Exxon Valdez **Oil Spill Trustee Council**

Long-Term Research and Monitoring, Mariculture, Education and Outreach

Annual Program Reporting Form

Program Number: 2322LTRM

Program Title: Gulf Watch Alaska Long-Term Research and Monitoring of Marine Conditions and Injured Resources

Principal Investigator(s): Mandy Lindeberg, National Oceanic and Atmospheric Administration, Auke Bay Laboratories, and Katrina Hoffman, Prince William Sound Science Center

Reporting Period: February 1, 2023 – January 31, 2024

Submission Date: April 1, 2024

Program Website: https://gulfwatchalaska.org/

Please check all the boxes that apply to the current reporting period.

☒ **Program progress is on schedule.**

Overall, the program is on schedule; however, several projects experienced delays due to delays in funding allocation.

☒ **Program progress is delayed.**

Because of the delay in the release of *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) funds, most projects are behind in their spending and will need to carry over funds from FY23 to FY24. The National Oceanic and Atmospheric Administration grant for non-Trustee organizations was released in early June 2022, with a grant fiscal year of June 1 – May 30 which is offset from the EVOSTC fiscal year of February 1 – January 31. More information may be found in Section 5 (Budget) and in individual project reports regarding the effect of delayed funding.

☒ **Budget reallocation request.**

On behalf of the projects, the program requests a no-cost extension for FY22 and FY23 funds that remain unspent because of the delay in funding allocation. More information may be found in Section 5 (Budget) and in individual project reports regarding the effect of delayed funding.

☐ **Personnel changes.**

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1. Summary of Work Performed:

This report serves as the fiscal year 2023 (FY23) annual report for the program management project (2322LTRM) and the program annual report for the Gulf Watch Alaska Long-Term

Research and Monitoring (GWA-LTRM) program. Below, the Program Management section provides a thorough accounting of the Program Management Team's (PMT's) work and the Nearshore, Environmental Drivers, Pelagic, Herring Research and Monitoring (HRM), and Lingering Oil component sections provide brief summaries of the work performed by each of the monitoring and research projects funded by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) as part of the GWA-LTRM program.

Program Management

Program Lead Mandy Lindeberg was on medical leave for much of FY23. Science Lead Rob Suryan picked up many of her duties. Because the PMT is small (four people), losing a key team member resulted in the PMT selecting the most important aspects of leadership duties to maintain during the year. The PMT continued to maintain oversight of all projects that are part of the GWA-LTRM program, provided oversight of the National Oceanic and Atmospheric Administration (NOAA) grant to non-Trustee organizations, assisted projects with funding change requests and closeouts with EVOSTC, held GWA-LTRM PI meetings, coordinated with the GWA-LTRM science review panel (SRP), and coordinated with other EVOSTC-funded programs and projects. Summaries of these activities are described in the subsections below.

Fiscal Administration

The Prince William Sound Science Center (PWSSC) continued its role as the fiscal agent for non-Trustee organizations working on EVOSTC long-term monitoring projects through the NOAA grant to PWSSC. The NOAA grant includes non-Trustee organizations with projects included in the GWA-LTRM program, the Data Management program, and the ocean acidification project at the Alutiiq Pride Shellfish Hatchery (this project submitted a final report to EVOSTC and was closed out). The NOAA grant runs from June 1 through May 30 each year and is offset from the EVOSTC fiscal year for the FY22-FY26 funding cycle. PWSSC maintained its fiscal obligations under the NOAA grant, including paying invoices from subawardees and submitting semi-annual reports (both programmatic and fiscal).

The PMT worked with several projects on project close-outs and funding redistribution. The Prince William Sound (PWS) walleye pollock-Pacific herring interactions project (22220203, PIs Rhea-Fournier et al.) ended without collecting any data when the vessel the team planned to use was decommissioned by the Alaska Department of Fish and Game (ADF&G) and no other vessel was available to perform the work within the allotted budget. The budgets for the herring surveys project (23170111-F, PI Morella) and herring disease program project (23120111-E, PIs

Hershberger and Paez) were adjusted to continue collecting pollock eggs for use in disease research. Several other projects (herring modeling [23120111-C, PI Branch], herring-salmon interactions [23220111-I PIs Rand et al.], and PWS oceanography [23120114-G, PI Campbell) submitted budget revisions to EVOSTC through the PMT, all of which were approved.

The PMT also worked with EVOSTC on a budget adjustment proposal to use funds intended for a science coordinator to fund bird surveys associated with the integrated predator-prey (IPP) surveys conducted by the forage fish (23120114-C, PIs Arimitsu and Piatt) and humpback whale (23120114-O) projects after the fall and winter marine bird survey project was not funded by the Trustees for the current funding cycle, fund aerial forage fish surveys that were not funded but linked to the Forage Fish Project, conduct data synthesis for the Pelagic component during the current five-year funding cycle, and provide funding to the killer whale project (23120114-N, PIs Durban and Matkin) to continue a portion of their work for FY24-FY26. The amount of the redistribution and the request to redistribute funds among projects required the request to be reviewed by the EVOSTC Science Panel and Public Advisory Committee, with a final decision by Trustee Council members. The Science Panel and Public Advisory Committee recommended approval of the request. The Trustee Council voted to allow the redistribution of funds for the IPP surveys for the Pelagic component post-doc, but the transfer of funds to continue killer whale work was not approved and the funding requested for killer whales was to be returned to EVOSTC. This decision was made in late January 2023.

Reporting

At the beginning of FY23, the PMT reviewed both FY22 annual reports and FY17-21 final reports because all projects had received a one-year no-cost extension to complete data analysis and write final reports. FY22 annual reports were reviewed internally by PMT members; EVOSTC staff have accepted all FY22 annual reports. FY17-21 final reports were reviewed internally by PMT members and peer reviewed by SRP members. All but two of the final reports have been reviewed and accepted by EVOSTC. The remaining two, PWS marine bird surveys (21170114-M, PIs Kuletz and Kaler) and lower Cook Inlet and Kachemak Bay oceanography (2117-114-J, PIs Holderied and Baird) have been reviewed by EVOSTC and are in final revision by the PMT and PIs with expected completion early in FY24.

Tragically, SRP member Stephen Okkonen died in early 2023. The PMT will seek a replacement for him in FY24.

Science Synthesis

Science synthesis activities for 2023 included completion of the ecosystem model to assess the effects of warming and heatwaves on the PWS food web and recovery timelines for species of interest to the EVOSTC and GWA. One overarching result of this modeling effort is that the relative proportion of energy going to upper trophic level species has declined over time (Fig. 1). This GWA-LTRM modeling effort continues to contribute to a much larger effort with various Gulf of Alaska (GOA) models development for different regions and purposes by the Northern Gulf of Alaska Long-term Ecological Research (NGA-LTER) investigators (National Science Foundation), NOAA Fisheries, University of Alaska Fairbanks (UAF), University of Washington, and others. The goal of this effort is to understand mechanisms and forecast the effects of climate change on the GOA ecosystem and various species of interest for management agencies and the EVOSTC.

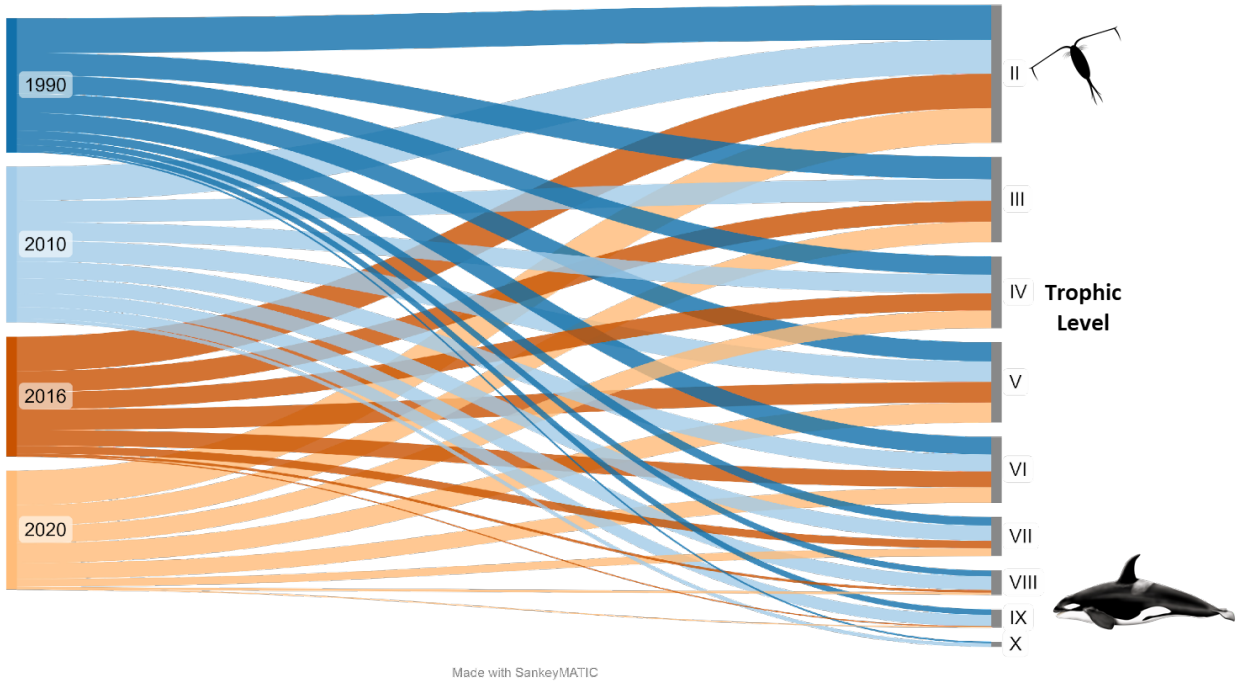

Figure 1. Energy pathways of the Prince William Sound food web depicting a decline in relative proportions directed to upper trophic levels in years after the 2014-2016 marine Pacific marine heatwave. Results from an Ecopath/Ecosim model.

Additional science synthesis efforts included identifying and initiating the component-specific contributions to the science synthesis report that will focus on lingering effects, timing, and recovery of the PWS and GOA ecosystems after the 2014-2016 and 2019 marine heatwaves.

We also led the production of four magazine articles in the publication Open Access Government (https://www.openaccessgovernment.org/) focused on GWA and various aspects of our studies addressing climate change in the GOA:

- Suryan et al. 2023. GWA: Long-term research and monitoring in the GOA.
- Suryan 2023. Food webs and fish: Ocean climate change in Alaska.
- Traiger et al. 2023. Climate, heatwaves, nearshore ecosystems and the sunflower sea star.
- Pegau et al. 2024. Forage fish: Pacific herring in Alaska.

Citations for these articles may be found in Section 2 (Products: Popular articles) below.

Meetings

The PMT held one videoconference and two in person principal investigator (PI) meetings during FY23. The summer quarter videoconference was held via GoTo Meeting and included updates from the PMT and field observations from project PIs. A multi-day PI meeting was held at the Alaska Ocean Observation System (AOOS)/North Pacific Research Board (NPRB) office in downtown Anchorage, Alaska, November 7-9, 2023 (Figs. 2 and 3). The meeting incorporated remote participation through GoTo Meeting videoconferencing. The meeting included an overview of the current program and required deliverables, data management, presentations from projects within each of the components, synthesis activities, and outreach requirements, including a presentation by the Community Organized Restoration and Learning (CORaL) Network. A lunch meeting was held during the Alaska Marine Science Symposium at the Hotel Captain Cook during the Alaska Marine Science Symposium (AMSS) in Anchorage, Alaska, January 31, 2024, and incorporated remote participation through GoTo Meeting videoconferencing. The meeting included program reminders, updates, an introduction of Kari Fenski, the Data Management program's recently hired project manager for the GWA-LTRM

program, and discussion. A planned spring videoconference during 2023 was not conducted because of other demands on the limited PMT.

Figure 2. Gulf Watch Alaska Long-Term Research and Monitoring team members attend a principal investigators' meeting in November 2023 in downtown Anchorage, Alaska.

Figure 3. Breaks during the November 2023 Gulf Watch Alaska Long-Term Research and Monitoring principal investigators' meeting included productive discussions between project team members and Science Review Panel members.

Outreach

The program website (https://gulfwatchalaska.org) and HRM website (https://pwssc.org/herring/) received substantial updates of project pages and findings based on FY17-21 final reports approved by EVOSTC and news items.

We continued providing articles to the PWSSC annual publication *Delta Sound Connections* which is published in the spring of each year. The articles are listed in Section 2 (Products) below under popular articles. PWSSC also sponsors a Facebook page on PWS herring, posting year-round, but primarily during the spawning season (Fig. 4). In addition, PWSSC staff recorded several Field Notes episodes in 2023, three focused on GWA-LTRM project activities related to herring, sea otters, and humpback whales (https://pwssc.org/education/field-notes/). Field notes are aired on PWS area radio stations and hosted on the PWSSC website at the link above.

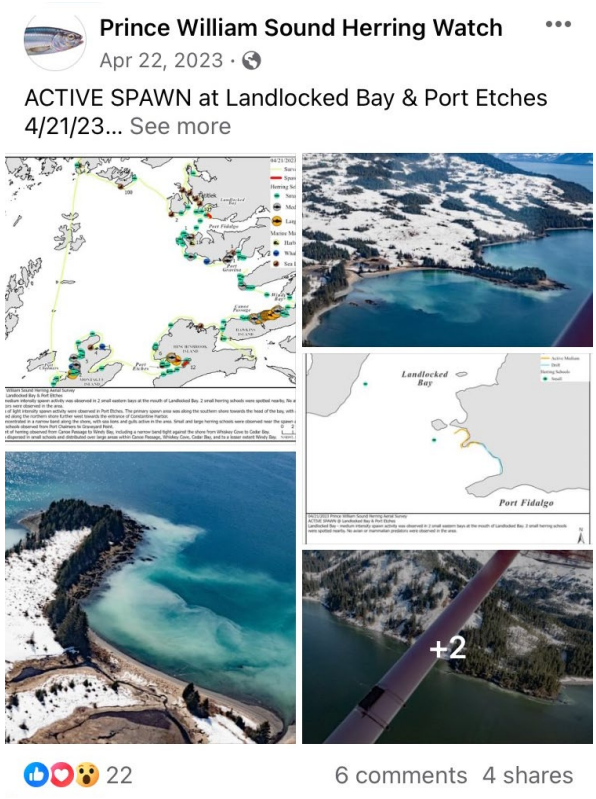

Figure 4. Prince William Sound Herring Watch Facebook post on herring spawning posted on April 21, 2023.

Chugach Regional Resources Commission (CRRC) held their annual subsistence memorial gathering in March 2023 in Anchorage. GWA-LTRM team members were invited to give presentations; Rob Campbell (PWSSC) presented on the effects of recent marine heatwaves and Caitlin Marsteller (U.S. Geological Survey) presented on forage fish monitoring in PWS and lower Cook Inlet. In addition, Claudine Hauri (UAF) presented on ocean acidification and ocean chemistry during a CRRC webinar in November.

The PMT facilitated coordination with the CORaL Network for outreach activities. Program Coordinator Donna Aderhold worked with CORaL Network team members to develop organizational structures and points of contact for GWA-LTRM and CORaL Network team

members to use. She also facilitated initial coordination between the Nearshore component and CORaL Network team members to produce an outreach video based on a recent publication: Evidence of increased mussel abundance related to the Pacific marine heatwave and sea star wasting (https://www.youtube.com/watch?v=AZex4dYvsHU). CORaL Network team members attended GWA-LTRM's November PI meeting to develop ideas for outreach collaboration and CORaL Network team members presented to the GWA-LTRM team during the meeting to further coordination between the programs. Program Coordinator Donna Aderhold attended an outreach workshop held by the CORaL Network at AMSS in January.

Nearshore Component

The Nearshore Component project (23120114-H, PIs Coletti et al.) conducted intertidal monitoring in four regions within the spill-affected area of the northern GOA: western PWS, Kenai Fjords National Park, Kachemak Bay, and Katmai National Park and Preserve. The nearshore monitoring program focuses on sampling numerous ecosystem components in the GOA that are both numerically and functionally important, including kelps (and other marine algae), seagrasses, marine intertidal invertebrates, marine birds, black oystercatchers, sea otters, and physical properties.

In 2023, team members completed all aspects of the nearshore monitoring component across all four regions. For the FY23 annual report, they reported on intertidal water temperature and rocky intertidal community structure.

Environmental Drivers Component

Continuous Plankton Recorder

All 2023 Continuous Plankton Recorder (CPR; 23120114-D, PIs Ostle and Batten) tows were successfully completed as planned from May to October (with two transects occurring in October, one at the start and one at the end of the month). The location of the ship's transect continues to be consistent from month to month. At the time of writing, provisional plankton data for May and June are available and the samples are undergoing quality control (QC). Annual sea surface temperature (SST) in 2023 was warmer than average (over the period 2004 - 2023) in the Alaskan shelf region but not as high as the 2016 and 2019 heatwave years.

Oceanographic Conditions of Prince William Sound

The planned surveys of PWS (project 23120114-G, PI Campbell) were conducted during the reporting period and all 12 standard stations were occupied. All conductivity and temperature at

depth (CTD) data collected to date have been processed. Temperatures in central PWS were mostly above average since late 2013, as has been observed elsewhere in the GOA (see Seward Line [23120114-L] and GAK-1 [23120114-I] projects), and late 2013 to 2016 has been labelled a basin scale marine heatwave. The GOA experienced an unprecedented "triple-dip" La Niña from 2020 to 2023 which eventually led to lower near-surface temperatures basin-wide. Temperatures in PWS tend to lag those in the GOA by approximately one year, which appears to have been the case in 2023.

Following a multiyear backlog created by staff changes and the coronavirus pandemic, analysis of zooplankton samples caught up this year, and all samples up to the end of 2022 have been analyzed (zooplankton samples are time consuming to process and take about a year to complete).

The PWS Profiler was not deployed in 2023. The primary battery that powers the system failed following the 2022 deployment. Communications with the battery controller stopped, most likely due to a failure of the controller. The controllers are no longer available and the battery is not repairable. That left only one of the original batteries purchased with the system in 2014, which is well beyond its service life (i.e., ~40% of original capacity) and only used for powering the profiler when servicing it on land. In addition, the nitrate sensor for the profiler (a Seabird SUNA) was returned for a factory service/calibration in 2022, but the service was extremely long, and the instrument was not returned until May 2023, well after the spring bloom had occurred. For those reasons, it was decided to not deploy the profiler in 2023, and to focus on readiness for 2024. Two new batteries have been purchased, and the profiler will be deployed in March 2024.

Oceanographic Station GAK-1

The GAK-1 project (23120114-I, PI Danielson) had a successful recovery and re-deployment of the 2022/2023 GAK-1 mooring in May 2023. All dataloggers returned full-year time series of all parameters, and only a modest number of data were removed in the data QA/QC stage of processing due to low or questionable quality. In this reporting period the PI has begun the re-analysis of the full GAK-1 time series, beginning with the construction of an updated climatology for our two dynamic variables: temperature and salinity. This effort is the first step in a half-century retrospective analysis of the GAK-1 dataset, which will include efforts from GWA-LTRM post-doc funding provided to Dr. Tyler Hennon of UAF. In addition to the mooring, the project team collected monthly hydrographic profiles at GAK-1 from *R/V Nanuq*. Combining the mooring and CTD profile data into a single annual anomaly time series, we find

that the near surface has been close to the 50-year average but slightly warm while the near-bottom is close to the average and slightly cool. The most recent salinity readings also depict contrasting anomalies, and for this case, both reinforce the observed long-term trends.

Seward Line

The Seward Line (project 23120114-L, PIs Hopcroft and Danielson) was sampled in early May and mid-September of 2023. In summary, spring temperatures were below the long-term mean by about one third degree, and one-half degree below in fall. During spring, nitrate concentrations appeared to be moderate to high throughout the region, and phytoplankton chlorophyll biomass was modest and patchy. It appears that an extensive, intense bloom had yet to develop and likely occurred later than normal, possibly due to persistent cloud cover. Spring copepod biomass was below the long-term spring means while euphausiid biomass was above the mean. Processing of samples continues year-round, and descriptive aspects evolve as more data become available.

Continuation and Expansion of Ocean Acidification Monitoring in the Spill Area

The ocean acidification project (23220202, PI Hauri) collected water samples for total alkalinity, dissolved inorganic carbon, and pH during the spring (256 samples), summer (259 samples), and fall (181 samples) 2023 GWA-LTRM and NGA-LTER cruises along the Seward and Kodiak lines and in PWS. The PI and her team finalized the laboratory analysis of all samples and the spring and summer data have been post-processed. They are currently working on the final QC. Data from the 2022 cruises and preliminary data from the spring and summer 2023 cruises were incorporated in NOAA's GOA Ecosystem Status Report, which included an ocean acidification contribution for the first time.

Pelagic Component

Monitoring Long-term Changes in Forage Fish in Prince William Sound and the Northern Gulf of Alaska

The forage fish project (23120114-C, PIs Arimitsu and Piatt) has three main components including continuation of the longest time series on forage fish availability to seabirds in the GOA, ship-based surveys including the Integrated Predator Prey (IPP) survey in PWS conducted in collaboration with the humpback whale study (project 23120114-O) project, and summer forage fish sampling.

Middleton Island seabird diet sampling was conducted by the Institute for Seabird Research and Conservation scientific team according to schedule. Seabird diet information from Middleton Island integrates forage fish species composition and availability over broad areas of the northern GOA. Seabird diet samples at Middleton Island were collected from 8 April to 19 August 2022. This included a total of 1121 diet samples from black-legged kittiwakes and 183 diet samples from rhinoceros auklets.

The fall IPP survey occurred on schedule during the second half of September. The crews conducted acoustic transects, trawls, and habitat sampling in Bainbridge Passage, Montague Strait, and Port Gravina as planned. Capelin and sand lance biomass estimates increased on acoustic surveys in 2023, however, macrozooplankton (primarily euphausiids) acoustic biomass indices for 2023 were well below 2022 levels. Still, the team observed most humpback whales in the southwest Sound and encountered seven humpbacks feeding on euphausiids during the acoustic survey in Bainbridge Passage on 9/21/2023. Prior to this survey, they had not observed humpbacks in Bainbridge Passage since September 2014.

Marine bird surveys conducted in conjunction with the acoustic surveys on IPP surveys in PWS found higher densities of seabirds in 2023 compared to 2022, and average densities in Port Gravina were more than twice as high as they were in Montague Strait or Bainbridge Passage in 2023. This was driven largely by higher densities of common murres and marbled murrelets. Future synthesis efforts will evaluate whale-foraging flock behavioral observations.

Validation surveys were conducted from Cordova, Alaska in support of the continuing GWA-LTRM aerial forage fish surveys during the second week of June when aerial surveys were conducted.

Prince William Sound and Northern Gulf of Alaska Marine Bird Surveys

The marine bird survey project (23120114-M, PI Kaler) conducted marine bird surveys in PWS and the northern GOA.

In July 2023, the PI and his team conducted boat-based surveys to monitor abundance and distribution of marine birds in PWS and completed the 17th year of summer surveys since the 1989 *T/V Exxon Valdez* oil spill. The randomly selected shoreline (212), coastal (91) and pelagic (50) 200-meter wide transects were completed from three (3) survey boats (7.6-meter length). Analyses of July 2023 PWS data are pending and will be completed in March 2024.

For the offshore component, at-sea seabird surveys were conducted in spring and fall (a bird and mammal observer was not available for the summer cruise) in collaboration with the multi-

disciplinary Seward Line and assess how seabird abundance and distribution responds to environmental drivers and lower trophic level changes.

During 2023, the project team conducted a total of 3077 linear km of marine bird surveys during three NGA-LTER cruises: April 22 – May 8, June 29 – July 15, and September 13 – 19. Averaged across all 3-km transects during each cruise, they observed highest mean density of marine birds during spring (12.5 birds/km^2), and the lowest mean density during summer (5.4 birds/km^2), while the mean density during fall was slightly less than during spring (10.6 birds/km^2).

Long-term Killer Whale Monitoring in Prince William Sound/Kenai Fjords

The killer whale project (23120114-N, PIs Durban, Matkin, and Olsen) completed 32 vessel survey days in 2023 with timing and geographic components of effort similar to previous years. Specifically, search effort was focused on known killer whale hotspots in the Kenai Fjords in late May and early June, with effort moving to Hinchinbrook Entrance and Montague Strait in PWS during the second half of June. There was also an opportunistic photo-identification effort in Kachemak Bay. They had 28 encounters when killer whale photo-identifications were collected, including 23 with the resident (fish-eating) ecotype and five with the transient (mammal-eating, also known as Bigg's killer whale) ecotype. There were no AT1 (Chugach transient) encounters on our surveys, but photographs of AT1s were contributed by naturalists on other platforms.

They also collected 11 free-floating scat samples from killer whales, and one sample of fish scales from a killer whale predation event; these will be analyzed genetically for prey preferences if/when funds are secured. Additionally, the team continues to maintain five hydrophones recording year-round occurrence of killer whales in the GOA: Marmot Island, Kachemak Bay, Resurrection Bay, Montague Strait, and Hinchinbrook Entrance. Acoustic recordings will be analyzed to document killer whale presence, at the level of ecotype and pod, if/when funds are secured.

Long-term Monitoring of Humpback Whale Predation on Pacific Herring in Prince William Sound

The humpback whale team (project 23120114-O, PIs Moran and Wild) continues to monitor the steep decline of the local humpback whale population in PWS following the 2014-2016 northeast Pacific marine heatwave (PMH). Prior to the heatwave, humpback whales in PWS fed primarily on adult Pacific herring, especially when herring aggregated in large shoals during the spring, fall, and winter. Following the PMH, juvenile herring and euphausiids are more common in the

diet of whales. They used the unique marking of the flukes to identify and "photographically mark" individual whales. Population estimates from 2007-2022 were derived using both closed and open mark/recapture models. The team identified a slight increase in whale abundance relative to the previous six years during 2022 and 2023, but numbers are still below pre-heatwave estimates. This increase is also likely driven by new arrivals to the population rather than previously marked whales returning to PWS. In 2021, they estimated that 4.3% of the pre-spawning biomass of herring was consumed by whales. This contrasts sharply with the peak consumption of 38.1% in 2013. Consumption rates for 2022 and 2023 remained low. The decline in the number of whales in PWS, either through mortality or emigration, along with a shift towards euphausiid as a prey source, has removed some of the predation pressure on herring, potentially aiding the modest recovery of herring seen within PWS.

Herring Research and Monitoring Component

Modeling and Stock Assessment of Prince William Sound Herring

The herring modeling project (23120111-C, PI Branch) completed goals 1-4 of the original eight proposed goals of the project, as detailed below.

Goal 1: conduct annual stock assessments of PWS herring by using the Bayesian age-structured assessment model (BASA):

The stock assessment of the 2023 season was completed early in December 2023. The assessment shows a slight improvement in spawning biomass to a median of 27,050 metric tons (t), above the management threshold for fishery reopening (19,958 t), albeit with an 11% probability of being below the threshold. Estimated biomass is the highest since 1993, driven by relatively strong 2020 and 2021 year classes and continued presence of the strong 2016 cohort. The Shannon-Wiener evenness index is added to the age composition plot showing that the 2022-23 biomass is more evenly distributed among age classes (0.71 and 0.70) than during 2019-21 (0.43-0.53) when the 2016 year class dominated. Another diagnostic added this year was to include a retrospective analysis involving sequentially removing one year of data and repeating the assessment, which showed no patterns of bias in the assessment.

Goal 2: Review best practices globally for managing highly variable fish populations:

During this period, the PI's team conducted a global review of harvest control rules used to manage marine fisheries, focusing on rules used in six major regions of the world including the USA and Canada. The review showed that best practices for harvest control rules of data-rich

fisheries, such as PWS herring, are to use threshold-based rules to manage them, where harvest rates are reduced below specific thresholds. Thus, one major conclusion is that the default harvest control rule used in managing PWS herring follows global best practices.

Goal 3: Create an MSE framework for Prince William Sound herring:

The framework for management strategy evaluations (MSEs) was developed as part of J. Zahner's MS thesis and is prepared for use in addressing the original Goals 4-6 of this proposal.

Goal 4: Evaluate alternative harvest control rules for setting herring catches:

The MSE framework in Goal 3 was used to conduct this evaluation, which used the global analysis of harvest control rules and a meeting of Alaskan herring managers and interested parties to select a suite of rules to evaluate. The MSE framework models the true state of the herring population; at each annual modeling step this simulates data that would be collected in the actual fisheries, applies the assessment model (BASA) to assess the state of the stock, and then uses the results of the assessment to feed into a harvest control rule that sets of the catch for the following simulated year. This process repeats over many years, and is repeated 150 times for each evaluated harvest control rule. The rules evaluated included a series of threshold rules (since these were considered best practice in the global review for data rich fisheries): the default harvest control rule, one with a lower threshold and higher threshold to open the fishery, one with a lower harvest rate and a higher harvest rate; plus additional rules that modify the threshold rules to take into account evenness of cohorts (fishing less when the population is dominated by a single cohort), and size of fish (fishing more when the population includes more large fish, which are more valuable). In the future projections for testing the rules, continuing the current state of the population would have been uninteresting since the fishery would remain closed for most rules given a continued low biomass state as has been the case since the 1990s. Therefore, the rules were tested with future projections assuming an elevated level of average recruitment for 15 years, initiating an increase in biomass over that time period, followed by a return to more recent recruitment conditions, and a corresponding decline in biomass towards more recent levels. Thus, the harvest control rules are tested both in how they respond to increased biomass, and to a decline in biomass.

The results showed that the default rule, the rule with a lower threshold for reopening the fishery, and the evenness rule performed the best, based on a balance between catch levels, probability of low biomass, and low inter-annual variability in catches.

Progress relative to goals, and deviations from plans:

Excellent progress was made in completing four of the ten goals in the second year of the planned ten-year proposal, including the MSE framework that will be used in two future goals (value of surveys, and robustness of the assessment model to biased parameter values). However, with the graduation of J. Zahner, there will be a slowdown in future work until October 2024 when two new PhD students are anticipated to join the project, one funded partly by ADF&G employment, and one funded partly by fellowships from the University of Washington.

Herring Disease Program

The herring disease program (project 23120111-E, PIs Hershberger and Paez) conducted field sampling to collect pre-spawn adult herring in PWS, Sitka Sound, and Puget Sound and tested for viral hemorrhagic septicemia virus, *Ichthyophonus*, and viral erythrocytic necrosis prevalence. The project team also conducted laboratory studies, including (1) using a swim flume to compare the relative swimming performance (critical swimming velocity) between groups of herring at different stages of infection with various pathogens (viral hemorrhagic septicemia virus, erythrocytic necrosis virus, and *Ichthyophonus*); (2) comparing temporal, environmental, and demographic correlates of *Icthyophonus* spp. infections in mature Pacfic herring between PWS and Sitka Sound; (3) characterizing a natural sea louse epizootic and the effects of parasitism on wild Pacific herring; and (4) determining that the developing heart of Pacific herring is responsive to crude oil at exposures below the limits of quantitation for polycyclic aromatic hydrocarbons in water and tissue.

In addition, the team built a modified epidemiological model of viral hemorrhagic septicemia in Pacific herring to improve understanding of the interactive roles of temperature and herd immunity on the dynamics of viral hemorrhagic septicemia. The specific type of model used was a Susceptible-Exposed-Infected-Carriers-Particle model, where the susceptible compartment represents fish that are naïve to the pathogen, exposed are the fish in the early stages of the disease, and not yet shedding virus, the infected are the symptomatic fish that are both shedding virus and vulnerable to disease mortality, and the carriers are the fish which survived the disease and are refractory to new infections. The fish can, however, shed the virus when exposed to cold temperatures. In contrast to most aquatic disease models, they explicitly modeled transmission via exposure to waterborne pathogen; the particle compartment tracks the waterborne virus (in quantities of plaque forming units) shed by infected and, at cold temperatures, carrier herring. Initial investigation shows that the model simulates experimental results with skill. Using this model, the team showed that viral hemorrhagic septicemia outbreaks are bigger and more lethal

at cold temperatures because the virus persists in cold temperatures longer than it does in warmer temperatures, viral shedding rates are higher in cooler water, and carrier herring shed virus at cooler temperatures. Survivors of epizootics contribute to herd immunity, limiting the impact of viral exposure until new naïve fish arrive. Under warm temperatures (14 ºC) the short persistence of the virus and the low shedding rate will quickly stop its spread. Under slightly cooler temperatures (11 ºC) herd immunity requires 75% of herring to be completely refractory. However, in every simulation, cold temperatures (9 ºC) will start viral shedding by carriers and start epizootics. Fisheries targeting year classes with high levels of susceptible fish will limit the loss of the protective effect of the carriers/refractory fish, while fisheries targeting year classes with high levels of carrier fish can result in a loss of herd immunity, contributing to future VHS outbreaks. The modeling work was funded through FY23 and will be extended through FY24 because of the funding delay in FY22. The full manuscript describing these results is in preparation and will be included in the FY24 final report.

Herring Surveys and Age, Sex, and Size Collection and Processing

During 2023, the herring surveys project (23170111-F, PI Morella) conducted 50 hours of aerial surveys during 21 flights of PWS. The 2023 PWS aerial spawn estimate of 26.1 statute mile-days-of-milt is less than the 2022 estimate but 29.2% above the 10-year average (2013–2022) of 20.2 mile-days-of-milt. Mile-days-of-milt in 2023 were well below levels observed in the 1980s and early 1990s. The team conducted vessel-based herring sampling surveys in 2023 and collected age, sex, and length samples from Red Head, Cedar Bay, Rocky Bay, Canoe Pass, and Port Etches. The weighted age composition for the 2023 PWS spawning biomass was 38% age-3, 33% age-4, 6% age-5, 7% age-6, 14% age-7, <1% age-8, and <1% age-9+.

Ecological Interactions between Pacific herring and Pacific salmon in Prince William Sound

The herring-salmon interactions project (2322011-I, PIs Rand et al.) conducted its first field season in 2023 and made strides in acquiring data from past sampling programs as part of a planned synthesis effort.

The team conducted four research cruises (24-28 May, 29 July – 1 July, 10-11 July, and 11-14 September). They caught fish by purse seine haul and surface trawl and carried out replicate bongo tows at stations where fish were collected. To date they have processed 48 juvenile pink salmon and 302 Pacific herring (juveniles and adults) for diets (data consist of stomach content mass and identification of stomach contents into 15 taxonomic prey groups) and 36 separate plankton samples to identify and quantify prey (data include subsample counts and expansions for 17 taxonomic prey groups). Blood smears on 264 herring and 178 juvenile pink salmon were

shipped to Dr. Hershberger's lab (project 23120111-E) for disease sampling, preserved stomach samples (81 adult herring and 49 juvenile pink salmon) were shipped to Dr. Wes Larson's NOAA genetics lab in Juneau, Alaska for metabarcoding analysis of fish prey contents, and 277 juvenile pink salmon were transferred to Jenni Morella (project 23170111-F) for otolith extraction and reading to determine hatchery origin, and voucher specimens of larval fish collected in the bongo net were sent to Dr. Wess Strasburger at the NOAA Juneau lab to confirm identification.

The project met all the major objectives for field work outlined for their proposal in 2023 and is making good progress on generating lab results. The team was unable to capture any juvenile pink salmon during their May cruise. They conjectured that the juvenile salmon may have been closer to shore (i.e., not yet dispersed into deeper waters where they would be vulnerable to capture by the sampling gear) so the team is considering shifting the May cruise approximately a week later in 2024.

Prince William Sound Walleye Pollock-Pacific Herring Interactions

Early in FY23, ADF&G canceled the pollock-herring interactions project (23220203, PIs Rhea-Fournier et al.) because the agency-owned vessel to be used for field work was decommissioned and no other vessel was available. Some aspects of the work and funds associated with that work were transferred to other projects (herring disease program, 23120111-E, and herring surveys, 23170111-F). There will be no additional reporting on this project.

Lingering Oil Component

The Lingering Oil component project (2320114-P, PIs Esler and Lindeberg) did not perform work during 2023. Field sampling for lingering oil and analysis of sampling is scheduled for 2025.

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Traiger, S., J. Bodkin, R. W. Campbell, H. Coletti, D. Esler, K. Holderied, K. Iken, B. Konar, C. McKinstry, D. Monson, J. Pretty, M. Renner, B. Robinson, R. Suryan, and B. Weitzman. 2024. Does larval supply matter? Meroplankton as drivers of intertidal invertebrate abundance. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaksa, January.

Turner, L., C. Cunningham, and M. Arimitsu. 2023. Combining predator diet and survey data to understand spatial and temporal patterns of forage fish in Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Turner, L., M. Arimitsu, J. Piatt, G. Ekert, and C. Cunningham. 2024. Combining predator diet and survey data to understand spatial and temporal patterns of forage fish in Alaska. Oral presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January. [Winner: Best Student Oral Presentation].

Waga, H., T. Kelly, B. Lowin, S. Strom, and W. Burt. 2024. High-resolution measurements of primary production in the northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Weitzman, B. 2023. Research and conservation updates from Alaska: Southeast and southcentral stocks of northern sea otters. Oral presentation, Sea Otter Conservation Workshop XIII, Seattle, Washington, March.

Weitzman, B. 2023. Sea otters and unconsolidated habitats: Appreciating the importance of soft sediments to sea otter recovery and conservation. Oral presentation, Sea Otter Conservation Workshop XIII, Seattle, Washington, March.

Weitzman, B. 2023. Research and conservation updates across the southcentral stock of northern sea otters. Oral presentation, Chugach Regional Resources Commission 21st Memorial Gathering, Anchorage, Alaska, March.

Weitzman, B., S. Traiger, H. Coletti, J. Womble, D. Esler, K. Kloecker, G. Esslinger, D. Monson, B. Konar, K. Iken, B. Ballachey, P. Schuette, S. Hanchett, B. Benter, and J.

Bodkin. 2024. Variation in clam assemblages related to sea otter abundance and habitat attributes. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Will, A., A. Baltensperger, S. Backensto, K. Hobson, H. Coletti, S. Schoen, J. Piatt, and A. Kitaysky. 2023. The 2015-16 common murre die-off in Alaska was primarily due to acute starvation of females from the northern Bering Sea. Oral presentation, Pacific Seabird Group, San Diego, California, February.

Williams, K., and S. Strom. 2024. Comparing primary production and vertical export of *Synechococcus* in the Northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Yee, J. L., M. T. Tinker, L. Bowen, H. A. Coletti, D. C Douglas, C. Kolden, S. E. Larson, R. Lugo, A. K. Miles, M. J. Murray, L. M. Nichol, W. P. Perry, J. A. Saarinen, V. von Biela, and J. L. Bodkin. 2023. What drives sea otter population growth and recovery? Oral presentation, Sea Otter Conservation Workshop XIII, Seattle, Washington, March.

Public presentations:

Arimitsu, M. 2023. Seabirds as ocean sentinels. Invited presentation, Juneau Marine Naturalist Symposium, Juneau, Alaska, April.

Arimitsu, M. L. 2023. Joint spatiotemporal models to predict seabirds at sea. Spatiotemporal modeling group meeting, virtual, May.

Arimitsu, M., and S. Schoen. 2023. Seabirds as ocean sentinels in Prince William Sound. Invited presentation, Prince William Sound Natural History Symposium, Whittier, Alaska, May.

Batten, S., and C. Ostle. 2023. North Pacific CPR survey update. North Pacific Marine Science Organization (PICES) Monitor Technical Committee, September.

Campbell, R. W. 2023. Effects of recent marine heat waves on the waters of PWS. *Oral p*resentation*,* Chugach Regional Resources Commission Annual Subsistence Memorial Gathering, Anchorage, March.

Coletti., H. 2023. Where the land meets the sea: Linkages between the ocean, nearshore and terrestrial ecosystems. Seward Teacher workshop, Seward, Alaska, October.

Coletti, H. 2023. Varying responses to a marine heatwave. Science for Lunch with Alaska NPS. Anchorage, Alaska, February.

Dias, B. S., T. Okey, R. Suryan, and R. Hopcroft. 2023. Differences on Prince William Sound marine food web structure during marine heatwaves and non-marine heatwave years. UAF-LTER Science Nuggets, Fairbanks, Alaska, Virtual, December.

Dias, B. S., T. Okey, R. Suryan, and R. Hopcroft. 2023. Marine food web structure differences between heatwave and non-heatwave years in Prince William Sound ecosystem. Oral presentation, ACLIM2 + GOACLIM Joint Annual Meeting, Seattle, Washington, December.

Dias, B. S., 2024. Higher Trophic Modeling. Oral presentation, Northern Gulf of Alaska LTER all hands meeting, Fairbanks, Alaska, January.

Hauri C. 2023. Ocean acidification and ocean chemistry. Chugach Regional Resource Commission webinar on ocean acidification and ocean chemistry, November.

Kaler, R. 2023. Status and trends of marine birds in Alaska. Invited presentation, "Lunch and Learn" at the UAF Bristol Bay Campus, Virtual, November.

Kaler, R. 2023. Updates on Alaskan seabirds, including avian influenza. Alaska Migratory Bird Co-management Council annual meeting, November. (Presentation slides contributed to information packet).

Kloecker, K., N. LaRoche, and H. Coletti. 2023. Nearshore marine ecosystems and sea otters. Romig Middle School STEM Day, Anchorage, Alaska, February.

Marsteller, C., M. Arimitsu, and J. Piatt. 2023. Forage fish monitoring in Prince William Sound and Cook Inlet. Chugach Regional Resource Commission Memorial Gathering, Anchorage, Alaska, March.

Matkin, C. 2023. Killer whale life history, behavior, and population dynamics. Lectures to Semester by the Bay Program students, University of Alaska Anchorage, Kenai Peninsula College.

Moran, J. 2023. The decline of humpback whales in Prince William Sound, Alaska following the 2014–2016 Northeast Pacific marine heatwave. Presentation, Alaska Student Chapter of the Marine Mammal Society. Juneau, Alaska, October.

Moran, J. 2023. What's Happening in Alaska? Whale Tales Maui global check-in segment,7th Annual Whale Tales, Kapalua, Hawaii, February.

Morella, J. 2023. Prince William Sound herring spawn and ASL, 2023. Oral presentation, Salmon Harvest Task Force 2023 meeting, October, Anchorage, Alaska.

Myers, H. 2023. Killer whale research presentation and bioacoustics class project. Hutchison High School Marine Biology class, Fairbanks, Alaska, April.

Myers, H. 2023. Eavesdropping on killer whales. Invited online talk, University of Alaska Fairbanks College of Fisheries and Ocean Sciences Advisory Council Meeting, April.

Myers, H. 2023. Listening to killer whales. Invited online seminar, Department of Natural Science, College of Coastal Georgia, March.

Olsen, D. 2023. Killer whale research updates. Presentation to marine naturalists working on commercial ecotourism boats in Seward, Alaska.

Schoen, S. K., M. Arimitsu, J. F. Piatt, C. M. Marsteller, S. B. Stark, N. Bargmann, and D. Donnelly. 2023. USGS seabird and forage fish monitoring in lower Cook Inlet. Invited presentation, Kachemak Bay Birders group, Homer, Alaska, March.

Smith, M., S. K. Schoen, C. Van Hemert, M. L. Arimitsu, N. Bargmann, D. Gerik, and J. F. Piatt. 2023. Harmful algal toxins in Alaskan seabirds: Updates and ongoing research. Oral presentation, Northwest Campus, University of Alaska Fairbanks Strait Science Series, Virtual, March.

Traiger, S. 2023. "I Know I Can" virtual visit with Mertarvik Pioneer School, Newtok, Alaska, 1-4th grade, January.

Traiger, S. 2023. "Kids2College", in person visit to Juneau Community Charter School organized by the Alaska Commission on Postsecondary Education, May.

Traiger, S. 2023. "Learning About Our Beaches" Teacher Workshop and presentation on intertidal ecology at the Dzantik'l Heeni Middle School, Juneau, Alaska, April.

Data and/or information products developed during the reporting period:

In addition to publishing data through the Alaska Ocean Observing System GOA Data Portal (see section below), projects that are part of the GWA-LTRM program regularly publish data to other permanent and publicly available databases, share data with researchers outside the GWA-LTRM program, and interpret data in various ways. Below are some examples from individual projects:

- CPR data have been included in the International Group for Marine Ecological Time Series effort led by the Intergovernmental Oceanographic Commission of UNESCO, the International Ocean Carbon Coordination Project and the Ocean Carbon and Biogeochemistry Program which seeks to integrate a suite of in situ biogeochemical variables from time-series stations, together with satellite-derived information, to look at holistic changes within different ocean regions. The website http://igmets.net/ has a Time Series Explorer which allows the user to construct time series of available variables and investigate trends. North Pacific CPR data provide much of the plankton information for the region. The data are also stored in the Ocean Biodiversity Information System: https://obis.org/dataset/e981eab6-f849-4891-8fac-495852829456.
- Monthly abundances for selected plankton can be generated for user-specified regions sampled by the CPR using this extraction tool: https://www.dassh.ac.uk/lifeforms/ and https://doi.mba.ac.uk/data/3086.
- The GAK-1 timeseries is served as a "Signature Data Set" on the NGA LTER program's website. This can be accessed at: https://nga.lternet.edu/data-overview/signature-datasets/.
- ADF&G displays PWS herring aerial survey data on an interactive web map: https://experience.arcgis.com/experience/53d54699cbf54e72aa1a4daf405076b7.
- Humpback whale blubber samples were sent to Shannon Atkinson, UAF, for stress and reproduction hormone assays.
- Humpback whale data were provided to the NOAA Fisheries Unusual Mortality Event working group.
- The forage fish project worked with other researchers to publish a Marine Ecology Progress Series HEAT special issue inspired by the heatwave impacts symposium at the 3rd World Seabird Conference held in October 2021. This theme issue includes 13 manuscripts that demonstrate impacts on seabirds from marine heatwaves and propose specific mechanisms that explain how ocean heating precipitates changes in seabird biology and behavior. https://www.int-res.com/journals/meps/theme-sections/heat.
- The Nearshore Component publishes data associated with the US Geological Survey Alaska Science Center, National Park Service Southwest Inventory and Monitoring Network, and University of Alaska Fairbanks College of Fisheries and Ocean Sciences publishes data with the US Geological Survey, including the following datasets:

- Black Oystercatcher Nest and Diet Data from Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park, and PWS, 2006-2022 (ver 2.0, September 2022): https://doi.org/10.5066/F7WH2N5Q.
- Intertidal mussel (*Mytilus*) data from PWS, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 3.0, September 2022): https://doi.org/10.5066/F7FN1498.
- Rocky intertidal data from PWS, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 1.0, September 2022): https://doi.org/10.5066/F7513WCB.
- Sea otter spraint data from Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park, and PWS: https://doi.org/10.5066/P9EDM6NL.
- Intertidal temperature data from Kachemak Bay, PWS, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 3.0, August 2022): https://doi.org/10.5066/F7WH2N3T.
- Intertidal soft-sediment bivalves from PWS, Kachemak Bay, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 2.0, September 2022): https://doi.org/10.5066/F71834N0.

- An updated analysis of resident killer whale population dynamics, inferred from photo-identification records, is being complied and prepared for submission to a peer-reviewed scientific journal.
- An updated analysis of resident killer whale diet, inferred from fecal and scale samples, is being reviewed by coauthors in advance of submission to a peer-reviewed scientific journal.
- An analysis of the acoustic calling rates of resident and transient killer whales, inferred from passive acoustic recordings, has been completed and submitted to a peer-reviewed scientific journal (Myers et al., submitted). This is an important component of passive acoustic density estimation.

Data sets and associated metadata:

Aguilar-Islas, A., and M. Kaufmann. 2023. Dissolved inorganic nutrient data from stations sampled on NGA-LTER seasonal cruises, 2018-2021. Research Workspace. 10.24431/rw1k586.

Arimitsu, M. L., and S. A. Hatch. 2023. Age-0 sablefish size and growth indices from seabird diets at Middleton Island, Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/P94KVH9X.

Arimitsu, M. L., J. F. Piatt, B. Heflin, and C. E. Marsteller. 2023. Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 3.0, March 2023): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z.

Arimitsu, M., J. Piatt, and C. Marsteller. 2023. Pelagic: Forage fish distribution, abundance, and body condition. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/3ca497e2-3421-4fa4-a550-f4d397a73c07/project.

Arimitsu, M. L., J. F. Piatt, J. T. Thorson, K. J. Kuletz, G. S. Drew, S. K. Schoen, D. A. Cushing, C. Kroeger, and W. J. Sydeman. 2023. Gridded seabird density estimates in lower Cook Inlet, Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/P94NDFRI.

Arimitsu, M. L., S. K. Schoen, J. F. Piatt, and C. E. Marsteller. 2024. Assessing the status and trends of seabirds and forage fish in lower Cook Inlet, Alaska (ver. 3.0, January 2024): U. S. Geological Survey data release, https://doi.org/10.5066/P961LWWE.

Branch, T., and J. Zahner. 2023. Bayesian age-structured-analysis (ASA) model and results for herring population dynamics in Prince William Sound, EVOS herring program. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/4aaecfe2-de4b-4b6b-ba8e-bb715d26c6f1/project/folder_metadata/41873621.

Campbell, R. 2023. Environmental drivers: Oceanographic conditions in Prince William Sound. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/fc5b0956-ef7c-49df-b261-c8e2713887fc/project.

Coletti, H., D. Esler, K. Iken, B. Konar, B. Ballachey, J. Bodkin, T. Dean, G. Esslinger, K. Kloecker, M. Lindeberg, D. Monson, B. Robinson, S. Traiger, and B. Weitzman. 2023. GWA nearshore component posted data. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/7867a791-8b05-4a8c-8065-eb6e1b425f5f/project.

Danielson, S. L. 2023. Hydrographic, optical, and meteorological parameters measured by R/V Sikuliaq's underway systems during the Northern Gulf of Alaska LTER cruises, 2018-2021.

Danielson, S. L. 2023. Water columns properties measured by CTD sensors during seasonal cruises in the Gulf of Alaska for the Northern Gulf of Alaska LTER project, 2018-2022. Research Workspace. https://doi.org/10.24431/rw1k459.

Danielson, S. 2023. Environmental drivers: Gulf of Alaska mooring (GAK1). Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/3c4ecb88-6436-4312-8281-ed584e020b0e/project.

Drew, G. S., S. K. Schoen, M. D. Hood, M. L. Arimitsu, and J. F. Piatt. 2023. North Pacific Pelagic Seabird Database (NPPSD) (ver 4.1, May 2023): U. S. Geological Survey data release, https://doi.org/10.5066/F7WQ01T3.

Hauri, C., and B. Irving. 2023. Inorganic Carbon data from water samples collected during CTD casts at stations during the Northern Gulf of Alaska LTER seasonal cruises, 2018-2022. Dataset. https://doi.org/10.24431/rw1k45g.

Hill, D. 2022. Gulf of Alaska Coastal Discharge Model Results, 2013-2021.

Hauri, C., B. Irving, and A. Norgaard. 2023. Inorganic Carbon data from water samples collected during CTD casts at stations during the Northern Gulf of Alaska LTER seasonal cruises, 2018-2021. Research Workspace. 10.24431/rw1k45g, version: 10.24431_rw1k45g_20230203T202101Z.

Hatch, S. A., M. L. Arimitsu, J. F. Piatt, S. Whelan, and C. E. Marsteller. 2023. Seabird diet data collected on Middleton Island, Gulf of Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/P93I0P67.

Hershberger, P. 2023. Herring: Herring disease program. Gulf of Alaska Data Portal. https://gulf-of-alaska.portal.aoos.org/#metadata/61b4ec5a-f15c-4347-b0ba-8a25ad763675/project.

Hopcroft, R. R. 2023. Gelatinous zooplankton abundance and wet weight biomass observations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018 - 2021. Research Workspace. 10.24431/rw1k58z.

Hopcroft, R. R. 2023. Zooplankton abundance and biomass observations determined traditional microscopy, from Multinet samples collected during research cruises for the Northern Gulf of Alaska LTER site, 2018-2021. Research Workspace. 10.24431/rw1k591.

Hopcroft, R. R. 2023. Zooplankton abundance and biomass observations obtained from the QuadNet, as analyzed by traditional microscopy, during NGA LTER seasonal cruises in the Northern Gulf of Alaska, 2018-2021. Research Workspace. 10.24431/rw1k587.

Hopcroft, R. R., and S. L. Danielson. 2023. Temperature and Salinity measured by a flow-through thermosalinograph (TSG) during research cruises aboard the *R/V Tiglax* and *R/V*

Woldstad for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021. Research Workspace. 10.24431/rw1k45o.

Kelly, T. B. 2023. Carbon and Nitrogen flux and isotopic signatures from surface tethered sediment trap data collected on research cruises for the Northern Gulf of Alaska LTER site in 2019, 2021. Research Workspace. 10.24431/rw1k58y.

Kaler, R. 2023. Pelagic: Prince William Sound marine birds. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/6aac5903-f3af-4eb4-b4d7-11006e6ea497/project.

Kuletz, K., D. Cushing, and E. Labunski. 2023. Marine bird survey observation and density data from Northern Gulf of Alaska LTER cruises, 2018-2022. Research Workspace. 10.24431/rw1k45w.

Moran, J., and J. Straley. 2023. CastAway CTD data: 2017-2019 and 2022-2023 Gulf Watch Alaska pelagic component, long-term monitoring of humpback whale predation on Pacific herring in Prince William Sound. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/41844522.

Morella, J. 2023. Aerial survey observations of Pacific herring biomass, marine birds, and marine mammals in Prince William Sound, Alaska, 2008-2023. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/35fd35d8-f6f1-4762-9cf0-8e2e970755c4/project/folder_metadata/41851163.

Morella, J. 2023. Aerial survey observations of Pacific herring spawn in Prince William Sound, Alaska,1973-2023. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/35fd35d8-f6f1-4762-9cf0-8e2e970755c4/project/folder_metadata/41851171.

Morella, J. 2023. Age-sex-length-weight data for Pacific herring in Prince William Sound, Alaska, 2014-2023. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/35fd35d8-f6f1-4762-9cf0-8e2e970755c4/project/folder_metadata/41851174.

Morella, J. 2023. Scales as growth history records for Pacific herring in Prince William Sound. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/35fd35d8-f6f1-4762-9cf0-8e2e970755c4/project/folder_metadata/3115471.

Ostle, C. and S. Batten. 2023. Continuous plankton recorder and temperature data, Gulf of Alaska, 2012-2022, Gulf Watch Alaska environmental drivers component. Gulf of Alaska Data Portal. https://gulf-of-alaska.portal.aoos.org/#metadata/87f56b09-2c7d-4373-944e-94de748b6d4b/project/folder_metadata/2510313.

Paez, D. J., J. L. Gregg, A. H. MacKenzie, S. A. Hall, and P. K. Hershberger. 2023. *Caligus Clemensi* prevalence and counts on *Clupea pallasii* from Port Angeles Harbor, WA and from a controlled laboratory experiment conducted at USGS Marrowstone Marine Field Station, WA. U.S. Geological Survey data release, https://doi.org/10.5066/P9KRGX06.

Pegau, W. S. 2023. Aerial surveys of juvenile herring. Gulf of Alaska Data Portal. https://portal.aoos.org/#metadata/2f2367fa-6f4c-44e6-9c7a-150dc156154c/project/files.

Straley, J., and J. Moran. 2023. Dall's and harbor porpoise survey data, Prince William Sound, Alaska: 2007-2008, 2011-2015, and 2017-2023, Gulf Watch Alaska pelagic component. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2514142.

Straley, J., and J. Moran. 2023. Lipid analyses for Pacific herring, invertebrates and humpback whales in the Gulf of Alaska, 2012-2021 and 2022-2023, Gulf Watch Alaska pelagic component. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2510153.

Straley, J., and J. Moran. 2023. Prince William Sound humpback whale fluke ID catalog, 2006-2023. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2510155.

Straley, J., and J. Moran. 2023. Significance of whale predation on natural mortality rate of Pacific herring in Prince William Sound, Alaska: 2006-2009, 2011-2015, 2017-2023, Gulf Watch Alaska pelagic component. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/41873807.

Strom, S. L., and K. Fredrickson. 2023. Chlorophyll-a concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2022. Research Workspace. 10.24431/rw1k45f.

Strom, S. L., and K. Fredrickson. 2023. Dissolved organic carbon concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021.

Strom, S. L., and K. Fredrickson. 2023. Primary productivity estimates from NGA-LTER research cruises in the Gulf of Alaska, 2018-2021. Research Workspace. 10.24431/rw1k45b.

Strom, S. L., K. Fredrickson, and K. Bright. 2023. Microzooplankton abundance and biomass from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021. Research Workspace. 10.24431/rw1k45e.

Additional Products not listed above:

During the reporting period, two graduate students associated with the GWA-LTRM program completed their degrees:

O'Hare, M. 2023. Distribution and mixotrophy of cryptophyte phytoplankton in the Northern Gulf of Alaska. M. S. Thesis, Western Washington University.

Zahner, J. A. 2023. Operational harvest control rules and their application to a recovering forage fish stock. M.S. Thesis, School of Aquatic and Fishery Sciences, University of Washington.

The humpback whale project, nearshore project, HRM component worked with PWSSC staff to produce Field Notes recordings (https://pwssc.org/education/field-notes/).

ADF&G Commercial Fisheries Division, based in part on data associated with the herring surveys project, published PWS herring announcement #1 on January 17, 2024: https://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1555372420.pdf.

GAK-1 maintained updates to the project website at http://research.cfos.uaf.edu/gak1/.

Nearshore project team members worked with the CORaL Network to publish a YouTube video explaining a recently published paper on the evidence of increased mussel abundance related to the Pacific marine heatwave and sea star wasting: https://www.youtube.com/watch?v=AZex4dYvsHU.

In association with the Nearshore component, federal agencies published web articles based on data associated with the GWA-LTRM program:

- Determining the diets of black oystercatchers using stable isotope analysis (https://www.nps.gov/articles/000/black-oystercatchers-diet-isotopes.htm)

- The Pacific marine heatwave did not impact all marine bird species equally (https://home.nps.gov/articles/000/seaduck-response-to-marine-heatwave.htm)
- Mearns Rock: A long-term study of ecological recovery (https://response.restoration.noaa.gov/mearnsrock)

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

PWSSC co-leads the GWA-LTRM program with NOAA and is the fiscal agent for non-Trustee organizations through a NOAA grant. PWSSC PIs also lead or co-lead projects that are part of the GWA-LTRM program. PWSSC coordinates with all team members within the GWA-LTRM program and facilitates collaboration among the projects and components. GWA-LTRM collaborates with the Alaska SeaLife Center via connections to the CORaL Network.

EVOSTC Long-Term Research and Monitoring Projects

The GWA-LTRM program is EVOSTC's Long-Term Research and Monitoring program. Beginning in FY22, GWA incorporated the HRM program and both programs were initiated in 2012. Throughout the course of these programs, the PMT has encouraged and facilitated coordination and collaboration among individual projects and between the components. The project teams are now highly integrated and will continue improving relationships through the current funding period. For specifics on project coordination and collaboration, see individual project annual reports.

EVOSTC Mariculture Projects

The GWA-LTRM and Mar ReCon program share PIs and have lead organizations in common (i.e., PWSSC, UAF). Individual project PIs are developing working relationships including sharing ship time, equipment, logistics, and field crews with the Mar ReCon program. The Science Lead and other team members attended the Mar ReCon PI meeting in January 2024.

EVOSTC Education and Outreach Projects

Education and outreach within the spill affected area is an important component of the GWA-LTRM program. The primary education and outreach project that our program works with is the CORaL Network. CORaL Network team members have attended numerous GWA-LTRM

meetings, most recently our November PI meeting held in Anchorage, and collaborative education and outreach projects are increasing between the programs.

Examples of GWA-LTRM team members coordinating with the CORaL Network include the following:

- Sarah Traiger, a PI on the nearshore project, worked with the CORaL Network and PWSSC staff to develop an outreach video based on a recent publication: Evidence of increased mussel abundance related to the Pacific marine heatwave and sea star wasting (https://www.youtube.com/watch?v=AZex4dYvsHU).
- Nicole Webster, a PhD student in PI Danielson's UAF oceanography lab, has been working closely with Katie Gavenus of Center for Alaskan Coastal Studies, joining CORaL Network visits to PWS communities and leading science exploration, especially in the realm of underwater soundscapes.
- Program coordinator Donna Aderhold attended a workshop at AMSS coordinated by the CORaL Network.

We continue to meet with CORaL Network members at programmatic and project levels to refine methods to coordinate education and outreach activities in the interest of both programs.

In addition to working with the CORaL Network, individual projects conduct a wide variety of education and outreach activities. Please see individual project annual reports for a complete description of these activities.

Individual EVOSTC Projects

The GWA-LTRM program has an ongoing collaborative working relationship with the Data Management program. We rely on the Research Workspace data sharing platform developed by Axiom Data Science and the GOA data portal developed by Axiom Data Science and hosted by AOOS, both of whom make up the data management team. The PMT and project PIs are dedicated to meeting data quality and publication requirements established by EVOSTC through the Data Management program. In addition, PWSSC serves as the fiscal agent for the Data Management program.

The GWA-LTRM program shares PIs and project team members with the Pigeon Guillemot Restoration and Status and Trends of EVOS Injured Seabirds projects.

Trustee or Management Agencies

The GWA-LTRM program collaborates regularly with Trustee and Management Agencies. Many of our PIs work for Trustee Agencies (ADF&G, NOAA, and Department of Interior agencies including National Park Service (NPS), U. S. Geological Survey (USGS), and U. S. Fish and Wildlife Service (USFWS).

Many GWA-LTRM projects annually provide data to NOAA for its Gulf of Alaska Ecosystem Status Report and Socio-economic Profiles. PIs also conduct studies for and provide information to the Bureau of Ocean Energy Management for possible oil and gas lease sales in lower Cook Inlet. Individual projects and PIs also provide important data to ADF&G, NOAA, NPS, USGS, and other agencies to meet agency management objectives. For specifics on project coordination and collaboration, see individual project annual reports.

Native and Local Communities

While outreach and education within the spill affected area are generally important, coordination with Native and local communities is a particular focus of the GWA-LTRM program. The Science Lead and several project team members gave presentations at the CRRC annual subsistence memorial gathering in March 2023 and intend to continue this relationship throughout the current funding cycle. Programmatically we are coordinating with the CORaL Network to facilitate collaborative efforts that introduce PIs to local communities and community members.

Individual projects are strengthening ties with Chugach Alaska Corporation and CRRC on data collection and information sharing, and PIs are collaborating with Alaska Native and local communities and individuals in mentoring and other activities. Please see individual project annual reports for details.

4. Response to EVOSTC Review, Recommendations and Comments:

EVOSTC provided no comments on the program in FY23. See individual projects for responses to project-related comments.

The GWA-LTRM PMT submitted a request for funding reallocation during FY23 that was reviewed by the Science Panel, Public Advisory Committee, and Trustees. The Trustees met in

January 2024 to discuss the request. GWA-LTRM will follow the decisions authorized by the Trustees at their January 2024 meeting.

5. Budget:

This section includes several summary-level cumulative spending budgets and cumulative spending for the NOAA and PWSSC portions of the program management project.

The budget below shows FY22 and FY23 cumulative spending relative to what was proposed for each project in the GWA-LTRM program. Note that most projects are behind in their intended spending for the two-year funding period due to a time lag in when NOAA grants were initiated for non-Trustee Agency partners.

2022-2026 Gulf Watch Alaska LTRM Program Budget

Principal Investigators and Affiliation	Activity - short project title	FY 22	FY 23	FY 24	FY 25	FY 26	5 Yr proposed TOTAL	Actual Cumulative
Coordination, Synthesis, Outreach, & Administration								
Lindeberg & Suryan, NOAA	Program Management A	$162,981	$162,799	$166,541	$170,365	$174,271	$836,957	$267,545
Hoffman, PWSSC	Program Management B	$487,250	$499,280	$512,820	$526,095	$535,355	$2,560,800	$608,321
Coordination, Synthesis, Outreach, & Administration Total		**$650,231**	**$662,079**	**$679,361**	**$696,460**	**$709,626**	**$3,397,757**	**$875,866**
Environmental Drivers								
Ostle, MBA, & Batten, PICES	CPR in the GOA	$78,502	$80,492	$82,503	$84,564	$86,676	$412,737	$132,163
Campbell, PWSSC	PWS Oceanographic	$229,140	$234,870	$240,740	$246,758	$252,929	$1,204,437	$315,095
Danielson, UAF	GAK-1 Mooring	$125,080	$141,301	$139,882	$187,741	$193,126	$787,129	$122,704
Hopcroft & Danielson, UAF	Seward Line	$216,613	$222,026	$227,577	$233,269	$212,008	$1,111,494	$278,384
Hauri, UAF	Ocean Acidification	$144,042	$127,311	$110,856	$113,123	$115,774	$611,107	$144,719
Environmental Drivers Total		**$793,376**	**$806,001**	**$801,559**	**$865,456**	**$860,513**	**$4,126,905**	**$993,065**
Pelagic Monitoring								
Arimitsu & Piatt, USGS	Forage Fish Monitoring	$319,226	$293,864	$302,757	$312,010	$321,639	$1,549,495	$608,413
Kuletz & Kaler, USFWS	PWS/LTER Marine Bird	$88,075	$376,519	$85,764	$304,165	$93,612	$948,135	$464,594
Durban & Matkin, NGOS	Killer Whale Monitoring	$195,690	$115,555	$0	$0	$0	$311,245	$256,299
Moran, NOAA, & Wild, UAS	Humpback Whale Monitoring	$187,806	$186,633	$183,260	$187,465	$186,616	$931,779	$264,944
Pelagic Monitoring Total		**$790,796**	**$972,571**	**$571,781**	**$803,640**	**$601,866**	**$3,740,654**	**$1,594,250**
Herring Research & Monitoring								
Branch, UW	Herring Modeling	$130,016	$130,573	$144,082	$146,528	$151,128	$702,327	$131,507
Hershberger & Paez, USGS	Herring Disease	$315,826	$389,456	$288,712	$296,288	$362,074	$1,652,356	$492,988
Morella, ADF&G	Spawning Surveys & ASL	$143,686	$208,590	$207,432	$183,375	$163,125	$906,209	$255,007
Rand, Campbell, PWSSC, Gorman, UAF, Heintz,								
Nearshore Monitoring								
Coletti, NPS, Esler, USGS, Konar & Iken, UAF	Nearshore Monitoring	$613,497	$642,629	$673,842	$551,847	$557,133	$3,038,947	$792,648
Nearshore Monitoring Total		**$613,497**	**$642,629**	**$673,842**	**$551,847**	**$557,133**	**$3,038,947**	**$792,648**
Lingering Oil								
Esler, USGS, & Lindeberg, NOAA	Lingering Oil	$0	$0	$0	$113,800	$0	$113,800	$0
Lingering Oil Total		**$0**	**$0**	**$0**	**$113,800**	**$0**	**$113,800**	**$0**
	Program Total Cost	**$3,821,106**	**$4,176,610**	**$3,738,382**	**$3,975,920**	**$3,713,354**	**$19,425,372**	**$5,502,528**
FY 22-26 Total all Program projects including 9% GA		**$4,165,006**	**$4,552,505**	**$4,074,837**	**$4,333,753**	**$4,047,555**	**$21,173,656**	**$5,997,755**

The budget below shows FY22 and FY23 cumulative spending relative to spending categories. Similar to the project spending, this budget indicates that spending by category is below proposed spending for reasons described above.

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
PROGRAM BUDGET PROPOSAL AND REPORTING FORM

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5-YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$2,042,670	$2,276,854	$2,194,831	$2,265,224	$2,227,845	$11,007,423	$2,894,198
Travel	$135,651	$154,877	$137,796	$164,396	$136,426	$729,146	$223,947
Contractual	$918,388	$969,746	$804,281	$958,898	$806,659	$4,457,972	$1,349,498
Commodities	$250,982	$232,264	$211,808	$237,260	$197,750	$1,130,063	$427,495
Equipment	$263,027	$324,543	$178,837	$131,432	$129,772	$1,027,611	$347,978
Indirect Costs (rate will vary by project)	$210,388	$218,327	$210,830	$218,711	$214,902	$950,936	$259,412
SUBTOTAL	$3,821,106	$4,176,610	$3,738,382	$3,975,920	$3,713,354	$19,425,372	$5,502,528
General Administration (9% of subtotal)	$343,900	$375,895	$336,454	$357,833	$334,202	$1,748,284	N/A
PROGRAM TOTAL	**$4,165,006**	**$4,552,505**	**$4,074,837**	**$4,333,753**	**$4,047,555**	**$21,173,656**	
Other Resources (In-Kind Funds)	**$1,921,954**	**$1,988,772**	**$1,947,543**	**$1,977,340**	**$1,958,099**	**$9,793,708**	

COMMENTS:
The GWA-LTRM program budget represents multiple agencies and organizations. Indirect rates and exemptions from indirect rates vary by proposer. This sheet summarizes all proposed project expenses by category. Please see individual project budgets for detail.

Most projects in the program are behind on their spending for FY22 and FY23. The delay in release of FY22 funds and delay in issuance of the NOAA grant for non-Trustee projects is the primary reason for the spending lag. Please see individual project budgets for specific reasons.

FY22-26	**Program Number: 2222LTRM** **Program Title: Gulf Watch Alaska-LTRM**	SUMMARY TABLE

The spreadsheet below shows spending that individual projects would like to carry over from FY22 and FY23 to FY24. The primary reason for the underspending in 2022 and 2023 is the delay in the release of funds by EVOSTC that led to delays in agency funding release and a delay in issuance of the NOAA grant for non-Trustee organizations. This serves as a no-cost extension request for FY24.

Project Number	Project Title	Lead PI(s)	FY23 Carry Over to FY24 (based on FY22-23 cumulative spending)
Program Management			
2322LTRM-A	GWA-LTRM Program (NOAA)	Lindeberg	$58,235
2322LTRM-B	GWA-LTRM Program (PWSSC)	Hoffman	$378,209
Environmental Drivers			
23120114-D	CPR	Ostle & Batten	$26,831
23120114-G	PWS Oceanographic	Campbell	$148,915
23120114-I	GAK-1	Danielson	$143,677
23120114-L	Seward Line	Hopcroft & Danielson	$160,255
23220202	Ocean Acidification	Hauri	$126,634
Pelagic			
23120114-C	Forage Fish	Arimitsu & Piatt	$4,677
23120114-M	PWS Marine Bird Surveys	Kaler	$0
23120114-N	Killer Whales	Durban & Matkin	$54,946
23120114-O	Humpback Whales	Moran & Wild	$109,495
Herring Research & Monitoring			
23220111-C	Herring Modeling	Branch	$129,081
23220111-E	Herring Disease	Hershberger & Paez	$212,294
23170111-F	Herring Surveys	Morella	$97,268
23120111-I	Herring/Salmon Interactions	Rand et al.	$381,193
~~23220203~~	~~Pollock/Herring Interactions~~	~~Rhea-Fournier et al.~~	~~$0~~
Nearshore			
23120114-H	Nearshore	Coletti et al.	$463,478
Lingering Oil			
23120114-P	Lingering Oil	Esler & Lindeberg	$0
Total Carry Over			**$2,495,189**

Below is the cumulative spending budget for the NOAA portion of the program management project. Spending is on track with some carryover funds that will be spent in FY24.

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
PROJECT BUDGET PROPOSAL AND REPORTING FORM

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	$205,507
Travel	$18,650	$18,930	$19,435	$19,940	$20,445	$97,400	$21,728
Contractual	$0	$0	$0	$0	$0	$0	$0
Commodities	$18,000	$13,500	$13,500	$13,500	$13,500	$72,000	$40,310
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
SUBTOTAL	$162,981	$162,799	$166,541	$170,365	$174,271	$836,957	$267,545
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)	$89,375	$91,609	$93,899	$96,247	$98,653	$469,783	

COMMENTS:
FY23 spending is on track with some carryover funds ($58,235) that will be spent in FY24.

NOAA:
In Kind Labor: Total = $469.8K for 5 years
Program Lead: Lindeberg = $390K (25 mos for 5 years)
Program Science Lead: Suryan = $80K (5 mos for 5 years)

FY22-26	**Project Number: 2222LTRM-A** **Project Title: Program Management A** **PI(s): Lindeberg & Suryan (NOAA)**	TRUSTEE AGENCY SUMMARY PAGE

Below is the cumulative spending budget for the PWSSC portion of the program management project. Underspending is related to the delay in the release of funds by EVOSTC and subsequent delay in NOAA issuing its grant for non-Trustee organizations.

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
PROJECT BUDGET PROPOSAL AND REPORTING FORM

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	$396,726
Travel	$12,400	$12,400	$12,690	$13,390	$13,390	$64,270	$11,329
Contractual	$121,800	$123,550	$126,190	$127,840	$129,490	$628,870	$192,715
Commodities	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	$7,551
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
Indirect waived							
SUBTOTAL	$487,250	$499,280	$512,820	$526,095	$535,355	$2,560,800	$608,321
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	

COMMENTS:
Spending for FY22 & FY23 continues to be lower than anticipated because of the delay in the release of funds by EVOSTC and issuance of the NOAA grant.

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.

FY22-26	Project Number: 2222LTRM-B Project Title: Program Management B Primary Investigator: Hoffman (PWSSC)	NON-TRUSTEE AGENCY SUMMARY PAGE