University of Guelph	Marine Biology	Ph.D. 1997
Monterey Bay Aquarium Research Institute (MBARI)	Zooplankton Ecology	1997-1999
University of Massachusetts Dartmouth	Zooplankton Ecology	1999-2000

COLLABORATORS

Collaborators: Bodil Bluhm (UiT), Ann Bucklin (UConn), Allen Collin (NMNH), Lee Cooper (UMaryland), Ken Coyle (UAF), Janet Duffy-Anderson (NOAA), Jackie Grebmeier (UMaryland), Al Herman (UW), John Horne (UW), Hans-Jurgen Hirche (AWI), Carol Ladd (NOAA), Catherine LaLande (ULaval), Mary-Beth Leigh (UAF), Petra Lenz (UHawaii), Dhugal Lindsay (JAMSTEC), Mike Litzow (NOAA), Toru Kobari (Kagoshima University), Ksenia Kosobokova (RAS), Sam McClatchie (NOAA), Karen Osborn (NMNH), Kevin Raskoff (MPC), Paul Renaud (NIVA), Vittoria Roncalli (SZAD), Akash Satari (DFO), Kalaei Shotwell (NOAA), Kate Stafford (UW), Suzanne Strom (WWU), Atsushi Yamaguchi (Hokkaido University), Stephanie Zador (NOAA)

Graduate advisor: John C. Roff (Acadia U)

Postdoctoral advisors: Bruce Robison & Francisco Chavez (MBARI), Brian Rothschild (UMass)

Graduate Students: Alex Poje (MS 2020), Heidi Mendoza-Islas (MS 2020), Imme Rutzen (Ph.D. 2017), Jennifer Questel (PhD 2016), Elizaveta Ershova (PhD 2015), Caitlin Smoot (MS 2015), Ayla Doubleday (MS 2013), Jenefer Bell (MS 2009), Laura Slater (MS 2004), Hui Liu (PhD 2006), Alexei Pinchuk (PhD 2006)

COMPONENT LEAD: PELAGIC ECOSYSTEMS

MAYUMI LYNN ARIMITSU

Research Ecologist, USGS-Alaska Science Center
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RELEVANT PROFESSIONAL EXPERTISE

Monitoring Strategies to Improve Detection of Change in Forage Fish Stocks (2011- present). Pelagic Component Lead and Principal Investigator on the Gulf Watch Alaska long-term monitoring program. Designed and implemented forage fish monitoring strategies that include broad-scale aerial surveys coupled with hydroacoustic-trawl surveys, integrated predator-prey surveys, and predator diets to assess status and trends of prey species such as capelin, sand lance, juvenile herring, and krill.

Monitoring the Recovery of Seabirds and Forage Fish Following a Major Ecosystem Disruption in Lower Cook Inlet (2016 – present). Principal Investigator on project to document changes in seabird and forage fish populations during and following the North Pacific marine heatwave. Lead scientist during ship-based acoustic-trawl and predator surveys in Kachemak Bay and Lower Cook Inlet, and supervision of 2-5 scientists conducing measurements of breeding population and reproductive success of murres and kittiwakes at two colonies.

MOST RELEVANT PUBLICATIONS

Arimitsu, M. L., J. F. Piatt, M. A. Litzow, A. A. Abookire, M. D. Romano, and M. D. Robards. 2008. Distribution and spawning dynamics of capelin (*Mallotus villosus*) in Glacier Bay, Alaska: a cold water refugium. Fisheries Oceanography 17:137–146.

Arimitsu, M. L., J. F. Piatt, E. N. Madison, J. S. Conaway, and N. Hillgruber. 2012. Oceanographic gradients and seabird prey community dynamics in glacial fjords. Fisheries Oceanography 21:148–169.

Arimitsu, M. L., J. F. Piatt, and F. J. Mueter. 2016. Influence of glacier runoff on ecosystem structure in Gulf of Alaska fjords. Marine Ecology Progress Series 560:19–40.

Arimitsu, M. L., K. Hobson, D. Webber, J. Piatt, E. Hood, and J. Fellman. 2017. Tracing biogeochemical subsidies from glacier runoff into Alaska coastal marine food webs. Global Change Biology, 24, 387–398.

Arimitsu, M. L., J. F. Piatt, S. A. Hatch, R. M. Suryan, S. D. Batten, M. A. Bishop, R. W. Campbell, H. Coletti, D. A. Cushing, K. B. Gorman, R. R. Hopcroft, K. J. Kuletz, C. Marsteller, C. A. E. McKinstry, D. W. McGowan, J. R. Moran, W. S. Pegau, A. L. Schaefer, S. K. Schoen, J. M. Straley, and V. R. von Biela. 2021. Heatwave-induced synchrony within forage fish portfolio disrupts energy flow to top pelagic predators. Global Change Biology. https://doi.org/10.1111/gcb.15556

McGowan, D. W., Goldstein, E. D., **Arimitsu, M. L.,** Deary, A. L., Ormseth, O., Robertis, A. De, Horne, J. K., Rogers, L. A., Matthew, T., Coyle, K. O., Holderied, K., Piatt, J. F., Stockhausen, W. T., & Zador, S. (2020). Spatial and temporal dynamics of Pacific capelin *Mallotus catervarius* in the Gulf of Alaska : implications for ecosystem-based fisheries management. Marine Ecology Progress Series, 637, 117–140.

Suryan, R. M., **M. L. Arimitsu,** H. A. Coletti, R. R. Hopcroft, M. R. Lindeberg, S. J. Barbeaux, S. D. Batten, W. J. Burt, M. A. Bishop, J. L. Bodkin, R. E. Brenner, R. W. Campbell, D. A. Cushing, S. L. Danielson, M. W. Dorn, B. Drummond, D. Esler, T. Gelatt, D. H. Hanselman, S. A. Hatch, S. Haught, K. Holderied, K. Iken, D. B. Iron, A. B. Kettle, D. G. Kimmel, B. Konar, K. J. Kuletz, B. J. Laurel, J. M. Maniscalco, C. Matkin, C. A. E. McKinstry, D. H. Monson, J. R. Moran, D. Olsen, W. A. Palsson, W. S. Pegau, J. F. Piatt, L. A. Rogers, N. A. Rojek, A. Schaefer, I. B. Spies, J. M. Straley, S. L. Strom, K. L. Sweeney, M. Szymkowiak, B. P. Weitzman, E. M. Yasumiishi, and S. G. Zador. 2021. Ecosystem response persists after a prolonged marine heatwave. Scientific Reports. https://doi.org/10.1038

Sydeman, W. J., Piatt, J. F., Thompson, S. A., García-Reyes, M., Hatch, S. A., **Arimitsu, M. L**., Slater, L., Williams, J.

C., Rojek, N. A., Zador, S. G., & Renner, H. M. (2017). Puffins reveal contrasting relationships between forage fish and ocean climate in the N. Pacific. Fisheries Oceanography, 26, 379–395. https://doi.org/10.1111/fog.12204

Sydeman, W. J., Thompson, S., Anker-Nilssen, T., **Arimitsu, M. L.,** Bennison, A., Boersch-Supan, P., Bransome, N., Boyd, C., Crawford, R., Daunt, F., Furness, R. W., Gianuca, D., Gladics, A., Koehn, L., Lang, J., Logerwell, E., Morris, T., Phillips, E., Provencher, J., … Zador, S. G. 2017. Best practices for assessing forage fish fisheries - seabird resource competition. Fisheries Research, 19, 209–221.

von Biela, V. R., **M. L. Arimitsu,** J. F. Piatt, B. Heflin, S. K. Schoen, J. L. Trowbridge, and C. M. Clawson. 2019. Extreme reduction in nutritional value of a key forage fish during the Pacific marine heatwave of 2014-2016. Marine Ecology Progress Series 613:171–182.

OTHER SIGNIFICANT PUBLICATIONS

Moran, J. R., M. B. O'Dell, **M. L. Arimitsu**, J. M. Straley, and D. M. S. Dickson. 2018. Seasonal distribution of Dall's porpoise in Prince William Sound, Alaska. Deep-Sea Research Part II.

Schoen, S. K., J. F. Piatt, **M. L. Arimitsu,** B. M. Heflin, E. N. Madison, G. S. Drew, M. Renner, N. A. Rojek, D. C. Douglas, and A. R. DeGange. 2018. Avian predator buffers against variability in marine habitats with flexible foraging behavior. Marine Biology 165:47.

Thompson, S. A., M. García-Reyes, W. Sydeman, **M.L. Arimitsu,** S. Hatch, and J. Piatt. 2019. Effects of ocean climate on the length and condition of forage fish in the Gulf of Alaska. Fisheries Oceanography, 28, 658–671. https://doi.org/10.1111/fog.12443

Thorson, J. T., **M.L. Arimitsu,** L. Barnettt, W. Cheng, L. Eisner, A. Haynie, A. Hermann, K. Holsman, D. Kimmel, M. Lomas, J. Richar, and E. Siddon. 2021. Forecasting community reassembly using climate-linked spatio-temporal ecosystem models. Ecography, 44, 1–14. https://doi.org/10.1111/ecog.05471

Van Hemert, C., Schoen, S. K., Litaker, R. W., Smith, M. M., **Arimitsu, M. L.,** Piatt, J. F., Holland, W. C., Hardison, D. R., & Pearce, J. M. (2020). Algal toxins in Alaskan seabirds: Evaluating the role of saxitoxin and domoic acid in a large-scale die-o ff of Common Murres. Harmful Algae, 92, 101730. https://doi.org/10.1016/j.hal.2019.101730

EDUCATION

University of California, Santa Cruz CA	B.Sc. Biology (1998)
University of Alaska Fairbanks, Juneau AK	M.Sc. Fisheries (2009)
University of Alaska Fairbanks, Juneau AK	Ph.D. Fisheries (2016)

COLLABORATIONS

Sonia Batten (PICES), Mary Anne Bishop (PWSSC), Rob Campbell (PWSSC), Heather Coletti (NPS), Dan Cushing (Pole Star Ecological), Gary Drew (USGS), Kristen Gorman (UAF), Scott Hatch (ISRC), Brielle Heflin (USGS), Keith Hobson (University of Ottowa), Russ Hopcroft (UAF), Kathy Kuletz (USFWS), Caitlin Marsteller (USGS), John Moran (NOAA), Dan Olsen (North Gulf Oceanic Society), John Piatt (USGS) , Anne Schaeffer (PWSSC), Sarah Schoen (USGS), Jan Straley (UAS) , Rob Suryan (NOAA), Bill Sydeman (Farallones Institute), Sarah Ann Thompson (Farallones Institute), Jim Thorson (NOAA), Caroline Van Hemert (USGS), Vanessa von Biela (USGS)

COMPONENT LEAD: HERRING RESEARCH & MONITORING

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RELEVANT PROFESSIONAL EXPERIENCE

Research Interests:

Circulation in Prince William Sound, Cook Inlet and the Gulf of Alaska and the associated larval transport. Relationship between oceanographic conditions and fisheries. Application of remote sensing for understanding coastal processes. Development of novel oil spill detection and tracking approaches. Understanding the fate and behavior of oil spilled in cold water environments.

Experience:

1996-1997	Research Associate (Post Doc), Oregon State University
1997-1999	Faculty Research Associate, Oregon State University
1999-2010	Assistant Professor, Oregon State University
2002-2003	Senior Scientist, Kachemak Bay Research Reserve
2003-2007	Research Coordinator, Kachemak Bay Research Reserve
2017-2020	Chief Operations Officer, Prince William Sound Science Center
2007-present	Research Program Manager, Oil Spill Recovery Institute
2009-present	Coordinator of the Herring Research and Monitoring program

MOST RELEVANT PUBLICATIONS

Aderhold, D. G. R., M. R. Lindeberg, K. Holderied, and W. S. Pegau, 2018. Spatial and temporal ecological variability in the northern Gulf of Alaska: What have we learned since the *Exxon Valdez* oil spill? Deep Sea Research II. 147, 3-8. DOI 10.1016/j.dsr2.2017.11.015

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Batten, S.D., S. Moffitt, W.S. Pegau, and R. Campbell. 2016. Plankton indices explain interannual variability in Prince William Sound herring first year growth, Fisheries Oceanography, 25, 420-432.

OTHER SIGNIFICANT PUBLICATIONS

National Academies of Sciences, Engineering, and Medicine, 2019. The Use of Dispersants in Marine Oil Spill Response. Washington, DC: The National Academies Press. DOI 10.17226/25161

Jarosz, E., D. Wang, H Wijesekera, W.S. Pegau, and J.N. Moum. 2017. Flow Variability within the Alaska Coastal Current in winter, Journal of Geophysical Research: Oceans, 122, 3884-3906. DOI 10.1002/2016JC012102

Musgrave, D.L., M.J. Halverson, and W.S. Pegau, Seasonal Surface Circulation, Temperature, and Salinity in Prince William Sound, Alaska, Continental Shelf Research, doi:10.1016/j.csr.2012.12.001, 2012.

Halverson, M.J., J.C. Ohlmann, M.A. Johnson, W.S. Pegau, Disruption of a cyclonic eddy circulation by wind stress in Prince William Sound, Alaska, Continental Shelf Research, 63, S13-S25, 2013.

Montes-Hugo, M. A., K. Carder, R. J. Foy, J. Cannizzaro, E. Brown, and S. Pegau, Estimating phytoplankton biomass in coastal waters of Alaska using airborne remote sensing, Remote Sensing of Environment. 98, 481-493, 2005.

EDUCATION

1990 B.S., Physics, University of Alaska, Fairbanks
1996 Ph.D, Oceanography, Oregon State University

COLLABORATORS

Eric Adams (MIT), Donna Aderhold (PWSSC), Mayumi Arimitsu (USGS), Adriana Bejarano (RPI), Mary Anne Bishop (PWSSC), Michel Boufadel (NJIT), Trevor Branch (UW), Victoria Broje (Shell), Gina Coelho (Sponson), Thomas Coolbaugh (ExxonMobil), Cortis Cooper (Chevron), Dominic Di Toro (U Del), Sherri Dressel (ADF&G), Jessica Garron (UAF), Julia Gohlke (VPI), Bernard Goldstein (U Pitt), Kristen Gorman (UAF), Stormy Haught (ADF&G), Terry Hazen (U Tenn), Ron Heintz (SSSC), Paul Hershberger (USGS), Kris Holderied (NOAA), Hayley Hoover (PWSSC), Rob Hovsapian (NREL), Ewa Jarosz (NRL), Mary Landry, Damien Jossett (NRL), Stacee Karras (NAS), Tom Kline, Clay Koplin (CEC), Ken Lee (DFO), Mandy Lindeberg (NOAA), Steve Martell (Sea State Inc), Steve Moffitt, Jim Moum (OSU), Steve Murawski (USF), Tim Nedwed (ExxonMobil), Marc Oggier (UAF), Pete Rand (PWSSC), Jeep Rice, Megan Roberts, Susan Roberts (NAS), Fletcher Sewell (NOAA), William Teague (NRL), Richard Thorne, Tim Thornton (Tactical Electronics), Ron Tjeermdema (UC Davis), David Valentine (UCSB), David Wang (NRL), Hemantha Wijesekera (NRL), Helen White (Haverford), Andrew Whitehead (UC Davis).

COMPONENT LEAD: NEARSHORE ECOSYSTEMS

HEATHER A. COLETTI

National Park Service
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RELEVANT PROFESSIONAL EXPERIENCE:

Marine Ecologist, National Park Service Southwest Alaska Network (SWAN) Inventory and Monitoring (I&M) Program tasked with monitoring resources that are explicitly linked to the marine nearshore along regions within the Gulf of Alaska through the NPS SWAN I&M program and Gulf Watch Alaska (GWA). Component lead of the Nearshore Component of GWA since 2017.

RELEVANT PUBLICATIONS (GWA):

Arimitsu, M., J. Piatt, R.M. Suryan, S. Batten, M.A. Bishop, R.W. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R.R. Hopcroft, K.J. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, J. Moran, R.S. Pegau, A. Schaefer, S. Schoen, J. Straley, and V.R. von Biela. In Review. Synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. Global Change Biology.

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Coletti, H. A. In Press. Sea Otter Behavior and Its Influence on Littoral Community Structure. In R.W. Davis and A. Pagano (Eds) The Ethology of Marine Mammals: Polar Bears and Sea otters. Springer.

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Piatt, J.F., J.K. Parrish, H.M. Renner, S. Schoen, T. Jones, K. Kuletz, B. Bodenstein, M. Arimitsu, M. García-Reyes, R. Duerr, R. Corcoran, R. Kaler, G. McChesney, R. Golightly, H. Coletti, R. M. Suryan, H. Burgess, J. Lindsey, K. Lindquist, P. Warzybok, J. Jahncke, J. Roletto, W. Sydeman. In Review. Mass mortality and chronic reproductive failure of common murres during and after the 2014-2016 northeast Pacific marine heatwave. PLOS One.

Suryan, R.M., M. Arimitsu, H. Coletti, R.R. Hopcroft, M.R. Lindeberg, S. Batten, M.A. Bishop, R. Brenner, R. Campbell, D. Cushing, S. Danielson, D. Esler, T. Gelatt, S. Hatch, S. Haught, K. Holderied, K. Iken, D. Irons, D. Kimmel, B. Konar, K. Kuletz, B. Laurel, J.M. Maniscalco, C. Matkin, C. McKinstry, D. Monson, J. Moran, D. Olsen, S. Pegau, J. Piatt, L. Rogers, A. Schaefer, J. Straley, K. Seeeney, M. Szymkowiak, B. Weitzman, J. Bodkin, and S. Zador. In Press. Ecosystem response to a prolonged marine heatwave. Scientific Reports.

Weitzman B, Konar B, Iken K, Coletti H, Monson D, Suryan R, Dean T, Hondolero D and Lindeberg M. 2021. Changes in Rocky Intertidal Community Structure During a Marine Heatwave in the Northern Gulf of Alaska. Front. Mar. Sci. 8:556820. doi: 10.3389/fmars.2021.556820

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Ballachey, B.E., J.L. Bodkin, K.A. Kloecker, T.A. Dean, and H.A. Coletti. 2015. Monitoring for Evaluation of Recovery and Restoration of Injured Nearshore Resources. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 10100750), U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska.

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Rider, M., Apeti, D.A., Jacob, A., Kimbrough, K., Davenport, E., Bower, M., Coletti, H. and Esler, D., 2020. A Synthesis of Ten Years of Chemical Contaminants Monitoring in National Park Service - Southeast and Southwest Alaska Networks. A collaboration with the NOAA National Mussel Watch Program. NOAA Technical Memorandum NOS NCCOS 277. Silver Spring, MD. 110 pp. DOI 10.25923/dbyq-7z17 https://repository.library.noaa.gov/view/noaa/25520

EDUCATION: Master of Science, Natural Resources: Environmental Conservation (University of New Hampshire, Durham, New Hampshire). Bachelor of Science, Zoology (University of Rhode Island, Kingston, RI).

COLLABORATORS:

Dr. Brenda Ballachey (USGS), Mr. James Bodkin (USGS), Mr. Michael Booz (ADF&G), Dr. Lizabeth Bowen (USGS), Dr. Katrina Counihan (ASLC), Dr. Thomas Dean, Dr. Dan Esler (USGS), Dr. Grant Hilderbrand (NPS), Dr. Katrin Iken (University of Alaska Fairbanks), Dr. Tahzay Jones (NPS), Mr. Robert Kaler (USFWS), Dr. Brenda Konar (University of Alaska Fairbanks), Ms. Mandy Lindeberg (NOAA), Dr. Daniel Monson (USGS) , Dr. John Piatt (USGS), Dr. Benjamin Pister (NPS), Dr. Robert Suryan (NOAA), Dr. Vanessa Von Biela (USGS). (Note: full listing of Gulf Watch Alaska PI's not given here; available upon request).

COMPONENT LEAD: LINGERING OIL

DAN ESLER

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RELEVANT PROFESSIONAL EXPERIENCE

Leader, Nearshore Marine Ecosystems Research Program (NMERP) of the Alaska Science Center, USGS. My program conducts studies to document and understand underlying causes of change in nearshore marine systems (August 2013 – present).

University Research Associate and Adjunct Professor, Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, British Columbia (February 2001 – May 2013).

MOST RELEVANT PUBLICATIONS

Konar, B., T.J. Mitchell, K. Iken, H. Coletti, T. Dean, **D. Esler**, M. Lindeberg, B. Pister, and B. Weitzman. 2019. Wasting disease and static environmental variables drive sea star assemblages in the northern Gulf of Alaska. Journal of Experimental Marine Biology and Ecology 520.

Esler, D., B.E. Ballachey, C.O. Matkin, D. Cushing, R. Kaler, J. Bodkin, D. Monson, G.G. Esslinger, and K. Kloecker. 2018. Timelines and mechanisms of wildlife population recovery following the *Exxon Valdez* oil spill. Deep Sea Research II 147:36-42.

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Bodkin, J. L., **D. Esler**, S. D. Rice, C. O. Matkin, and B. E. Ballachey. 2014. The effects of spilled oil on coastal ecosystems: lessons from the *Exxon Valdez* spill. Pp. 311-346 in B. Maslo and J. L. Lockwood, eds. Coastal Conservation. Cambridge University Press.

Esler, D., B. E. Ballachey, K. A. Trust, S. A. Iverson, J. A. Reed, A. K. Miles, J. D. Henderson, B. W. Wilson, B. R. Woodin, J. R. Stegeman, M. McAdie, and D. M. Mulcahy. 2011. Cytochrome P4501A biomarker indication of the timeline of chronic exposure of Barrow's goldeneye to residual *Exxon Valdez* oil . Marine Pollution Bulletin 62:609-614.

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Iverson, S. A., and **D. Esler**. 2010. Harlequin duck population dynamics following the 1989 *Exxon Valdez* oil spill: assessing injury and projecting a timeline to recovery. Ecological Applications 20:1993-2006.

OTHER SIGNIFICANT PUBLICATIONS

Esler, D., and S. A. Iverson. 2010. Female harlequin duck winter survival 11 to 14 years after the *Exxon Valdez* oil spill Journal of Wildlife Management 74:471-478.

Peterson, C. H., S. D. Rice, J. W. Short, **D. Esler**, J. L. Bodkin, B. A. Ballachey, and D. B. Irons. 2003. Long-term ecosystem response to the *Exxon Valdez* oil spill. Science 302:2082-2086.

Esler, D., T. D. Bowman, K. Trust, B. E. Ballachey, T. A. Dean, S. C. Jewett, and C. E. O'Clair. 2002. Harlequin duck population recovery following the *Exxon Valdez* oil spill: progress, process, and constraints. Marine Ecology Progress Series 241:271-286.

EDUCATION

2000 Ph.D. Wildlife Science. Oregon State University, Corvallis, Oregon, USA.
1988 M.Sc. Wildlife Ecology. Texas A&M University, College Station, Texas, USA.
1985 B.Sc. Biology/Outdoor Education. Northland College, Ashland, Wisconsin, USA.

COLLABORATIONS

Anderson, Eric (British Columbia Institute of Technology), Ballachey, Brenda (USGS-retired), Bodkin, James (USGS-retired), Bowen, Liz (USGS), Bowman, Tim (USFWS), Boyd, W. Sean (Environment Canada), Coletti, Heather (NPS), Green, David (Simon Fraser University), Hogan, Danica (Environment Canada), Hollmen, Tuula (UAF/Alaska SeaLife Center), Iken, Katrin (UAF), Konar, Brenda (UAF), Kurtz, Deborah (NPS), Lok, Erika (Environment Canada), Lindeberg, Mandy (NOAA), Rice, Jeep (NOAA-retired), Schmutz, Joel (USGS), Thompson, Jonathan (Alberta Provincial Covernment), Tinker, Tim (USGS/University of California Santa Cruz), Uher-Koch, Brian (USGS), Ward, David (USGS), Weitzman, Ben (NOAA), Willie, Megan (Simon Fraser University), Ydenberg, Ron (Simon Fraser University)

ATTACHMENT 2 – List of leveraged partners for GWA and HRM programs in 2020

Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) project summary of leveraged partnerships with outside agencies and groups to integrate data from broader efforts. Affiliated partner acronyms are defined in the text of the proposal.

GWA Project / Affiliated Partner(s)	Description
Program Management 20120114-A-B	
NOAA NMFS AFSC & NPFMC	Coordinate GWA contributions (23) to GOA Ecosystem Status Report for fisheries stock assessments
PWS Forage Fish 20120114-C	
NPRB/NOAA	Coordinate with GOAIERP PIs on synthesis of capelin in the GOA
NOAA NMFS AFSC & NPFMC	Contribute forage fish trend data to GOA Ecosystem Status Report for fisheries stock assessments and socioeconomic profiles
USGS/USFWS/NPS/UW	Provide information, data, and samples for documenting a large-scale common murre die-off centered in PWS
NPRB/OSU/ PWSSC/USGS	Provide forage fish and macrozooplankton samples for harmful algal bloom study
USGS/BOEM	Complimentary study of forage fish and seabird trends in areas of oil and gas development in Cook Inlet
Farallon Institute/USGS	Contribute predator diet data for analyses of biogeography and spatio-temporal variation in forage fish from southeast AK to the western Aleutians
BOEM/NOAA/USFWS/UAF	Compile data on forage fish for resource management and planning in areas of oil and gas development
Canada DFO/NPS	Coordinate and advise on forage fish monitoring methods
CPR 20120114-D	
NPRB	NPRB contributes funding at a similar annual level to that requested here, through NPRB's long-term monitoring program
Canada DFO	The Canadian Department of Fisheries and Oceans (DFO) contributes funding annually to PICES and in-kind support by providing laboratory facilities at the DFO lab in Sidney, BC. Plankton data are contributed to annual State of the Ocean reports
NOAA NMFS AFSC & NPFMC	Contribute plankton data to GOA Ecosystem Status Report and Socioeconomic Profiles for stock assessments
PWS Fall/Winter Marine Birds 20120114-E	
ADF&G	ADF&G provides a vessel for a survey platform annually
USFWS/USGS	Project data are uploaded to the North Pacific Pelagic Seabird Database (NPPSD), maintained by USFWS and USGS and made available to the scientific community for research and analysis

GWA Project / Affiliated Partner(s)	Description
PWSRCAC	Conduct complementary marine bird transects during late winter in and around the oil tanker lane for use by RCAC in oil spill response planning; data also incorporated into the marine bird fall/winter database
PWS Oceanography 20120114-G	
NOAA NMFS AFSC & NPFMC	Contribute 4 oceanographic and plankton indicators to GOA Ecosystem Considerations Report for stock assessments
OSU	Synthesis of physical oceanographic datasets from the inner fjords across the GOA
Georgia Tech/WHOI	Proposing to leverage GWA observations to develop and deploy autonomous drifters near Columbia Glacier
PWSAC	Collaborate with PWSAC staff to use GWA and other observations to better time releases of hatchery fish
APSH	Collect samples for pCO_2 measurements at Alutiiq Pride Shellfish Hatchery
USGS Marrowstone	Plankton samples used to test for fish disease life stages
USGS/UW/Northeastern	Proposing to add a discrete water sampler to the profiler
USGS/ASC/Boise State	Proposing to leverage GWA observations in the vicinity of tidewater glaciers
OSU/NOAA Beaufort	Phytoplankton, fish, and shellfish samples being sent to OSU Hatfield Marine Science Center and NOAA Beaufort Laboratory for analysis of the prevalence of paralytic shellfish toxins in the marine food webs of PWS and Kachemak Bay
NPRB	NPRB funding is used to evaluate high frequency observations of the secondary production cycle in PWS
ADF&G	The project endeavors to conduct a spring cruise around the time of herring spawning to coordinate oceanographic data with ADF&G spawn survey data
OSRI/UAF	Water samples collected to test the efficacy of additives designed to enhance microbial degradation of oil spills
Nearshore Ecosystems 20120114-H	
NPS	Documenting variation in nearshore physical oceanography in relation to tidewater glacial input and quantifying biological responses to that variation across trophic levels in Kenai Fjords NP
NSF/UAA/UAS	Examining how the timing, duration, and character of the freshwater flux from precipitation vs glacial melt influences nearshore biological communities at sites from southeast AK to Kachemak Bay
USGS & USFWS MMM	Katmai National Park and Preserve nearshore data include studies of the status of the southwest Alaska stock of sea otters, which is listed as threatened under MMPA; data are shared with USFWS MMM which has management responsibility for the species
NP Foundation/ USGS WERC/ASLC	The Changing Tides study examines the linkages between terrestrial and marine ecosystems and is based in Katmai National Park and Preserve

GWA Project / Affiliated Partner(s)	Description
BOEM/NPS	Nearshore Component PIs are developing recommendations to BOEM for nearshore community assessment and long-term monitoring related to the agency's OCS leasing program in lower Cook Inlet
CMI/BOEM/NPS	Analyzing food web structure in western Cook Inlet and Kachemak Bay
NPS	Collaborating on the Pacific Nearshore Project to assess the overall health of nearshore ecosystems across the north Pacific
Simon Fraser University	Collaboration on studies of black oystercatcher movement ecology and migration strategies
NOAA NMFS AFSC & NPFMC	Contribute 4 nearshore indicators to the GOA Ecosystem Status Report for stock assessments
USGS	Collaborated to ensure marine bird and mammal data collected since 2006 in the GWA nearshore regions were included into the North Pacific Pelagic Seabird Database
GAK-1 20120114-I	
NOAA NMFS AFSC & NPFMC	Contribute oceanographic indicators to GOA Ecosystem Status Report for stock assessments
ADF&G	Data made available to ADF&G for salmon forecasting
NPS	Establishing monthly sampling data and processing protocol in Glacier Bay national Park and Preserve
AOOS	Data are used for ocean acidification monitoring at a surface buoy near GAK-1
NSF/IOOS	Project is part of the NGA LTER program
LCI/KBay Oceanography 20120114-J	
NOAA Beaufort Lab	Project phytoplankton data used to identify environmental triggers for increases in *Alexandrium* that causes PSP
NOAA NMFS	Provide data for the Kachemak Bay Habitat Focus Area
NOAA NMFS Protected Resources	Provide data for whale and sea lion mortalities in Cook Inlet
ADF&G/ADEC/ADHSS	Provide real-time data and historical trends on water temperature to shellfish managers related to harmful algal blooms
USFWS	Provide vessel platform for opportunistic seabird/marine mammal observers, coordinate on sea otter stranding and sampling, and coordinate with Alaska Maritime NWR on seabird and sea otter mortality events
NPRB/OSU/NOAA Beaufort	Phytoplankton, fish, and shellfish samples being sent to OSU Hatfield Marine Science Center and NOAA Beaufort Laboratory for analysis of the prevalence of paralytic shellfish toxins in the marine foodwebs of PWS and Kachemak Bay
AOOS	The need for routine oceanic observations in Cook Inlet and Kachemak Bay has been identified as a high priority in regional workshops and stakeholder meetings
Seward Line 20120114-L	

GWA Project / Affiliated Partner(s)	Description
NOAA NMFS AFSC & NPFMC	Contribute 2 oceanographic and plankton indicators to GOA Ecosystem Status Report for stock assessments
ADF&G	Data are made available to ADF&G for salmon forecasting
NPRB/AOOS	Multi-disciplinary sampling program that represents the most comprehensive long-term dataset available for the northern GOA
NSF	Project is part of the Northern GOA LTER program
USFWS	Provide vessel platform for seabird/marine mammal observers
NOAA	Provide bongo collections for larval fish assessments
Summer Marine Birds 20120114-M	
USFS/NPS/ADF&G	Data inform management agencies with lands and waters adjacent to the study area
Alaska Maritime NWR	Data on population trends are provided for inclusion in annual reports on status and trends of seabirds in Alaska
Killer Whales 20120114-N	
NOAA NMML	Data are supplied annually to NOAA NMML for application in marine mammal stock assessments
NOAA NMML	Confirm detection of killer whales in Cook Inlet beluga whale monitoring
NOAA Northwest Region	Contribute fecal samples for comparison of microplastics with endangered Southern Resident killer whale
NOAA Northwest Region	Collaborate on publication using fecal samples for comparison of diet with endangered Southern Resident killer whale diet
Canada DFO Pacific Biological Station	Contribute prey remains from killer whale predation events as part of long-term Resident killer whale diet study
Canada DFO Pacific Biological Station	Contribute data and share authorship on publication regarding diet of Offshore killer whales
Orcasound/Google	Contribute autonomous and field recordings to advance coding for active learning automatic detection of killer whale calls
Happywhale	Contribute to worldwide killer whale database
Humpback Whales 20120114-O	
NOAA PRD	Data from this project will be implemented into the de-listing monitoring plan for humpback whales and builds on data collected on humpback whales in southeast Alaska
NOAA NMFS	Draft Biological Report for the Proposed Designation of Critical Habitat for the Central America, Mexico, and Western North Pacific Distinct Population Segments of Humpback Whales
NOAA NMFS AFSC & NPFMC	Contribute indicators to the GOA Ecosystem Status Report for stock assessments
NOAA NMML	Collect eDNA from harbor porpoise to identify stock structure
ADF&G	Photograph Steller sea lion brands whenever possible, re-sightings used to identify movements and survival rates
IWC Comp. Assess. Working Group	Used to inform the population structure model for the IWC's Comprehensive Assessment

GWA Project / Affiliated Partner(s)	Description
Happywhale	Contribute to worldwide humpback whale database
Alaska Whale Foundation/UH Manoa	Provide data on humpback whale populations in the GOA
HRM 20120111-A	
ADF&G	The monitoring work of the HRM program provides the data necessary for ADF&G to monitor the Pacific herring population in PWS and determine if the population is at a fishable threshold
HRM 20120111-C	
ADF&G	Coordination with ADF&G scientists is ongoing and required for data inputs collected by ADF&G and used in the BASA stock assessment model
HRM 20120111-E	
ADF&G	Cordova to collect herring infection and disease data onboard the shared ADF&G seining platform; Sitka to collect herring infection and disease data from pre-spawn aggregations in Sitka Sound; Juneau to provide consistent virologic methods between all EVOSTC funded herring disease projects between 1994 and present
NOAA Fisheries AFSC	Walleye pollock samples from Shelikoff Strait were used to assess Ichthyophonus infection prevalence and attempt laboratory transmission studies through ovivory
HRM 20120111-G	
ADF&G	To coordinate surveys based on their aerial survey and age-sex-length sampling. We depend on the ADF&G data for final processing of the acoustics information
HRM 20120115	
NOAA NWFSC/ USGS Marrowstone Facility	Collaborating in animal exposure experiments, since they have research goals that include oil exposure impacts on growth and development
ADF&G	Hundreds of Pacific herring tissue samples for population genomics analysis were provided to the project
HRM 20120116-B	
ADF&G	In the field collaboration to locate adult herring schools in spring for capture and tagging; receive age, weight, and length data from ADF&G that has helped us with aging captured herring
HRM 20120116-F	
ADF&G	The estimates of aerial biomass as well as acoustic biomass and age structured assessment model outputs are central in evaluating the population in relation to regulatory thresholds set by ADF&G in the Prince William Sound Herring Management Plan (5 AAC 27.365); results of these surveys are disseminated to all relevant ADF&G commercial fisheries management and research staff

ATTACHMENT 3 – Program Letters of Commitment

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Alaska Fisheries Science Center
7600 Sand Point Way N.E.
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July 7, 2021

Shiway Wang
Exxon Valdez Oil Spill Trustee Council
4230 University Drive, Ste. 220
Anchorage, AK 99508-4650

Dear Ms. Wang,

We are pleased to provide this letter of commitment for the Gulf Watch Alaska – Long-Term Research and Monitoring (GWA-LTRM) program proposal and two embedded project proposals to the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC). These proposals were drafted in response to the EVOSTC's FY22-31 Invitation in March and subsequent request for final submission by August 13, 2021. AFSC will provide support for Mandy Lindeberg as the GWA Program Lead and Rob Suryan as Science Lead. AFSC also supports John Moran as a principal investigator (PI) for the humpback whale monitoring project and Mandy Lindeberg as a co-PI for the periodic lingering oil project. We support AFSC's role in leading and conducting research for this long-term program with in-kind contributions by our agency.

If these proposals are funded over the next 10 years, in-kind support is estimated to be:

- GWA-LTRM Program proposal 2222LTRM: $100K/year = salaries (6 mos/year combined salary for Lindeberg and Suryan).
- Humpback Whale project #22120114-O: $140K/year = $90K/year for salary (7 mos/year for PI Moran); and all field and laboratory equipment required ($50 K/year).
- Lingering Oil project # 22220114-P: $84K = salary (5 mos/10 years) for co-PI Lindeberg.
- Nearshore project #22120114-H: $10K/year = salary for co-PI Lindeberg

Sincerely,

Robert J. Foy, Ph.D.
Science and Research Director

PRINCE WILLIAM SOUND SCIENCE CENTER

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August 11, 2021

To: Mandy Lindeberg - NOAA, GWA-LTRM Program Lead
Shiway Wang, EVOSTC Executive Director

Re: *Letter of Commitment*

I am pleased to provide this letter of commitment for the Prince William Sound Science Center's participation in the proposed project "*Gulf Watch Alaska Long-Term Research and Monitoring Program of Marine Conditions and Injured Resources*", project number 2222LTRM that is part of the program management of the Gulf Watch Alaska Long-Term Research and Monitoring (GWA-LTRM) program and is led by principal investigator (PI) Katrina Hoffman, Administrative Lead. I work collaboratively with PIs Lindeberg and Suryan on this project and commit to collaborating with Herring Lead Pegau and Data Management Lead Janzen to ensure effective program management. Together, we engage with all PIs to ensure that the GWA-LTRM program is carried out according to plan.

This proposal was drafted in response to the EVOSTC's FY22-31 Invitation for Proposals and subsequent request for final submission on August 13, 2021. PWSSC's costs for this project over a ten-year period will be $5,500,920 (without EVOSTC GA).

This project proposal is part of the larger multi-agency GWA-LTRM program proposal package and follows on the tails of a decade of GWA-LTRM work. Across many years, PWSSC has successfully provided fiscal administration services to non-Trustee Agency partners, as well as all PWSSC PIs, for these integrated programs supported by the EVOSTC and various agencies and organizational investments

Thank you for the opportunity to serve on behalf of the priorities and interests of the *Exxon Valdez* Oil Spill Trustee Council.

Sincerely,

Katrina Hoffman, President & CEO
Authorized Representative of Prince William Sound Science Center
khoffman@pwssc.org *907-424-5800*