Exxon Valdez **Oil Spill Trustee Council**

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

Annual Program Reporting Form

Program Number: 2222LTRM

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, 2022 – January 31, 2023

Submission Date: October 13, 2023

Program Website: https://gulfwatchalaska.org/

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

☒ **Program progress is on schedule.**

While the program is on schedule, several projects experienced delays because of the delay in transferring funds to agencies and in the award of the National Oceanic and Atmospheric Administration's (NOAA's) grant to non-Trustee organizations. See individual project annual reports for information on these delays.

☐ **Program progress is delayed.**

☒ **Budget reallocation request.**

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 FY22 to FY23. The NOAA 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 about the request may be found in Section 5. Budget.

☐ **Personnel changes.**

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1. Summary of Work Performed:

Fiscal year 2022 (FY22) was the first year of a new *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) funding cycle and was a busy year for the Gulf Watch Alaska Long-Term Research and Monitoring (GWA-LTRM) program management team (PMT). During the proposal process that led to the current configuration of the GWA-LTRM program, the program management project was incorporated into the program, so this annual report includes a thorough accounting of the PMT's work as well as brief summaries of the work performed by each of the monitoring and research projects.

Program Management

Following the Trustee funding award to the GWA-LTRM program, PMT members worked with EVOSTC staff and Trustee agencies to award funds and initiate contracts and grants. The largest is the National Oceanic and Atmospheric Administration's (NOAA's) grant to Prince William Sound Science Center (PWSSC) as the fiscal agent for non-Trustee organizations working on EVOSTC long-term monitoring projects. 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. PWSSC staff prepared annual scopes of work and budgets and submitted them to NOAA. Once the NOAA grant award was made, PWSSC established subawards with each non-Trustee organization for each project. Because of delays in the release of funds from EVOSTC, the NOAA grant was not awarded until June and the fiscal year for the NOAA grant will run from June 1 through May 30 each year and will be offset from the EVOSTC fiscal year for the current funding cycle. During the remainder of FY22, PWSSC maintained its fiscal obligations under the NOAA grant, including submitting semi-annual reports.

The GWA-LTRM PMT incorporated the previous Herring Research and Monitoring (HRM) program by creating a new HRM component. We also welcomed two projects into the GWA-LTRM program that were funded as individual projects: Continuation and expansion of ocean acidification monitoring in the spill area (22220202, PI Hauri) and Prince William Sound (PWS) walleye pollock-Pacific herring interactions (22220203, PIs Rhea-Fournier et al.). As part of this process, we updated program contact information and distribution lists.

The PMT reevaluated the Science Review Panel (SRP) and incorporated HRM SRP members into the program. Based on SRP member retirements and reorganization, the GWA-LTRM SRP

members currently include Sherri Dressel (Statewide herring fisheries scientist, Alaska Department of Fish and Game [ADF&G]), Terrie Klinger (Lowell A. and Frankie L. Wakefield endowed professor, School of Marine and Environmental Affairs, University of Washington), Steve Martell (quantitative fisheries scientist at Sea State, Inc.), Stephen Okkonen (oceanographer), Stanley "Jeep" Rice (scientist emeritus, NOAA Alaska Fisheries Science Center, Auke Bay Laboratories), and Mike Sigler (NOAA Alaska Fisheries Science Center, retired). Biographical information about SRP members may be found at the GWA-LTRM program website (https://gulfwatchalaska.org/people/science-review-team/).

The PMT held two in person PI meetings during FY22. A multi-day meeting was held at the Cordova Center in Cordova, Alaska, November 7-9, 2022 (Fig. 1). 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. Time was also allocated for component meetings. A lunch meeting was held during the Alaska Marine Science Symposium at the Dena'ina Civic and Convention Center in Anchorage, Alaska, January 25, 2023, and incorporated remote participation through GoTo Meeting videoconferencing. The meeting included program reminders and updates, and presentations and collaborative time with the Mariculture Recon and CORaL network programs recently funded by the EVOSTC. Planned spring and summer teleconferences during 2022 were not conducted due to the late funding of the program.

Program-level outreach activities began ramping up during FY22. The program website (https://gulfwatchalaska.org) received modest revisions to update the list of PIs and SRP members, add HRM and other new projects, and incorporate several news items. The HRM website (https://pwssc.org/herring/) also received project description updates. A more comprehensive update will occur in FY23 to add findings from FY17-21 final reports once the reports are approved by EVOSTC.

We continued providing articles to the PWSSC annual publication *Delta Sound Connections* which is published in the spring of each year. Articles by project team members were solicited during the final year of the previous funding cycle and published during the current funding cycle and GWA and HRM articles appeared in separate spreads. Going forward, the pages will be combined. The five HRM articles and six GWA 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. 2).

Figure 1. Gulf Watch Alaska Long-Term Research and Monitoring team members attend a principal investigators' meeting in November 2022 at the Cordova Center in Cordova, Alaska.

The Chugach Regional Resources Commission (CRRC) held their annual gathering in March 2022 in a hybrid format after cancelling the gathering for two years due to the coronavirus pandemic. GWA and HRM were invited to give presentations; Rob Suryan presented on marine heatwave effects on subsistence species and Hayley Hoover provided an overview of herring in PWS.

The GWA-LTRM PMT looks forward to the opportunity to work with members of the CORaL network on outreach activities. We invited members of the CORaL network to attend our

November 2022 and January 2023 PI meetings. In January, the full CORaL network leadership team attended our PI meeting to provide information about various aspects of their network and goals and to answer questions from GWA-LTRM PIs.

Figure 2. Prince William Sound Herring Watch Facebook post.

The GWA-LTRM PMT facilitates coordination and collaboration with other programs and projects funded by EVOSTC and encourages projects to develop individual relationships with other programs. We continue our close working relationship with the Data Management program and are developing relationships with the CORaL network and Mariculture Recon program. These are described in greater detail in Section 3. Coordination and Collaboration.

Science synthesis activities included completion of the final articles for the special issue of the journal Deep-Sea Research II, titled "Understanding Ecosystem Processes in the Gulf of Alaska." Production of this special issue, plus five of the fourteen papers within were led by GWA-LTRM investigators. Additional science synthesis efforts in 2022 included continued development of an ecosystem model to assess the effects of heatwaves on the PWS food web and recovery timelines for species of interest to the EVOSTC and GWA. This GWA-LTRM modeling effort contributes to a much larger effort with complimentary regional GOA models under development by the Northern Gulf of Alaska Long-term Ecological Research site (National Science Foundation), NOAA Fisheries, University of Alaska Fairbanks, University of Washington, and others. The goal of this effort is to understand mechanisms and forecast the effects of climate change to the GOA ecosystem and various species of interest for management agencies and the EVOSTC. The third priority task in 2022 was developing the focus for Pelagic Component science synthesis efforts, which includes evaluating predator responses to variability in prey-field characteristics across contrasting oceanographic settings in the GOA and establishing the cooperative funding agreements to begin the research.

Nearshore Component

The Nearshore Component project (22120114-H, principal investigators [PIs] Coletti et al.) conducted intertidal monitoring in four regions within the spill-affected area of the northern Gulf of Alaska (GOA): western Prince William Sound, 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 2022, team members completed all aspects of the nearshore monitoring component across all four regions. For the 2022 annual report, they reported on intertidal water temperature and several intertidal indicators that represent key nearshore ecosystem components of primary production and prey abundance.

Environmental Drivers Component

Continuous Plankton Recorder

All 2022 Continuous Plankton Recorder (CPR; 22120114-D, PIs Ostle and Batten) tows were successfully completed as planned, the sampling season was cut short as the cargo vessel (the

Matson Kodiak) had to go into dry dock in July. To account for this shorter sampling season, the team started towing the CPR in the GOA earlier than normal (March), to achieve four full months of samples collected.

The CPR was deployed on four transects in 2022, monthly from March to June. All four transects were successful in their sampling. The location of the ship's transect continues to be consistent from month to month. At the time of writing, provisional plankton data for March to June are available and the samples are undergoing quality control.

Oceanographic Conditions of Prince William Sound

The planned surveys of PWS (project 22120114-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. Plankton and chlorophyll-a samples were collected from all stations with no incidents. Sample processing is catching up following delays caused by the coronavirus pandemic and the departure and replacement and training of the technician who processes those samples.

The profiling mooring was deployed March 30, 2022, and profiled for several days before malfunctioning; it was serviced in early April when the weather allowed. The profiler malfunctioned again in late August, was serviced in September, and did a number of profiles into October before malfunctioning a third time. The malfunctions appear to have been related to the profiler battery. Replacing the batteries is not budgeted (~$40K each), and we are working with engineers at Georgia Tech to develop a less expensive, more user-serviceable battery.

A plankton camera was developed and installed on the profiler in 2016, with funding from the North Pacific Research Board. Following a robust period of training and testing a classification system, the classifier is now being applied to the full image set, and concordance with samples taken with a 202 µm mesh plankton net at approximately the same time and depth range are being evaluated. The camera observes fewer copepods than seen in the net samples, which may reflect avoidance of the camera frame, which has a smaller opening (15 cm) than the net (60 cm). Copepods are very sensitive to tactile stimulation and the pressure wave produced by the profiler and camera can elicit escape reactions (the camera has captured numerous images of copepods exhibiting an escape response). The camera appears to be more effective than the net at enumerating fragile taxa, such as Cnidarians, which are damaged or destroyed by net sampling.

Several of the gelatinous taxa (*Beroe* and *Bollinopsis* ctenophores, and Siphonophores) have never been collected by the net at the profiler site and have only been observed by the camera.

Oceanographic Station GAK-1

The GAK-1 project (22120114-I, PI Danielson) had a successful recovery and re-deployment of the 2021/2022 GAK-1 mooring in May 2022. 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 addition to the mooring, the project team collected monthly hydrographic profiles at GAK-1 from *R/V Nanuq,* managing to get casts in all months except March. New analyses of the GAK-1 record indicate that the nature of thermal and haline trends are seasonally dependent. Although additional progress has not yet been made in diagnosing the causes of these signals, we anticipate that a focused study of seasonality in the coastal GOA will yield new insights into the physical and ecological functioning of this marine system.

Seward Line

The Seward Line (project 22120114-L, PIs Hopcroft and Danielson) was sampled in early May and mid-September of 2022. In summary, spring temperatures were slightly below the long-term mean by about a quarter degree and fall warmer by about a quarter degree. The spring bloom was large and sustained. Copepod and euphausiid biomasses were at or above the long-term means for both seasons. 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 (22220202, PI Hauri) was added to the GWA-LTRM program after it was funded by the Trustee Council for FY2022-2026. The team collected water samples for total alkalinity, dissolved inorganic carbon, and pH during the spring (265 samples) and fall (174 samples) joint GWA-LTRM and Northern Gulf of Alaska Long-Term Ecological Research cruises along the Seward and Kodiak lines and in PWS. Due to the delay in funding and limited availability of sampling bottles, they were not able to collect water samples on the summer cruise. To maintain the 23-year long time series they prioritized the spring and fall cruises. They finalized the laboratory analysis of all samples and started the purified dye experiment and dye perturbation experiment to additionally improve the quality of the pH measurements. This

experiment will continue throughout the year. They ordered necessary consumables for sample collection and lab analyses and are currently cleaning sampling bottles to be ready for the upcoming field season.

Pelagic Component

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

The forage fish project (22120114-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 22120114-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 30 August 2022. This included a total of 1129 diet samples from black-legged kittiwakes and 369 diet samples from rhinoceros auklets.

The Fall IPP survey occurred on schedule during the second two weeks of September. The crews conducted acoustic transects, trawl, and habitat sampling in Bainbridge Passage, Montague Strait, and Port Gravina as planned. They also conducted focal follows of humpback whales whenever possible and encountered notable concentrations of adult herring near three feeding humpback whales at Glacier Island on 21 Sep 2022.

Summer forage fish sampling was conducted from Cordova, AK in support of the continuing aerial forage fish surveys during the second week of June.

Prince William Sound and Northern Gulf of Alaska Marine Bird Surveys

The marine bird survey project (22120114-M, PI Kaler) conducted marine bird surveys in PWS and the Northern GOA. For the PWS component, we conducted small boat surveys to monitor abundance of marine birds in PWS during July 2022 by using carryover funds from the previous funding cycle (2017-2021) to continue the time series used to monitor population trends for

marine birds following the 1989 *T/V Exxon Valdez* oil spill. 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.

Our PWS results indicate that recovery is underway for many taxa. We conclude bald eagles, cormorants, and harlequin ducks are recovering, while mergansers, murrelets, pigeon guillemots, and terns are not recovering. The population status of black-legged kittiwakes, black oystercatchers, bufflehead, goldeneyes, grebes, loons, short-billed (mew) gulls, murres, and scoters is unknown. Mergansers, murrelets, pigeon guillemots, and terns, all of which are piscivorous, continue to decrease in oil affected areas of PWS.

Along the Seward Line, different marine bird groups had contrasting responses to temperature variability over a two-decade period. Three out of four evaluated species of tubenoses were positively associated with warmer upper-ocean temperatures, while three out of four alcids and gulls were negatively affected. During and after the Pacific marine heatwave, murres, kittiwakes, and gulls became less abundant on the shelf and concentrated near the coast, concurrent with reproductive failures and die-off events. Negative effects of this heatwave on piscivorous marine birds highlight their susceptibility to ongoing ecological changes in the region. Taken as a whole, our results suggest that food-web mechanisms are probably a primary factor behind the failure of some species of marine birds to recover from mortality caused by the oil spill.

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

The killer whale project (22120114-N, PIs Durban, Matkin, and Olsen) completed 50 vessel survey days in 2022 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, Hinchinbrook Entrance to PWS in early May and the second half of June and Montague Strait / southwest PWS in July.

To help understand ecosystem interactions underlying population dynamics for these top predators, scientists continued to collect samples to investigate diet. In 2022 we collected free-floating fecal samples and scale samples that will be genetically analyzed to identify prey species. This project continued to service and collect data from bottom-mounted hydrophones at four sites in the northern GOA (Hinchinbrook Entrance, Montague Strait, Resurrection Bay, and

Kachemak Bay), and deployed a hydrophone at a new location off the northeast corner of Kodiak Island. The team used drone photogrammetry for quantitative measurements of health metrics, specifically to better understand nutritional health and the ecological factors underpinning contrasting pod dynamics.

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

The April and September 2022 GWA-LTRM humpback whale surveys (project 22120114-O, PIs Moran and Straley) in PWS were completed. All samples from both surveys have been processed or submitted for analysis. Completed data have been archived with the Alaska Ocean Observing System. Although herring appear to be recovering in PWS, humpback whale numbers remain low. Whale numbers were up slightly from recent years but are still nowhere close to pre-heatwave abundance. Prey was abundant with spawning herring being the main target of whales followed by euphausiids. Our general impression was that the ecosystem was starting to get back to pre-heatwave conditions except humpback whales.

We completed the humpback whale component of the IPP survey in September with the forage fish project (22120114-C). Whale numbers remain low within the Sound. Large concentrations of prey were located in Whale Bay (euphausiids) and near Glacier Island (adult herring). Juvenile herring schools were scattered throughout the Sound with a few humpbacks targeting these schools. Prey schools with marine birds foraging on them were targeted by whales near Fox Farm and McCleod Bay.

Herring Research and Monitoring Component

Modeling and Stock Assessment of Prince William Sound Herring

The herring modeling project (22120111-C, PI Branch) ran the 2022 Bayesian age-structured stock assessment for PWS herring, began gathering data for best practices globally for harvest control rules of highly variable fish populations, created a management strategy evaluation framework for PWS herring, and developed preliminary results for the evaluation of alternative harvest control rules for setting PWS herring catch.

Herring Disease Program

The herring disease program (project 22120111-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 constructing 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*), used mitochondrial encoded cytochrome-c oxidase gene sequences and phylogenic analysis to compare *Icthyophonus* spp. Isolates from several marine and anadromous fish hosts to develop a phylogeny of different strains of *Icthyophonus* and possible host/niche segregation not previously described, explored a novel approach for directly incorporating disease into fisheries stock assessment by using seroprevalence data, and conducted controlled exposure studies to provide evidence for a direct relationship between increased temperature and the progression of viral erythrocytic necrosis.

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

During 2022, the herring surveys project (22170111-F, PI Morella) conducted 69 hours of aerial surveys during 22 flights of PWS. The aerial spawn estimate is 32.7 statute mile-days-of-milt, which is the highest level of spawn recorded since 2014. The team monitored satellite imagery to look for spawn in areas or on days they did not fly. Age, sex, and length (ASL) sampling of 2022 spring herring was conducted in six locations within PWS: Red Head, Cedar Bay, Rocky Bay, Port Chalmers, Port Etches and Boswell Bay. Overall, PWS age composition was 19.5% age-3, 10.7% age-4, 15.8% age-5, 51.3% age-6 and 2.8% age-7 or older. Overall weight at age increased in all major age classes while length at age decreased. The team also conducted aerial surveys of Kayak and Wingham islands. Historically, Kayak Island has not had regular aerial survey coverage or sampling, and therefore was not included in the development of the age structured assessment model and the minimum spawning biomass threshold for consideration of a commercial fishery.

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

The herring-salmon interactions project (2222011-I, PIs Rand et al.) was first funded by the EVOSTC in FY22. Due to the late arrival of funding, the field work and associated data collections was delayed until May 2023. However, in FY22 PIs began the process of acquiring

needed equipment (trawls, field sampling supplies, etc.), applying for collection and Institutional Animal Care and Use Committee permits, and establishing a cooperative agreement with ADF&G. PIs also spent some time attending the GWA-LTRM PI meeting in Cordova, AK (Nov 2022) and the Alaska Marine Science Symposium (Jan 2023), identifying additional collaborators who will be involved in the project, including a graduate student (University of Alaska Fairbanks) and a field/lab technician (PWSSC), in addition to and planning for field work scheduled to begin in spring 2023.

Prince William Sound Walleye Pollock-Pacific Herring Interactions

Due to the delay in the release of funds for FY22 and the resulting no-cost extension request for the pollock-herring interactions project (22220203, PIs Rhea-Fournier et al.), no field work was performed in 2022 and the summer bottom trawl survey and associated data collections will begin in June 2023. However, in the current fiscal year, data collection methods were refined and equipment was purchased. Examination of stomach contents from piscivorous groundfish target species on an ADF&G funded bottom trawl survey in PWS resulted in the observation of Pacific herring in the stomachs of walleye pollock, arrowtooth flounder, and longnose skates. Net mensuration equipment, acoustic equipment, and electronic data collection equipment were purchased in preparation for surveys in 2023. ADF&G personnel also collaborated with PWSSC staff to ensure standardized collection of oceanographic data.

Lingering Oil Component

The Lingering Oil component project (2220114-P, PIs Esler and Lindeberg) did not perform work during FY22. Field sampling for lingering oil and analysis of sampling is scheduled for 2025.

2. Products:

Peer-reviewed publications:

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Dowling, A., B. Konar, and K. Iken. *In press.* Influence of environmental conditions on *Mytilus trossulus* size frequency distributions in two glacially influenced estuaries. Estuaries and Coasts.

Du, X., R. W. Campbell, and S. Kibler. 2022. Seasonal Changes of Microphytoplankton Community in Prince William Sound, Alaska in 2019. Estuaries and Coasts. doi: 0.1007/s12237-022-01144-z.

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Kelly, T. 2023. Spatial scales of bio-optical properties highlight bio-physical coupling in the Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

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Marsteller, C., M. Arimitsu, J. Piatt, V. von Biela, and D. Donnelly. 2022. Pacific capelin age-at-spawning and energy content following a prolonged marine heatwave. Oral presentation, Capelin Symposium Bergen, Norway, October.

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Myers, H. 2022. Killer whale vocal behavior and passive acoustic density estimation. Poster presentation, National Defense Science and Engineering Graduate Fellows Conference, Boston, Massachusetts, July.

Myers, H. 2022. Year-round calling rate of a southern Alaska resident killer whale pod., Oral presentation, Workshop on Detection, Classification, Localization, and Density Estimation of Marine Mammals using Passive Acoustics, Honolulu, HI, March.

Myers, H. 2023. How much do killer whales call? Quantifying calling rates for passive acoustic density estimation. Oral presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

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Norgaard, A., C. Hauri, B. Irving, and S. Danielson. 2023. Interannual variability in the inorganic carbon system at the Gulf of Alaska Ecosystem Observatory. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

O'Daly, S. 2022. Efficient carbon export in the Northern Gulf of Alaska during the 2019 Pacific Marine Heatwave. Poster presentation, LTER All Scientists Meeting, virtual, September.

O'Hara, M. 2022. Cryptophyte distribution and mixotrophy in the subarctic Pacific Ocean. Poster presentation, Ocean Sciences Meeting, virtual, February.

O'Hara, M. 2022. High biomass indicates importance of small phytoplankton cells. Poster presentation, LTER All Scientists Meeting, virtual, September.

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Ostle, C. 2022. Update on the North Pacific CPR survey. Presented to the North Pacific Marine Science Organization (PICES) Monitor Technical Committee annual meeting, September.

Ostle, C. 2023. Alaska HABs research: Current state and future directions. Participant, Alaska Marine Science Symposium workshop, Anchorage, AK, January.

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Questel, J. M. 2023. Molecular characterization of the deep-sea zooplankton community from the Gulf of Alaska Seamount Province. Oral presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Pages, R. 2022. Long-term trends and compound events of ocean deoxygenation and acidification in the Gulf of Alaska. Oral presentation, Ocean Sciences Meeting, virtual, March.

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Reynolds, E., and B. Konar. 2023. Sea otter interactions with mariculture. Poster presentation, Alaska Marine Science Symposium, January, Anchorage, AK.

Robinson, B., H. Coletti, B. Ballachey, J. Bodkin, G. Esslinger, and D. Esler. 2022. Spatial and temporal variation in nearshore marine bird communities in a warming Gulf of Alaska. Pacific Seabird Group, February.

Robinson, B., H. Coletti, and D. Esler. 2022. Turning up the heat: Investigating effects of the Pacific marine heatwave on Black Oystercatcher diets in the Gulf of Alaska. International Wader Study Group Annual Meeting, Szeged, Hungary, September.

Salzer, J. E., J. B. Greer, M. L. Groner, A. H. MacKenzie, J. L. Gregg, and P. K. Hershberger. 2022. Effects of temperature on viral erythrocytic necrosis (VEN) in Pacific herring. Western Fish Disease Workshop. Hood River, OR, May.

Salzer, J. E., J. Greer, M. Groner, A. MacKenzie, J. Gregg, and P. Hershberger. 2023. Elevated temperature increases disease progression and host response of Pacific herring to erythrocytic necrosis virus. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Spanjer, A., T. Liedtke, P. Hershberger, K. Conn, and K. Snekvik. 2022. Immunotoxic response and disease susceptibility in adult Pacific Herring, *Clupea pallasii*, fed a complex PCB congener mixture. 2022 Salish Sea Ecosystem Conference, virtual, April.

Stidham, E. 2022. Two-decades of observations on pelagic tunicates and pelagic snails in the Northern Gulf of Alaska (NGA). Oral presentation, Ocean Sciences Meeting, virtual, March.

Stidham, E. A. 2022. Two decades of observations on mucus-net feeders in the Northern Gulf of Alaska. Poster presentation, LTER All Scientists Meeting, virtual, September.

Stidham, E. A. 2023. Two decades of observations on mucus-net feeders in the Northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Strom, S. 2022. Seward Line spring phyto-microzooplankton. Oral presentation, Spring Preview of Ecosystem and Economic Conditions (PEEC) Workshop, NOAA Integrated Ecosystem Assessment Program, May.

Strom, S., and S. Danielson. 2022. Ecological structure from a variable river plume in a productive marine setting. Poster presentation, LTER All Scientists Meeting, Asilomar, CA, September.

Traiger, S., J. Bodkin, R. Campbell, H. Coletti, D. Esler, K. Holderied, C. McKinstry, D. Monson, M. Renner, B. Robinson, R. Suryan, and B. Weitzman. 2023. Does larval supply matter? Relating meroplankton variability with benthic invertebrate abundance in Prince William Sound. Alaska Marine Science Symposium, Anchorage, AK, January.

Turner, L., C. Cunningham, and M. Arimitsu. 2022. Combining forage fish datasets to understand spatial and temporal patterns for management. Oral presentation, American Fisheries Society Alaska Chapter, March.

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, AK, January.

Wright, S. K., D. Lowry, R. Gustafson, J. Hyde, M. Lindeberg, S. Lonhart, M. Neuman, D. Stevenson, N. Tolimieri, and S. Traiger. Sunflower sea star: Update on the Endangered Species Act status review. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Zahner, J. A., and T. A. Branch. 2023. Evaluation of harvest control rules for Prince William Sound Pacific herring. Oral presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Public presentations:

Batten, S., and C. Ostle. 2022. The North Pacific Continuous Plankton Recorder survey. Fisheries and Ocean Sciences Seminar, University of Alaska Fairbanks, spring.

Campbell, R. W. 2023. Oceanography and plankton in Prince William Sound from a robotic observatory. Presentation to University of Alaska FRACAS faculty meeting, January.

Corliss, K. 2022. Otoliths and marine food webs. BEST Homeschool Presentation.

Cushing, D., E. Labunski, and K. Kuletz. 2022. Summer tourists: The rare, amazing, and out-of-their-range visitors observed during seabird surveys in the Northern Gulf of Alaska. Poster presentation, Kachemak Bay Shorebird Festival, Homer, AK, May.

Fearnbach, H., and J. Durban. 2022. Studying killer whale health using aerial photogrammetry. Naturalist Training, The Whale Museum, Friday Harbor, WA, August.

Hershberger, P.K. June 23, 2022. What's Happening Down at the Point? USGS - Marrowstone Marine Field Station. Invited Seminar: Friend of Fort Flagler. Nordland, WA.

Hershberger, P.K. August 3-4, 2022. Understanding and Mitigating the Impacts of Marine Disease. Invited Seminar and Laboratory Instructor: Friday Harbor Laboratories, University of Washington, Friday Harbor, WA.

Hershberger, P.K. September 29, 2022. The Ecology of Disease in Marine Fishes: Insights from Pacific Herring. Invited seminar: Memorial University, Newfoundland, Canada.

Hoover, H. 2022. Herring research and monitoring. Oral presentation, Chugach Regional Resources Commission annual gathering, virtual, March.

Moran, J. 2022. What's happening with Prince William Sound humpback whales? Large whale entanglement response training, Cordova, AK, June.

Moran, J. 2022. What's happening with Prince William Sound humpback whales? Large whale entanglement response training, Gustavus, AK, June.

Moran, J. 2022. Whales in the time of COVID. Maui Whale Tales, Maui, Kapalua, HI, March.

Myers, H. 2023. Eavesdropping on killer whales. Forum on Ecoacoustics, Anchorage Museum Pass the Mic Series. Anchorage, AK, January.

Olsen, D. 2022. Killer whale culture. Alaska Wildlife Alliance marine mammal forum, Homer, AK, April.

Olsen, D. 2022. Killer whales of Kenai Fjords. Seward Captain and naturalist training, Seward, AK, May.

Olsen, D. 2022. Killer whales of Kenai Fjords. Kayak Adventures Worldwide guide training, Seward, AK, May.

Olsen, D. 2022. Killer whales of Kenai Fjords. Sunny Cove guide training, Seward, AK, May.

Olsen, D. 2022. Killer whales of Kenai Fjords. Kachemak Bay naturalist training, Homer, AK, May.

Traiger, S. 2022. Recent changes in the Gulf of Alaska nearshore ecosystem revealed by long-term monitoring. Seminar August 26th, USGS Central Midwest Science Center.

Suryan, R. 2022. Changes in marine subsistence species abundance following the Pacific marine heatwave. Oral presentation, Chugach Regional Resources Commission annual gathering, virtual, March.

Weitzman, B. 2022. Sea Otters Across Alaska: Perspectives on Population Change through long-term monitoring and advancing methods. UAF College of Fisheries & Ocean Sciences Fall Seminar, November.

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.

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

CPR data have been included in the International Group for Marine Ecological Time Series 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.

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/

The herring disease program publishes herring infection prevalence metadata on DataOne (https://search.dataone.org/view/10.24431%2Frw1k32b) and metadata from the laboratory studies are housed on ScienceBase.

The humpback whale project has updated the PWS Fluke Catalog through September of 2022, including the following information:

- 2008-2022 aerial herring biomass observations shapefiles
- 1973-2022 aerial herring spawn observations shapefiles
- 1997-2022 herring aerial survey routes shapefiles
- 2008-2022 aerial survey marine bird observations shapefiles
- 2008-2022 aerial survey marine mammal observations shapefiles
- 2008-2022 aerial survey sea lion observations
- 1973-2022 PWS herring age, sex size

Data sets and associated metadata:

Aguilar-Islas, A. 2022. Seasonal profiles and Surface Dissolved Iron from research cruises for the Northern Gulf of Alaska LTER site, 2018-2020. Research Workspace. 10.24431/rw1k594.

Aguilar-Islas, A., and M. Kaufman. 2022. Dissolved inorganic nutrient data from stations sampled on NGA-LTER seasonal cruises, 2018-2021. Research Workspace. 10.24431/rw1k586.

Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E. 2017 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.

Campbell. 2022. 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.

Cheeseman, T., K. Southerland, J. M. Acebes, K. Audley, J. Barlow, L. Bejder, C. Birdsall, A. Bradford, J. Byington, J. Calambokidis, and R. Cartwright. 2023. (Almost) all the humpback whales of the North Pacific: A collaborative and comprehensive photo-ID dataset.

Coletti, H., D. Esler, K. Iken, B. Konar, B. Ballachey, J. Bodkin, G. Esslinger, K. Kloecker, M. Lindeberg, D. Monson, B. Robinson, S. Traiger, and B. Weitzman. 2023. 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. 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

Danielson, S. 2022. CTD profile time series data from the GAK1 site in the Northern Gulf of Alaska, 1970-2021. Research Workspace. 10.24431/rw1k595.

Danielson, S., and E. Dobbins. 2022. Water columns properties measured by CTD sensors during seasonal cruises in the Gulf of Alaska for the Northern Gulf of Alaska LTER project, 2018-2021. Research Workspace. 10.24431/rw1k459.

Kaler, R. 2022. Prince William Sound Marine Bird Surveys, July 2022, Gulf Watch Alaska Pelagic Component. Research Workspace. Uploaded December 2022.

Kaler, R., and K. Kuletz. 2023. Prince William Sound Marine Bird Surveys, July 2012 to 2018, Gulf Watch Alaska Pelagic Component. Research Workspace. 10.24431/rw1k21k, version: 10.24431_rw1k21k_20230307T231301Z.

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

Hauri, C., and B. Irving. 2021. Inorganic Carbon data from water samples collected during CTD casts at stations during the Northern Gulf of Alaska LTER seasonal cruises, 2018. Research Workspace. https://doi.org/10324431/rw1k45g.

Hopcroft R. 2022. Zooplankton abundance and biomass observations determined traditional microscopy, from Multinet samples collected during research cruises for the Northern Gulf of Alaska LTER site, 2018-2020. Research Workspace. 10.24431/rw1k591.

Hopcroft R. 2022. Gelatinous zooplankton abundance and wet weight biomass observations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018 - 2020. Research Workspace. 10.24431/rw1k58z.

Hopcroft R. 2022. 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, 2018-2020. Research Workspace. 10.24431/rw1k587.

Ostle, C., and S. Batten. 2023. Environmental drivers: Continuous plankton recorders. Gulf of Alaska Data Portal. https://gulf-of-alaska.portal.aoos.org/#metadata/87f56b09-2c7d-4373-944e-94de748b6d4b/project

Straley, J., and J. Moran. 2022. Pelagic: Humpback whale predation on herring. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project.

Strom, S., and K. Fredrickson. 2022. Chlorophyll-a concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021. Research Workspace. 10.24431/rw1k45f.

Strom, S., and K. Fredrickson. 2022. Primary productivity estimates from NGA-LTER research cruises in the Gulf of Alaska, 2018-2020. Research Workspace. 10.24431/rw1k45b.

Strom, S., and K. Fredrickson. 2022. Biomass and abundance data for Synechococcus and eukaryotes smaller than 20 microns in size in the northern Gulf of Alaska, spring and summer 2018 and 2019. Research Workspace. 10.24431/rw1k6cc.

Strom, S., and K. Fredrickson.2022. Research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2019. Research Workspace. 10.24431/rw1k45e.

Additional Products not listed above:

Alaska Department of Fish and Game. 2022. ADF&G advisory announcements- 2022 PWS Herring Announcement #1 October 12, 2022. http://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1374428997.pdf

Alaska Department of Fish and Game. 2022. ADF&G advisory announcements- 2022 PWS Herring Announcement #1 May 26, 2022. http://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1441717667.pdf

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.

Summer marine bird surveys in PWS provide a comparison with year-round marine bird surveys conducted by the Alaska SeaLife Center in Resurrection Bay, a region downstream of PWS in the oil spill affected area.

EVOSTC Long-Term Research and Monitoring Projects

The GWA-LTRM program is the 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

EVOSTC funded three mariculture projects during the current funding cycle, with funding beginning during FY22. We recognize that the GWA-LTRM program has a great potential to share ecosystem knowledge and understanding with these mariculture projects. Our initial coordination and collaboration have been with the Mariculture Recon program. The GWA-LTRM and Mariculture Recon program share PIs and lead organizations in common. We invited PIs from the Mar Recon program to attend and participate in our January 2023 PI meeting and individual project PIs are developing working relationships with the Mar Recon program. For specifics on project coordination and collaboration, see individual project annual reports.

We intend to increase coordination and collaboration with the remaining projects in upcoming years.

EVOSTC Education and Outreach Projects

Education and outreach within the spill affected area is an important component of the GWA-LTRM program. The PMT looks forward to the opportunity to work with members of the CORaL network on outreach activities. We invited members of the CORaL network to attend our November 2022 and January 2023 PI meetings. In January, the full CORaL network leadership team attended our PI meeting to provide information about various aspects of their network and goals and to answer questions from GWA-LTRM PIs. For specifics on project coordination and collaboration, see individual project annual reports.

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

the Axiom Data Science and the Gulf of Alaska data developed by Axiom Data Science and hosted by the Alaska Ocean Observing System, 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.

PWSSC serves as the fiscal agent for the Data Management program and the Gulf Watch Ocean Acidification Sampling project.

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), US Geological Survey (USGS), and US 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 a particular focus of the GWA-LTRM program. We began FY22 with program level presentations at the Chugach Regional Resources Commission (CRRC) annual gathering in March 2022 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 also developing programs for engaging with local communities throughout the spill affected area.

4. Response to EVOSTC Review, Recommendations and Comments:

May 2021 EVOSTC Science Panel Comment: The Science Panel is pleased that the Gulf Watch Alaska and Herring Research and Monitoring programs are now integrated into one proposal and that five postdocs will help address key objectives and hypotheses of ecosystem change, recovery of injured resources, and potential effects on commercial, recreational and subsistence resources as part of the scientific synthesis and modeling effort. We recognize the administrative complexity described in this proposal and appreciate the effort required for its preparation. We have several observations and comments. First, we recognize that these two 'management' proposals (2222LTRM-A and 2222LTRM-B) do not fit perfectly into the format used for most of the other project proposals concerned with research, outreach, and restoration. Further, once formally submitted, the relatively large cost (>$60 million over ten years) may result in relatively more scrutiny than many of the other proposals. Therefore, we recommend careful and substantial revision of the presentation to explain the diversity of topics and linkages of projects that are presented within the administrative umbrella.

GWA-TLRM Management Team Response: We concur with the Science Panel that combining Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) will make a well-integrated program under the Long-Term Research and Monitoring (LTRM) Focus Area. Regarding the cost for the GWA-LTRM program: The 10-year cost of the program falls within the funding cap of the Invitation, "…up to $5,000,000 annually (not including 9% GA)…" and encompasses a significant consortium of researchers affiliated with an array of agencies and organizations. Our proposal package also leverages over $2M/year of non-EVOSTC funds for the program.

GWA-LTRM will operate under the existing management and science oversight structure of the GWA program, thereby consolidating and improving efficiency in program management and science integration. Program administrative costs are low (11% of the total budget) for a large, multi-organizational program with substantial reporting requirements. We have added text to help clarify administrative objectives and added Section 10, Budget, D. Key Budget Summaries (pages 43-44) for key budget summaries associated with integrated program management activities.

May 2021 EVOSTC Science Panel Comment: A major and firm recommendation is to combine both projects that were submitted as separate entities (2222LTRM-A and 2222LTRM-B). The

rationale for presenting the two proposals as separate items was not immediately clear to the SP and probably would not be clear to others.

GWA-TLRM Management Team Response: In March we submitted a GWA-LTRM Program proposal (2222LTRM) and an Integrated Program Management Project proposal (2222LTRM-A&B) following our existing structure. During FY17-21 there were originally two GWA oversight projects (17120114-A and 17120114-B) but they were combined in 2018 at the request of the Science Panel.

As recommended by the Science Panel, we have removed this project proposal and migrated relevant information held within to the program proposal (2222LTRM). To facilitate disbursement of EVOSTC funds to non-Trustee agencies and organizations, we have retained two separate budgets (NOAA and PWSSC) in the budget workbook and provided additional program management budget summaries in the program proposal under Section 10, Budget, C. Integrated Program Management Budget Forms, pages 41-42.

May 2021 EVOSTC Science Panel Comment: Another recommendation is to provide a justification for the continuance of the administrative program. While to many reviewers the wisdom of such continuity may appear as self-evident, it may help some readers to appreciate that research projects cannot occur within a vacuum and that there are efficiencies related to management of multiple programs. Further, there are opportunities to promote functional or operational linkages between concurrent field projects that result in additional cost-savings. On this point, however, some SP members wondered why there would not be any cost-reductions related to the linkage of the administrative functions of LTRM and GWA.

GWA-TLRM Management Team Response: We appreciate the Science Panel highlighting the benefits of having leadership and a management team for the LTRM program. An integrated program management team is also specifically requested in the Invitation. We have made an effort in the revised proposal to explain the critical needs and complexities of leading and administering a large, integrated ecosystem monitoring and research program based on 10 years of prior experience. With the presence of a program management team (PMT), not only has GWA been very productive, but this has allowed many synergies occurring within and outside the program, increasing the impact of EVOSTC funding that would not have occurred otherwise. Examples of the value of having a management team for the program have been added to the proposal, primarily in Section 4, Program Administration, pages 21-26.

Regarding cost-reductions related to the linkage of the administrative functions of LTRM and GWA: We have maintained the same general administrative personnel and costs of GWA and HRM for the combined GWA-LTRM. While this does not reduce costs, it does increase administrative efficiency as the LTRM program has new projects, now larger than the two combined programs, and will have additional duties such as coordinating with the EVOSTC's two new Foci, Mariculture and Education and Outreach. A considerable portion of this increased effort will fall upon the Program Lead and Science Lead who provide their salaries as in-kind at no cost to the EVOSTC.

May 2021 EVOSTC Science Panel Comment: There are instances where the proposal should be clarified. For example, the second sentence of the abstract refers to an entity called the "PMT" ('project management team') of the "GWA LTRM". Presumably the PMT will be a new entity that would develop once this proposal is approved. Without more explanation some reviewers may wonder why this is necessary. If the intention is to provide for a new, coordinated administrative structure beginning in 2022, then perhaps some new, or original, nomenclature could be used that could reduce and simplify an otherwise acronym-rich text.

GWA-TLRM Management Team Response: Overall, we have made an effort to reduce acronyms where possible. However, the example sentence is actually found in the now removed Integrated Program Management project proposal. But, to clarify, the program management team (PMT) is not a new entity and has been the term used by the GWA program for the past five years (FY17-21). We plan to continue the PMT as part of the GWA-LTRM program.

May 2021 EVOSTC Science Panel Comment: We noted that NOAA was listed as the administrative agency but as stated, this is misleading and could be controversial if not revised. It is personnel within NOAA that would provide the administrative functions, but not the NOAA per se.

GWA-TLRM Management Team Response: Personnel within NOAA will provide program support (e.g., scientific, managerial, and administrative leadership). This has been clarified in the proposal.

May 2021 EVOSTC Science Panel Comment: We were disappointed that a plan for coordinating with Native and local communities was not yet developed given how long the GWA and HRM programs have been operating. The proposal merely states that the PIs will reach out to local communities and Native communities during the first year to ask them what engagement they

would like. They would then develop an approach that involves PIs from each project. Consequently, each LTRM project suffers the same shortcoming.

GWA-TLRM Management Team Response: *The GWA-LTRM PMT appreciates the Science Panel's concerns regarding the development of a plan for coordinating with Native and local communities. We understand the value of information sharing and are committed to programmatic work to engage with communities in the spill-affected area. Prior to COVID-19, during the 2017-21 program cycle, successful engagement with local Native communities occurred. GWA PIs participated in a community exchange that was structured as a two-way listening session with the Chugachmiut Local Education Coordinators and Elders from Cordova, Tatitlek, Chenega Bay, Valdez, Seward, Nanwalek, and Port Graham communities. GWA PIs have also volunteered, when invited into these communities, for education events such as Sea Week or in schools when they are doing fieldwork in the area.*

Efforts to coordinate with small and remote communities need to be strategic, well planned, and flexible. An Outreach Coordinator is key for maintaining communication avenues and relationships with local communities over time. A successful Native and local community outreach plan needs to be in a collaborative manner that will develop a meaningful exchange of knowledge. The first year of the upcoming funding cycle is needed to develop such a plan. Moving forward, we see great opportunities with the Trustee Council's new Education and Outreach Focus Area. The capacity that small Alaska Native villages have for engaging with outside entities (including internet services) can be very limited. Therefore, excellent coordination between GWA-LTRM, the eventual Education and Outreach entity, and local communities will reduce any unnecessary burdens or duplicative efforts. We also look forward to working with NOAA Alaska Fisheries Science Center's newly hired Tribal Research Coordinator to broaden community awareness of our program's activities and findings.

September 2021 EVOSTC Science Panel Comment: This proposal now combines all the research projects that, in previous years, were part of separate programs: Gulf Watch and Herring. We recognize and applaud the effort put into the combined proposals linking research projects that were once administratively distinct, but cooperative entities within the Gulf Watch program and the Herring program. We also appreciate the attention given the revisions following our comments on an earlier draft in March. The revised proposal shows that a considerable and thoughtful effort was made to accommodate the diverse requirements and research interests and

capabilities of the research scientists engaged in research that is either directly, or indirectly related to the 1989 oil spill and subsequent environmental changes.

GWA-TLRM Management Team Response: The GWA-LTRM PMT appreciates the Science Panel's comments and looks forward to improved integration with the now HRM Component and the rest of GWA.

September 2021 EVOSTC Science Panel Comment: Can the reasons for the linkage of the GWA and Herring programs be made clearer? The linkage was made in the interest of administrative efficiency and perhaps this could be briefly elaborated in the proposal for clarity.

GWA-TLRM Management Team Response: The GWA and HRM programs were combined because of a requirement of the EVOSTC Invitation for Proposals for all LTRM projects to be incorporated into a single integrated management structure. The simplest solution was to make HRM a fourth component of the GWA-LTRM. That said, the two programs were highly collaborative before they merged and now that we have experienced a year of working as one program, we are finding benefits in administrative oversight and increased scientific understanding of the Gulf of Alaska and Prince William Sound ecosystems.

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 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 fiscal year.

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	$162,981
Hoffman, PWSSC	Program Management B	$487,250	$499,280	$512,820	$526,095	$535,355	$2,560,800	$216,600
Coordination, Synthesis, Outreach, & Administration Total		**$650,231**	**$662,079**	**$679,361**	**$696,460**	**$709,626**	**$3,397,757**	**$379,581**
Environmental Drivers								
Ostle, MBA, & Batten, PICES	CPR in the GOA	$78,502	$80,492	$82,503	$84,564	$86,676	$412,737	$39,251
Campbell, PWSSC	PWS Oceanographic	$229,140	$234,870	$240,740	$246,758	$252,929	$1,204,437	$55,786
Danielson, UAF	GAK-1 Mooring	$125,080	$141,301	$139,882	$187,741	$193,126	$787,129	$3,780
Hopcroft & Danielson, UAF	Seward Line	$216,613	$222,026	$227,577	$233,269	$212,008	$1,111,494	$114,334
Hauri, UAF	Ocean Acidification	$144,042	$127,311	$110,856	$113,123	$115,774	$611,107	$25,531
Environmental Drivers Total		**$793,376**	**$806,001**	**$801,559**	**$865,456**	**$860,513**	**$4,126,904**	**$238,682**
Pelagic Monitoring								
Arimitsu & Piatt, USGS	Forage Fish Monitoring	$319,226	$293,864	$302,757	$312,010	$321,639	$1,549,495	$264,148
Kuletz & Kaler, USFWS	PWS/LTER Marine Bird	$88,075	$376,519	$85,764	$304,165	$93,612	$948,135	$88,075
Matkin, Olsen, & Durban, NGOS	Killer Whale Monitoring	$195,690	$115,555	$0	$0	$0	$311,245	$122,228
Moran, NOAA, & Straley, UAS	Humpback Whale Monitoring	$187,806	$186,633	$183,260	$187,465	$186,616	$931,779	$128,960
Pelagic Monitoring Total		**$790,796**	**$972,571**	**$571,781**	**$803,640**	**$601,866**	**$3,740,654**	**$603,411**
Herring Research & Monitoring								
Branch, UW	Herring Modeling	$130,016	$130,573	$144,082	$146,528	$151,128	$702,327	$37,727
Hershberger & Purcell, USGS	Herring Disease	$315,826	$343,206	$288,712	$296,288	$362,074	$1,606,106	$150,622
Morella, ADF&G	Spawning Surveys & ASL	$143,686	$208,590	$178,060	$158,003	$163,125	$851,465	$143,686
Rand, Campbell, PWSSC, Gorman, UAF, Heintz, SSSC	Salmon-Herring Interactions	$231,033	$364,711	$371,613	$318,527	$307,888	$1,593,773	$61,732
Rhea-Fournier, ADF&G, Rand, PWSSC, Hershberger, UW	Pollock-Herring Interactions	$333,385	$403,164	$364,647	$270,111	$414,317	$1,785,624	$99,475
Herring Research & Monitoring Total		**$1,153,946**	**$1,450,244**	**$1,347,114**	**$1,189,458**	**$1,398,533**	**$6,539,294**	**$493,242**
Nearshore Monitoring								
Coletti, NPS, Esler, USGS, Konar & Iken, UAF	Nearshore Monitoring	$613,497	$642,629	$673,842	$551,847	$557,133	$3,038,947	$331,791
Nearshore Monitoring Total		**$613,497**	**$642,629**	**$673,842**	**$551,847**	**$557,133**	**$3,038,947**	**$331,791**
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	**$4,001,847**	**$4,533,524**	**$4,073,657**	**$4,220,659**	**$4,127,671**	**$20,957,358**	**$2,046,707**
FY 22-26 Total all Program projects including 9% GA		**$4,362,013**	**$4,941,541**	**$4,440,286**	**$4,600,519**	**$4,499,161**	**$22,843,520**	**$2,230,910**

The budget below shows FY22 spending relative to spending categories. Similar to the project spending, this budget indicates that spending by category is below proposed spending.

***Exxon Valdez* Oil Spill Trustee Council**

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

Annual Program Reporting Form

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	$2,097,969	$2,452,931	$2,434,834	$2,460,546	$2,510,902	$11,957,182	$1,083,239
Travel	$139,651	$166,087	$145,619	$168,140	$145,086	$764,584	$76,679
Contractual	$993,056	$1,127,471	$853,334	$976,226	$884,384	$4,834,471	$542,263
Commodities	$251,671	$234,934	$208,641	$237,209	$198,929	$1,131,383	$155,707
Equipment	$276,949	$294,543	$178,837	$131,432	$129,772	$1,011,533	$120,012
Indirect Costs (rate will vary by project)	$242,550	$257,558	$252,393	$247,107	$258,598	$1,127,234	$68,807
SUBTOTAL	$4,001,847	$4,533,524	$4,073,657	$4,220,659	$4,127,671	$20,957,358	$2,046,707
General Administration (9% of subtotal)	$360,166	$408,017	$366,629	$379,859	$371,490	$1,886,162	N/A
PROGRAM TOTAL	**$4,362,013**	**$4,941,541**	**$4,440,286**	**$4,600,519**	**$4,499,161**	**$22,843,520**	
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. 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 to FY23. The primary reason for the underspending in 2022 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. The PMT submitted a no-cost extension request to EVOSTC on April 11, 2023, and received authorization for that request on April 12.

Project Number	Project Title	Lead PI(s)	FY22 Carry Over to FY23 (based on FY22 cumulative spending)
Program Management			
2322LTRM-A	GWA-LTRM Program (NOAA)	Lindeberg	$0
2322LTRM-B	GWA-LTRM Program (PWSSC)	Hoffman	$270,650
Environmental Drivers			
23120114-D	CPR	Ostle & Batten	$39,251
23120114-G	PWS Oceanographic	Campbell	$173,354
23120114-I	GAK-1	Danielson	$121,300
23120114-L	Seward Line	Hopcroft & Danielson	$102,279
23220202	Ocean Acidification	Hauri	$118,511
Pelagic			
23120114-C	Forage Fish	Arimitsu & Piatt	$55,078
23120114-M	PWS Marine Bird Surveys	Kaler	$0
23120114-N	Killer Whales	Durban et al.	$73,462
23120114-O	Humpback Whales	Moran & Straley	$58,846
Herring Research & Monitoring			
23220111-C	Herring Modeling	Branch	$92,289
23220111-E	Herring Disease	Hershberger & Paez	$165,204
23170111-F	Herring Surveys	Morella	$0
23120111-I	Herring/Salmon Interactions	Rand et al.	$169,301
23220203	Pollock/Herring Interactions	Rhea-Fournier et al.	$0
Nearshore			
23120114-H	Nearshore	Coletti et al.	$281,706
Lingering Oil			
23120114-P	Lingering Oil	Esler & Lindeberg	$0
Total Carry Over			**$1,721,231**

Below is the cumulative spending budget for the NOAA portion of the program management project. Spending is on track.

***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	$126,331
Travel	$18,650	$18,930	$19,435	$19,940	$20,445	$97,400	$18,650
Contractual	$0	$0	$0	$0	$0	$0	$0
Commodities	$18,000	$13,500	$13,500	$13,500	$13,500	$72,000	$18,000
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	$162,981
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:
FY22 spending is on track.

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 in FY22 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	$148,014
Travel	$12,400	$12,400	$12,690	$13,390	$13,390	$64,270	$3,009
Contractual	$121,800	$123,550	$126,190	$127,840	$129,490	$628,870	$65,577
Commodities	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	$0
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	$216,600
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 is 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