1. Project Number:

20120114-A & -B

2. Project Title:

Program Management I – Program Coordination and Science Synthesis

Program Management II – Administration, Science Review Panel, PI Meeting Logistics, Outreach, and Community Involvement

3. Principal Investigator(s) Names:

Mandy Lindeberg, NOAA Auke Bay Laboratories (PM I)

Katrina Hoffman, Prince William Sound Science Center (PM II)

4. Time Period Covered by the Report:

February 1, 2020-January 31, 2021

5. Date of Report:

March 2021

6. Project Website (if applicable):

www.gulfwatchalaska.org

7. Summary of Work Performed:

This report summarizes the work of two program management (PM) projects. PM I provides science coordination and synthesis for the Gulf Watch Alaska (GWA) program and PM II provides administration and logistics for non-Trustee agencies and outreach and community involvement coordination. PM I and PM II collectively house the GWA program management team (PMT) – a Program Lead, Administrative Lead, Program Coordinator, and Science Coordinator.

Overall FY20 was a busy year for the PMT facing new challenges due to the COVID-19 pandemic. A great deal of effort was put into mitigating the impacts of the pandemic to the program's objectives, especially maintaining the long-term monitoring datasets. The PMT worked with all program members to identify scientific priorities and adapt schedules and budgets to the best of their ability. Detailed contingency plans for conducting field and lab work safely were coordinated and shared among the principal investigators (PIs) to meet the various requirements of federal and state agencies. The PMT helped PIs prioritize their scientific objectives and advised them on how to

proceed with appropriate budgetary adjustments. Some creative solutions for resources and data collection were developed across projects, a clear benefit of a multi-agency program. The PMT also successfully hosted its first virtual annual PI meeting during the pandemic with more than 40 attendees. Highlights included virtual surveys on the fly so all participants could weigh in on topics and the traditional group photo was just a little different – a composite of selfies at their computer.

Science Coordination and Synthesis (PM I)

FY20 Program Coordination

The GWA PMT coordinated with the Herring Research and Management (HRM) Program Lead to develop a strategy for proposing GWA and HRM as a single Long-Term Research and Monitoring (LTRM) program for the FY22-FY31 *Exxon Valdez* Oil Spill (EVOS) Trustee Council (EVOSTC) Invitation for Proposals. The PMT discussed with GWA investigators and solicited feedback via polls on how best to best to integrate and continue LTRM efforts over the next 10 years. This included how to allocate limited increases in funding among the components and how to work with investigators outside of GWA and HRM who were interested in proposing new LTRM projects. The guidelines for prioritizing funding needs were as follows:

1. Adequately fund currently underfunded efforts
2. Add postdocs, students, and other personnel for data analysis efforts, operational needs, and succession of principal investigators (PIs)
3. New data collection or processing of unused/archived data that fills important gaps

The GWA PMT also made efforts to gain new partnerships and funding that will complement the GWA program. The Program Lead focused on prospects with Bureau of Ocean Energy Management, (BOEM), Alaska Region. BOEM and GWA areas that overlap are in Cook Inlet where oil and gas leases occur in federal waters. The work with BOEM resulted in a GWA priority "profile" included in the Environmental Studies Program - Studies Development Plan for potential funding in FY2022. This later enabled GWA PIs to directly respond to BOEM's call for input and ideas for new studies. The PMT went through an internal process with PIs to develop, review, and prioritize 10 concept proposals that would complement GWA monitoring projects. The top five ideas BOEM showed interest in (the first three PIs followed through and submitted to BOEM) include the following:

- Developing eDNA applications for forage fish sampling
- Linking seabird, forage fish and jellyfish distribution and abundance within key Outer Continental Shelf regions of the northern Gulf of Alaska (GOA)
- Monitoring with mussels: Transcriptomics to assess nearshore ecosystem health across GWA long-term monitoring sites
- Predatory fish diets to monitor trends in forage fish populations in Lower Cook Inlet and Kachemak Bay.
- Linking pelagic and nearshore benthic ecosystems in lower Cook Inlet and Kachemak Bay through meroplankton.

Coordinating Program Activities

The program conducted key meetings throughout the past year. The PMT met via teleconference on June 8, 2020 to discuss the status of the GWA program and goals for FY20. The PMT facilitated quarterly GWA program team meetings during FY20 (Table 1). The Program Coordinator scheduled, developed agendas based on input from PMT and Science Coordinating Committee members, and facilitated the meetings. The purpose of these meetings was to provide the GWA program team with updates on programmatic and scientific activities and allow for collaboration among team members. All meetings were coordinated in communication with the HRM program lead, and HRM PIs attended all or portions of the November 2020 and January 2021 meetings to encourage cross-program communication, data sharing, and synthesis. Typically, the fall and winter meetings are held in person to facilitate discussion and collaboration among the project teams; however, because of the coronavirus pandemic all meetings were conducted virtually.

Table 1. Gulf Watch Alaska program team quarterly meeting dates and venues.

Meeting Dates	Meeting Venue
May 13, 2020	GoToMeeting video conference
July 22, 2020	GoToMeeting video conference
November 18-19, 2020	GoToTraining video conference
January 13, 2021	GoToMeeting video conference

The GWA program tracks multiple recurring and one-time activities throughout each year. The Program Coordinator developed a comprehensive list of dates and activities and updates the list on a regular basis to monitor each of these activities. Regularly occurring activities include data and metadata submissions, annual work plans and annual reports, and quarterly meetings. In addition, the Program Coordinator tracks publications and reports published by PIs and coordinates with the Outreach Coordinator on outreach activities and website updates.

The PMT compiled and reviewed all FY19 annual reports and FY21 work plans (13 projects, 1 program) including comprehensive program budget workbooks. The Program Lead, Science Coordinator, and Science Coordinating Committee conducted internal reviews of all reports and work plans. We continue efforts to standardize format and content to help improve efficiencies in GWA PI reporting efforts and EVOSTC review. We also compiled and reviewed replies to EVOSTC and science panel review comments on the FY19 annual reports and FY21 work plans.

Communicating Program Information

The Alaska Marine Science Symposium (AMSS), held virtually January 26-28, 2021, accepted 8 poster and 2 oral presentations based on GWA monitoring data for the 2021 conference, all presentations were pre-recorded for the online event. In addition, GWA team members participated in live keynote and panel discussions related to the GOA ecosystem. The Program Coordinator maintained a list of oral and poster presentations.

The PMT distributed the *Quarterly Currents* newsletter to EVOSTC staff, science panel members, public advisory committee members; GWA outreach steering committee members; and sponsoring

agency public relations personnel; HRM PIs; and Prince William Sound (PWS) and Cook Inlet Regional Citizens' Advisory Council staff and board members. The newsletter provides highlights of GWA program activities each quarter. All *Quarterly Currents* newsletters are available publicly on the GWA website (https://gulfwatchalaska.org/resources/quarterly-currents-newsletter/).

The PMT has continued efforts to develop program graphics for outreach, presentations, publications, and potential interpretive displays. We recently completed graphic illustrations for the Environmental Drivers component to compliment those developed for the pelagic and nearshore components (Figs. 1-3).

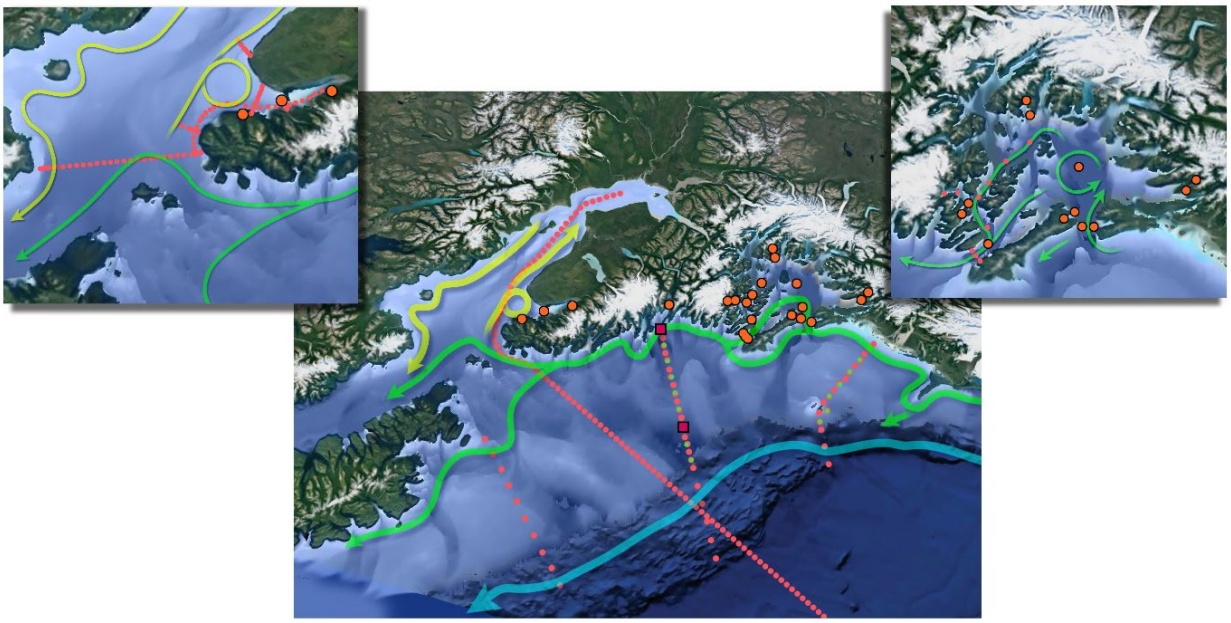

Figure 1. Bathymetric and oceanographic current maps showing Gulf Watch Alaska/Long-term Ecological Research Environmental Drivers monitoring transects, stations, and moorings throughout Prince William Sound, Gulf of Alaska continental shelf/break, and lower Cook Inlet/Kachemak Bay. These maps have separate modules and layers.

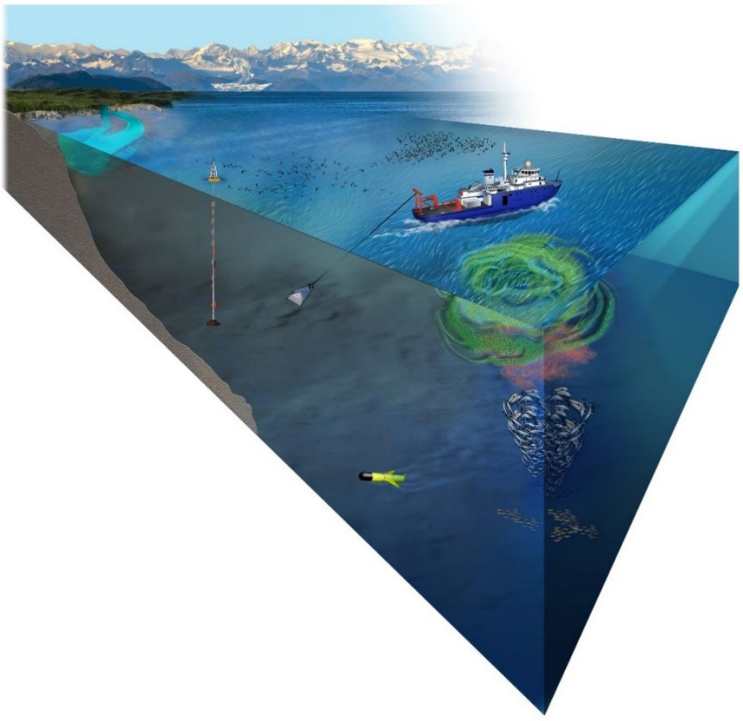

Figure 2. An Environmental Drivers ecosystem block to match previously developed blocks for the pelagic and nearshore components.

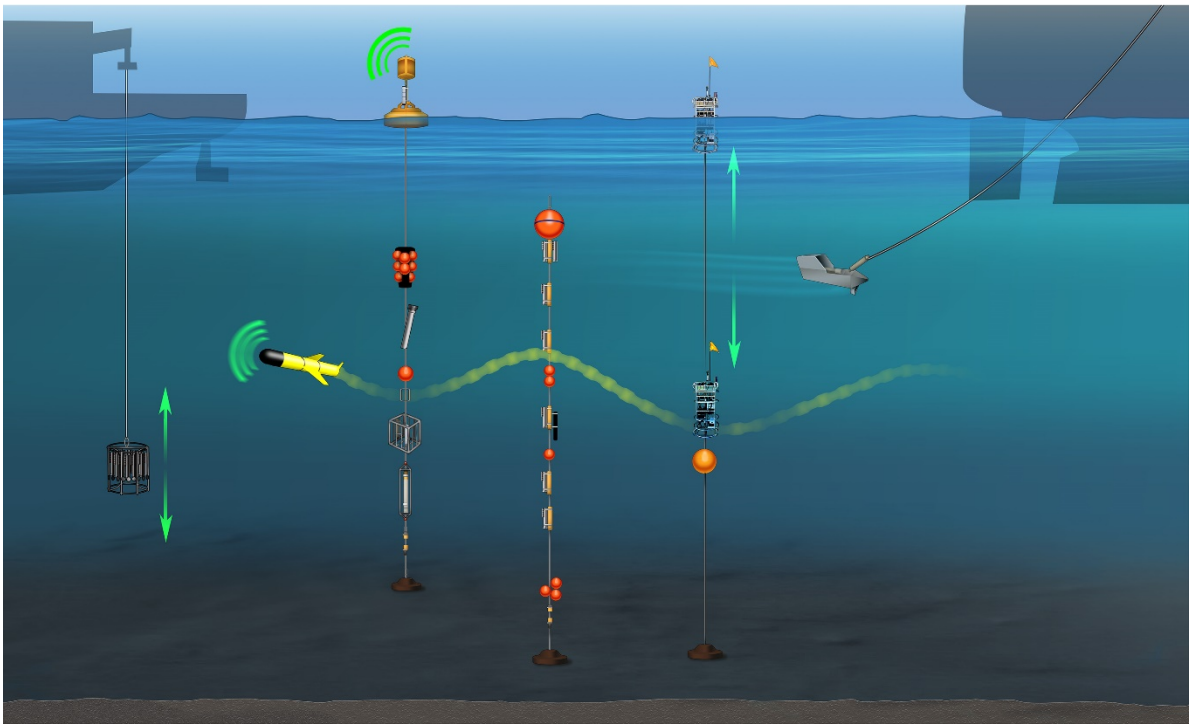

Figure 3. An Environmental Drivers composite of oceanographic instrumentation highlighting: GAK-1 and Seward Line moorings, the profiler in Prince William Sound, an autonomous glider, and continuous plankton recorder and conductivity and temperature at depth casts off vessels.

Please see the **PM II – Outreach** section below for Program Coordinator, Program Lead, and PI outreach activities.

FY20 Science Synthesis

The main focus of science synthesis efforts in FY20 included: 1) revising and submitting for publication the four manuscripts that comprised our science synthesis report, 2) coordinating long-term monitoring and research priorities for our 10 year Long-Term Research and Monitoring (LTRM) proposal to the EVOSTC in early FY21, 3) providing additional time series indicators to the National Oceanic and Atmospheric Administration's (NOAA's) annual Alaska Ecosystem Status Report and Ecosystem and Socioeconomic Profiles to support ecosystem-based fisheries management in the GOA, and 4) continuing leadership toward a Deep-Sea Research Part II (DSRII) special issue titled "Understanding Ecosystem Processes in the Gulf of Alaska: Volume 3".

GWA presented results of their science synthesis report to the EVOTC Science Panel during a workshop in February 2020. Following that meeting, the GWA PMT coordinated revisions and responses to reviews from the EVOSTC Science Panel and submitted a final report (Suryan et al. 2020, section 9.A.2). The four manuscripts comprising the synthesis report, included data and accomplishments from the beginning of GWA and in collaboration with other investigators in the GOA. The four manuscripts followed the theme of the Pacific marine heatwave in 2014-2016 that severely disrupted the GOA ecosystem. The heatwave resulted in seabird and whale mortality events and disruption groundfish and salmon fisheries, leading to emergency fishery declarations and impacts to recovery of EVOS injured resources (e.g., herring, killer whales, pigeon guillemots). The effect of the marine heatwave on the GOA ecosystem was a logical focus of our synthesis efforts. Because of our annual ecosystem-level monitoring, GWA captured this event in detail that was not possible by other research and monitoring programs. Furthermore, these four manuscripts serve as the foundation of continued GWA synthesis efforts that address mechanisms and longevity of this major ecosystem perturbation. Three of the four manuscripts have been accepted for publication, and the fourth was recently submitted to a peer-reviewed journal.

Science Synthesis Publications

The four synthesis manuscripts that we produced included varying amounts of cross-component data integration.

The Science Coordinator was the lead author of the synthesis manuscript "*Ecosystem response persists after a prolonged marine heatwave*". This manuscript provides a broad perspective on ecosystem response for the northern GOA, from PWS to the Alaska Peninsula. GWA originated 2 years prior to the Pacific marine heatwave (2014-2016) and is uniquely positioned to address this topic. We used 187 biological time series ranging from intertidal organisms and zooplankton to forage fishes, whales, and commercial fisheries to quantify response of the GOA ecosystem to the Pacific marine heatwave. The time series sources included the following: 77 from GWA, 58 from NOAA Alaska Fisheries Science Center, 22 from the U.S. Fish and Wildlife Service (including the EVOSTC Pigeon Guillemot project 20100853), 18 from the Northern GOA long-term ecological research (NGA LTER) site, 8 from Alaska Department of Fish and Game, 2 from the Alaska SeaLife Center, and 2 from the HRM program. This paper will be published in the open access journal Scientific Reports (Nature Publishing Group) and two press releases are planned for the publication in early March 2021.

This is the overarching synthesis to tie together a diverse array of GWA, HRM, and other datasets to address the following objectives:

a. Identify which taxa exhibited negative, positive, or neutral responses to the heatwave.

b. Determine whether taxa showed signs of recovery 5 years after the onset of the heatwave.

c. Assess how the biological community responded as a whole.

General findings included the following:

Indicators with primarily negative responses were phytoplankton, intertidal organisms, forage fish, adult groundfish, pinnipeds and piscivorous seabirds at haul-outs and breeding colonies, and commercial fish harvest, especially Pacific cod and sockeye salmon. During the heatwave, humpback whales in the northeastern GOA exhibited a precipitous decline and remained low through 2019 (Fig. 4).

Warm water associated zooplankton abundance showed a positive response, but also stayed positive even as the water column cooled the year after the heatwave (Fig. 4). Surprisingly, the cool water associated zooplankton community did not show a marked decline during the intense warming of the heatwave, as we would have expected based on studies elsewhere. Not surprisingly, species that eat primarily zooplankton or a variety of fish and zooplankton, including storm-petrels, gulls, and cormorants, showed primarily neutral responses. Juvenile groundfish abundance that showed positive trends included southern rock sole and sablefish. Commercial fish harvest with positive trends included, chum salmon, sablefish, coho salmon, and pollock, but with regional variability among ports.

Some aspects of the GOA community were less affected. About half the indicators showed short-term or no detectable response. They included phytoplankton bloom timing, phytoplankton size, forage fish growth and condition, and at-sea densities of highly mobile seabirds. Ecosystem indicators that show little or no responses to such a large heatwave also provide important information about resilience in the marine environment.

Collectively, these relative changes in the annual biological metrics that we analyzed led to novel community-level groupings during and after the heatwave, with 2017 and 2018 particularly distant from prior years (Fig. 5).

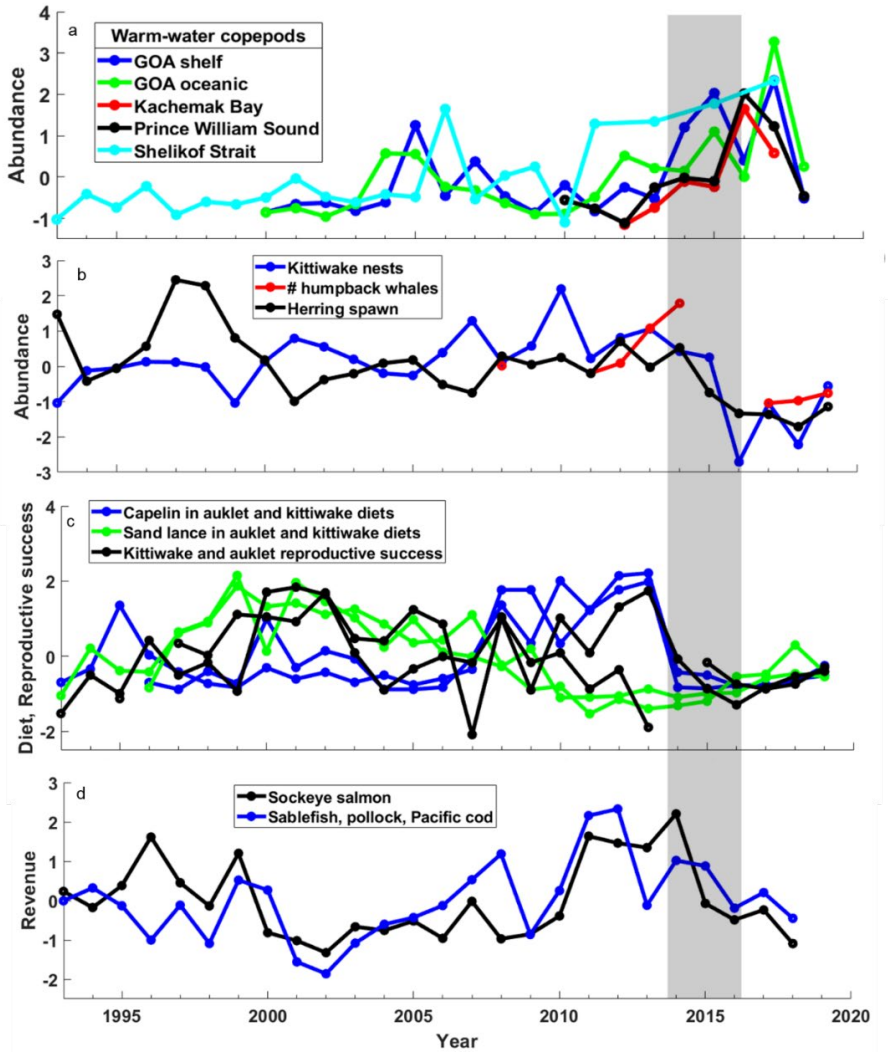

Figure 4. Long-term trends (1993-2019; a and d through 2018) in (a) the abundance of warm water associated copepod species in the Gulf of Alaska (GOA), (b) herring and herring-dependent predators in Prince William Sound, (c) capelin and sand lance availability to marine birds and reproductive success of kittiwakes foraging from Middleton Island, and (d) ex-vessel revenue for sockeye salmon and combined for the three most valuable groundfish species. Grey shading represents the 2014-2016 northeast Pacific marine heatwave. Values are z-score standardizations so the y-axes are unitless.

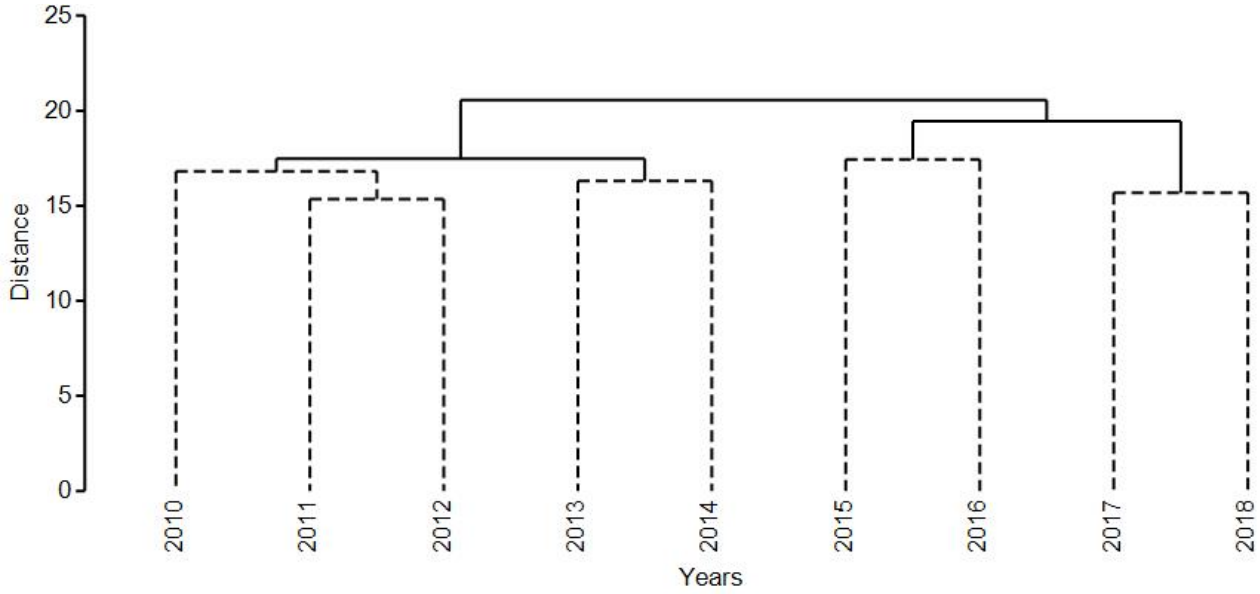

Figure 5. Community analyses of 187 biological time series in the Gulf of Alaska. Cluster analysis shows significantly different groupings (solid lines) in the years during and after (2015-2018) the marine heatwave.

The Science Coordinator also contributed as a co-author to the three other GWA science synthesis report manuscript that are either accepted or recently submitted. Please see Section 9 for full citations.

- Danielson et al. in review. Thermal variability in the Northern Gulf of Alaska across years of marine heatwaves and cold spells. DSRII
- Weitzman et al. 2021. Changes in rocky intertidal community structure during a marine heatwave in the northern Gulf of Alaska. Frontiers in Marine Science 8 https://doi.org/10.3389/fmars.2021.556820
- Arimitsu et al. 2021. Heatwave-induced synchrony within forage fish portfolio disrupts energy flow to top pelagic predators. Global Change Biology. https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.15556

The Program Lead contributed as co-author to the Weitzman et al. synthesis report manuscript.

GOA Time Series Indicators for the GOA Ecosystem and Stakeholder Interests

Our goal is for each GWA project to have at least one signature time series that best indicates the state of their part of the GOA ecosystem. Collectively, these would provide GWA's best assessment of the GOA each year. This follows similar efforts for large marine ecosystems throughout Alaska and elsewhere. GWA has greatly expanded its annual contributions to these efforts. Furthermore, GWA, HRM, and the NGA LTER site sample annually, whereas most other large vessel research programs sample every other year (e.g., NOAA ecosystem surveys). Therefore, GWA is uniquely positioned to contribute to the annual ecosystem status reports to the North Pacific Fisheries Management Council. This was particularly true in 2020 as GWA was successful in safely completing over half their typical survey efforts, whereas nearly all agency cruises and fieldwork

was canceled due to federal and state health mandates and restrictions associated with the COVID-19 pandemic.

For the 2020 Ecosystem Status Report (Ferriss and Zador 2020), investigators from all three GWA components (Environmental Drivers, Pelagic Ecosystem, and Nearshore Ecosystem) contributed 20 metrics. Contributors included: Ostle/Batten (20120114-D, 3 metrics), Danielson (20120114-I, 3 metrics), Hatch/Arimitsu (20120114-C, 5 metrics), Moran/Straley (20120114-O, 1 metric), Hopcroft (20120114-L, 2 metrics), Campbell/McKinstry (20120114-G, 1 metrics), and Coletti et al. (20120114-H, 2 metrics), and Holderied/Baird (20120114-J, 3 metrics). We also facilitated contributions by HRM (Pegau et al. 20120111, 3 metrics).

Additionally, Arimitsu and Hatch (20120114-C) provided a juvenile sablefish growth index from fish collected when sampling diets of rhinoceros auklets nesting on Middleton Island. This juvenile growth index is being used in the ecosystem and socioeconomic profile of the sablefish stock assessment for Alaska (Shotwell et al. 2020).

DSRII special issue - Understanding Ecosystem Processes in the Gulf of Alaska: Vol 3

A multi-disciplinary group of scientists is developing the third installment in a series of special issues dedicated to understanding ecosystem processes in the GOA. Volume 1 (DSRII volume 132, Dickson et al. 2016) was a compilation of papers focused on physical processes from the initial outcomes of the Gulf of Alaska Integrated Ecosystem Research Program (GOAIERP) that began in 2010. Volume 2 (DSRII volume 165, Dickson et al. 2019) showcased biological research and final results from GOAIERP in its synthesis phase. The goal for volume 3 is to present new findings from GOAIERP's final synthesis phase and complementary work from other large multidisciplinary programs in the GOA, including GWA and HRM (DSRII volume 147, Aderhold et al. 2018), and the National Science Foundation's NGA LTER. Findings from these programs and related research projects benefit the special issue by filling information gaps and contributing to conceptual synthesis, thereby increasing understanding of this large marine ecosystem. Overall, these DSRII special issues establish a significant foundation of information upon which future scientists and resource managers will rely, especially as the GOA ecosystem faces accelerating environmental change.

Volume 3 is a collaborative effort sponsored by the North Pacific Research Board (NPRB) and EVOSTC long-term monitoring programs. Mandy Lindeberg (GWA's Program Lead) is the managing editor, and the diverse scientific team of guest editors includes Matt Baker (NPRB Science Director), David Kimmel (NOAA Alaska Fisheries Science Center, Research Oceanographer), Olav Ormseth (NOAA AFSC, Research Fisheries Biologist), Suzanne Strom (Western Washington University, Biological Oceanographer), and Rob Suryan (GWA Science Coordinator). The deadline for submitting manuscripts to this special issue is March 1, 2021.

FY20 Administration, Science Review Panel, PI Meeting Logistics, Outreach, and Community Involvement (PM II)

Administration

Prince William Sound Science Center (PWSSC) extended contract amendments to all the non-Trustee Agency sub-awardees for the fourth year of this grant, FY20. The non-Trustee Agency portions of the GWA program that are administered by the PWSSC under this award include

projects associated with coordination and oversight, outreach and community involvement, data management, oceanographic monitoring in PWS and the GOA, monitoring of zooplankton and oceanographic conditions in the GOA, monitoring of seabird abundance in PWS, monitoring of killer whale populations in PWS, and monitoring of intertidal communities in Kachemak Bay. For each of the aforementioned projects, PWSSC invoiced NOAA and subsequently remunerated sub-awardees based on demonstrated expenses. We ensured that cumulative spending levels were tracked for non-Trustee Agency project reporting. As required, we underwent field testing for our annual audit in the first week of December 2020 and submitted semi-annual reports to NOAA in both March and August 2020 for the work that was being conducted in the program.

PI Meeting and Science Review Panel Logistics

The program held four quarterly PI meetings, all held via video conference because of the coronavirus pandemic (Table 1).

PWSSC ensures all telephonic and Internet-based meeting needs are met for the PI meetings by providing conference lines and GoToMeeting portals as needed. Because the typically in-person fall PI meeting was held virtually, we added a GoToTraining portal which provided for breakout groups and activities such as jointly editing a document and a Slido license which allowed for polling during throughout the meeting. We submitted all federal financial SF425 reports to NOAA as required and in advance of deadlines. PWSSC booked and paid for travel, lodging, and per diem for participating GWA Science Review Panel (SRP) members (Klinger, Heintz, and Brenner) to attend and participate in the EVOSTC synthesis workshop on February 25-27, 2020.

Outreach and Community Involvement

Our outreach plan included community engagement in a PWS community during FY20. Statewide mandates related to travel and health in response to the coronavirus pandemic forced a change in our outreach plans. The GWA program is highly sensitive to the need to keep our remote villages healthy, particularly community elders. We explored the possibility of a virtual outreach activity in Tatitlek or Chenega but because in-person engagements are more effective, we postponed our community engagement with the hopes of success in 2021. Our ability to conduct this important outreach will depend on the status of the pandemic and statewide vaccinations during 2021, and the comfort level and willingness to participate of either of the villages in Prince William Sound. Even if the pandemic continues to preclude an in-person event in one of the smaller villages, it may still be possible to have a virtual event. The Native Village of Eyak also may be a partner in a two-way information exchange.

We continue to make updates to the website www.gulfwatchalaska.org. The changes include the following:

- Blog posts added with relevant program announcements
- Inclusion of FY20 Quarterly Currents newsletters
- Recent publications (with hyperlinks where possible) added at: http://www.gulfwatchalaska.org/resources/publications-2/
- Updated most project pages with current results and time series

- Revamped the Nearshore project pages to reflect the sampling focus areas of the project: intertidal temperature, intertidal communities, bivalves, marine birds, black oystercatchers, and sea otters
- Posting of an updated team photo and updated PI photos where appropriate, as well as updated PI and SRP biographies where appropriate

Outreach contacts for Trustee Agencies are recipients of *Quarterly Currents* so they can remain apprised of program progress. The distribution for *Quarterly Currents* includes staff and board members of the Prince William Sound and Cook Inlet Regional Citizens' Advisory Councils in addition to Trustee Agency contacts.

Each year the GWA program includes two pages of articles in PWSSC's annual outreach publication *Delta Sound Connections*. Typically, *Delta Sound Connections* is widely distributed throughout the PWS region, Anchorage, and beyond. With travel severely restricted because of the coronavirus pandemic during 2020, PWSSC printed fewer copies of the publication and instead promoted the online version. However, print copies were still distributed throughout the region.

8. Coordination/Collaboration:

A. Long-term Monitoring and Research Program Projects

1. Within the Program

PM I and PM II are responsible, overall, for coordinating the GWA program. Program-level coordination is pursued for all activities. The four-member PMT (Lindeberg, Hoffman, Suryan, Aderhold) communicated by email, phone, and/or video teleconference on a weekly basis to ensure effective program management.

2. Across Programs

a. Herring Research and Monitoring

The GWA PMT coordinated regularly with the HRM program. The HRM Lead was invited to all GWA meetings and teleconferences. All non-Trustee Agency administrative functions are combined at PWSSC to serve both the GWA and HRM programs. Because the EVOSTC FY22-31 Invitation for Proposals incorporates the long-term monitoring and herring programs into one long-term research and monitoring program, GWA and HRM began coordinating even more closely during FY20. HRM and GWA PIs were encouraged to fully attend each other's fall PI meetings and HRM team members participated in breakout sessions during GWA's two-day meeting.

HRM data were used and HRM PIs are included in two of the GWA publications (see Reports under Section 9).

b. Data Management

GWA coordinates closely with the Data Management program. Data Management staff are invited to all GWA meetings and teleconferences. Data Management one-on-one consultations were incorporated into the fall meeting in Anchorage. A Data Management team member (Buckelew) is active on the Outreach Steering Committee. Data Management

is also a part of the NOAA grant through which PWSSC manages all project funds for non-Trustee Agencies. As such, PM II coordinates with the Data Management team on all reporting requirements to NOAA.

B. Individual Projects

GWA summer and winter marine bird surveys in PWS (20120114-H, 20120114-M, 20120114-E) provide information on population trends of species studied by EVOSTC-funded pigeon guillemot restoration project (20100853). In addition, the GWA Program Coordinator provides support to the pigeon guillemot restoration project as needed. Data from the pigeon guillemot restoration project were used in one chapter of the GWA science synthesis report.

C. With Trustee or Management Agencies

GWA contributed to the 2020 NOAA Ecosystem Status Report to the North Pacific Fisheries Management Council (Ferriss and Zador et al. 2020) and in the ecosystem and socioeconomic profile of the sablefish stock assessment for Alaska (Shotwell et al. 2020). These reports are used to facilitate ecosystem-based fisheries management in the Gulf of Alaska.

The GWA Science Coordinator collaborated with multiple agencies and organizations to incorporate more than 100 time series in the synthesis manuscript of the Pacific marine heatwave. Trustee and management agencies included in the collaboration include NOAA Alaska Fisheries Science Center, Alaska Department of Fish and Game, and U.S. Fish and Wildlife Service.

9. Information and Data Transfer:

A. Publications Produced During the Reporting Period

1. Peer-reviewed Publications

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

Danielson, S.L., T.D. Hennon, D.H. Monson, R.M. **Suryan**, R.W. Campbell, S.J. Baird, K. Holderied, and T.J. Weingartner. *in review*. Thermal variability in the Northern Gulf of Alaska across years of marine heatwaves and cold spells. Submitted to Deep-Sea Research II Special Issue.

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

Ecosystem response persists after a prolonged marine heatwave. Scientific Reports. https://doi.org/10.1038/s41598-021-83818-5

Wietzman, B., B. Konar, K. Iken, H. Coletti, D. Monson, R.M. **Suryan**, T. Dean, D. Hondolero, and M.R. **Lindeberg.** 2021. Changes in rocky intertidal community structure during a marine heatwave in the northern Gulf of Alaska. Frontiers in Marine Science 8 https://doi.org/10.3389/fmars.2021.556820

2. Reports

Arimitsu, M., J. Piatt, R.M. **Suryan**, S. Batten, M.A. Bishop, R.W. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R.R. Hopcroft, K.J. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, J. Moran, R.S. Pegau, A. Schaefer, S. Schoen, J. Straley, and V.R. von Biela. 2020. Chapter 3 Synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. *In* R.M. Suryan, M.R. Lindeberg, and D.R. Aderhold, eds. The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Gulf Watch Alaska Long-Term Monitoring Program Final Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 19120114). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Danielson, S.L., T.D. Hennon, D.H. Monson, R.M. **Suryan**, R.W. Campbell, S.J. Baird, K. Holderied, and T.J. Weingartner. 2020. Chapter 1 A study of marine temperature variations in the northern Gulf of Alaska across years of marine heatwaves and cold spells. *In* R.M. Suryan, M.R. Lindeberg, and D.R. Aderhold, eds. The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Gulf Watch Alaska Long-Term Monitoring Program Final Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 19120114). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

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

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3. Popular articles

Aderhold, D. 2020. Scientists integrate studies of predators and prey in Prince William Sound. *Delta Sound Connections*. Prince William Sound Science Center https://pwssc.org/wp-content/uploads/2020/07/DSC-2020-web.pdf

B. Dates and Locations of any Conference or Workshop Presentations where EVOSTC-funded Work was Presented

1. Conferences and Workshops

Lindeberg, M., R. **Suryan**, D. **Aderhold**, K. **Hoffman**, R. Hopcroft, H. Coletti, M. Arimitsu. 2021. Gulf Watch Alaska: Building Partnerships to Understand Ecosystem Change. Poster. Alaska Marine Science Symposium, virtual, January 26-28.

Lindeberg, M. and S. Traiger. 2021. Changes in nearshore ecosystems and relevance to coastal communities – Gulf of Alaska. Panelists. Alaska Marine Science Symposium, virtual, January 26-28.

Lindeberg, M., and J. Bodkin. 2020. Gulf Watch Alaska: Program Overview and Highlights and Monitoring Upper Trophic Consumers in the Nearshore. Oral Presentation. Virtual MARINe Annual Workshop, March 13.

Lindeberg, M., R. **Suryan**, D. **Aderhold**, and K. **Hoffman**. 2020. Gulf Watch Alaska: Program Overview and Highlights (FY2012-2019). Oral Presentation. EVOSTC Public Advisory Committee. EVOSTC Science Synthesis Workshop. Anchorage, Alaska, Feb. 26, 2020.

Lindeberg, M. 2020. Gulf Watch Alaska Program: Website Overview. Oral Presentation. EVOSTC Public Advisory Committee. EVOSTC Science Synthesis Workshop. Anchorage, Alaska, Feb. 26.

Arimitsu, M., J. Piatt, R.M. **Suryan**, S. Batten, M. Bishop, R.W. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R. Hopcroft, K.J. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, J. Moran, S. Pegau, A. Schaefer, S. Schoen, J. Straley, and V.R. von Biela. 2020. Synchronous Collapse of Forage Species Disrupts Trophic Transfer During A Prolonged Marine Heatwave. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Arimitsu, M., J. Piatt, R. **Suryan**, S. Batten, M.A. Bishop, R. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R. Hopcroft, K. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, Jo. Moran, S. Pegau, A. Schaefer, S. Schoen, J. Straley, V. von Biela. 2020. Synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. Pacific Seabird Group annual meeting, Portland, Oregon.

Lindeberg, M., R. **Suryan**, D. **Aderhold**, and K. **Hoffman**. 2020. Gulf Watch Alaska Program Overview and Highlights (FY2012-2019). Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Lindeberg, M., R. **Suryan**, D. **Aderhold**, and K. **Hoffman**. 2020. Gulf Watch Alaska Program Recommendations. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Danielson, S., T.D. Hennon, D.H. Monson, R.M. **Suryan**, R.W. Campbell, S.J. Baird, K. Holderied, and T.J. Weingartner. 2020. A study of Marine Temperature Variations in the Northern Gulf of Alaska Across Years of Marine Heatwaves and Cold Spells. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Suryan, R., M. **Lindeberg**, D. **Aderhold**, and K. **Hoffman**. 2020. Gulf Watch Alaska Program Science Synthesis Overview. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Suryan, R., M. Arimitsu, H. Coletti, R. Hopcroft, M. **Lindeberg**, S. Barbeaux, S. Batten, W. Burt, M. Bishop, J. Bodkin, R. Brenner, R. Campbell, D. Cushing, S. Danielson, M. Dorn, B. Drummond, D. Esler, T. Gelatt, D. Hanselman, S. Hatch, S. Haught, K. Holderied, K. Iken, D. Irons, A. Kettle, D. Kimmel, B. Konar, K.J. Kuletz, B. Laurel, J.M. Maniscalco, C. Matkin, C. McKinstry, D. Monson, J. Moran, D. Olsen, W. Palsson, S. Pegau, J. Piatt, L. Rogers, A. Schaefer, I. Spies, J. Straley, S. Strom, K. Sweeney, M. Szymkowiak, B. Weitzman, E. Yasumiishi, S. Zador. 2020. Ecosystem Response to a Prolonged Marine Heatwave in the Gulf of Alaska. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Suryan, R., M. **Lindeberg**, D. **Aderhold**, and K. **Hoffman**. 2020. GWA 2012-2019 Highlights and Wrap-Up. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

Suryan, R.M., M. Arimitsu, H. Coletti, M.A. Bishop, D. Cushing, D. Esler, S. Hatch, D. Irons, R. Kaler, K. Kuletz, J. Piatt, A. Schaefer. 2020 Response of seabirds on colony and at sea to a prolonged marine heatwave in the Gulf of Alaska. 6th World Seabird Twitter Conference.

Suryan, R.M., and M.L. **Lindeberg.** 2020. Gulf Watch Alaska. Presentation to ecosystem-based fisheries management meetings and workshops within the NOAA Alaska Fisheries Science Center, including: (1) Preview of Ecosystem and Economic Conditions workshop, (1) Ecosystem and Socioeconomic Profile workshop, (3) Recruitment Processes Alliance annual meeting and strategic planning.

Weitzman, B., B. Konar, K. Iken, H. Coletti, D. Monson, R.M. **Suryan**, T. Dean, D. Hondolero, and M.R. **Lindeberg**. 2020. Changes in Rocky Intertidal Community Structure During a Marine Heatwave in the Northern Gulf of Alaska. Oral Presentation. EVOSTC Science Review Panel. Science Synthesis Workshop. Anchorage, Alaska, Feb. 27.

2. Public presentations

Lindeberg, M.R. 2020. Gulf Watch Alaska: A Long-Term Monitoring Program of the *Exxon Valdez* Oil Spill Trustee Council. Oral Presentation. 2020 EVOSTC Trustee's Public meeting, October 14, virtual, Anchorage, Alaska.

C. Data and/or Information Products Developed During the Reporting Period, if Applicable

Data

Gulf of Alaska Data Portal. Gulf Watch Alaska Research Workspace. https://portal.aoos.org/gulf-of-alaska#search?type_group=all&query=gulf%20watch%20alaska&page=1

Specific datasets are listed in the individual project annual reports and the program annual report.

Informational Products

Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2020. GWA Quarterly Currents. Newsletter. Volume 3.1: spring quarter. Link on gulfwatchalaska.org.

Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2020. GWA Quarterly Currents. Newsletter. Volume 3.2: summer quarter. Link on gulfwatchalaska.org.

Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2020. GWA Quarterly Currents. Newsletter. Volume 3.3: fall quarter. Link on gulfwatchalaska.org.

Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2020. GWA Quarterly Currents. Newsletter. Volume 3.4: winter quarter. Link on gulfwatchalaska.org.

Online Resources

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

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

Additional online resources are listed in the individual project annual reports and the program annual report.

D. Data Sets and Associated Metadata that have been Uploaded to the Program's Data Portal

PM I and PM II projects do not currently collect or generate original data or post data to the data portal. All other published data sets are reported on in the relevant project annual report.

10. Response to EVOSTC Review, Recommendations and Comments:

Science Panel Comments (FY21):

The Science Panel agrees with the Science Director on her comments regarding outreach activities going virtual. There should be no reason why these activities should not continue unless these communities do not have internet access.

The Science Panel would like clarification on the role of the new postdoc. How will this person be onboarded (remotely, in-person)? What aspects will Rob Suryan continue to work on and what will be the responsibility of the new postdoc? Will the postdoc be able to accomplish these goals remotely? The request seems reasonable on its surface, but the SP would like to see the more specific goals and activities of the postdoc specified.

Program and Administrative Lead Response (FY21):

Thank you for the suggestion. We will reach out to the native villages in Prince William Sound to gauge the potential for in-person or virtual engagement in FY21. We will be sensitive to their capabilities and interests and will endeavor to engage in low-risk interactions due to the pandemic and interactions that are otherwise culturally and socially sensitive, appropriate, and welcomed. If novel engagements in the Prince William Sound villages are not possible due to COVID-19 and community connectivity capabilities, we will explore pivoting towards re-engagement in meaningful ways with already established relationships of native communities in the Kachemak Bay area.

Our current plan is for the postdoc to be onboarded remotely. This has worked successfully with Sarah Traiger, the new postdoc in the Nearshore Component (replacing Ben Weitzman), and we are confident remote onboarding will work in this situation, too. Rob will continue to fulfill the science coordinator position in working with the management team and PIs in directing cross-program science synthesis, continuing collaborations with other Gulf of Alaska sampling programs, and developing Work Plans for the next EVOSTC funding cycle. The new postdoc will be incorporated into these efforts as much as possible. The primary responsibility of the postdoc will be to lead data synthesis efforts identified as priority analyses and manuscripts by program management and PIs. The postdoc will be lead author on these efforts and Rob will primarily act in an advisory role.

Science Panel Comments (FY20):

The Panel appreciates the Quarterly Currents and the links to media (e.g., newspaper articles) with a range of topics. The Science Panel wonders whether this effort can also benefit public outreach. For example, could this publication be modified such that all or selected parts can be included in Riley Woodford's ADFG's Wildlife News email? This may also be a good opportunity to provide a product for communities as requested by the Science Coordinator. Science Panel concurs with the Science Coordinator's comments.

Program and Administrative Lead Response (FY20):

We are pleased with how well the Quarterly Currents have been received. Expanding the distribution list is a great idea and we appreciate the suggestions. We will look into these suggestions and others, keeping the EVOSTC Science Coordinator apprised of opportunities.

11. Budget:

Please see provided program workbook. Cumulative spending for PM I and PM II is listed below.

PM I

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

Budget Category:	Proposed FY 17	Proposed FY 18	Proposed FY 19	Proposed FY 20	Proposed FY 21	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$117.0	$120.0	$123.0	$126.0	$130.0	$616.0	$486.0
Travel	$13.1	$13.1	$13.1	$13.1	$8.6	$61.0	$52.4
Contractual	$67.0	$70.0	$0.0	$0.0	$0.0	$137.0	$137.0
Commodities	$3.0	$5.7	$2.0	$2.0	$8.2	$20.9	$16.8
Equipment	$8.0	$0.0	$0.0	$0.0	$0.0	$8.0	$8.0
SUBTOTAL	$208.1	$208.8	$138.1	$141.1	$146.8	$842.9	$700.2
General Administration (9% of subtotal)	$18.7	$18.8	$12.4	$12.7	$13.2	$75.9	N/A
PROJECT TOTAL	$226.8	$227.6	$150.5	$153.8	$160.0	$918.8	
Other Resources (Cost Share Funds)	$105.4	$105.4	$105.4	$105.4	$92.7	$514.3	

The total request for FY21 has not changed. Current expenditures of some line items exceed ± 10% deviation from the originally proposed amount due to COVID-19 (e.g., travel), or where reporting accounts lagged behind actual expenses between federal and EVOSTC fiscal year start dates. These costs will even out towards the end of the fiscal year, and we expect to spend the total proposed budget amount by the end of the project.

The Science Coordinator (Suryan) is now a permanent NOAA employee and a portion of his FY21 salary ($110K) will go towards a fulltime postdoc. Suryan will still be GWA's Science Coordinator guiding and working closely with a postdoc to continue synthesis efforts. Due to expected reductions in travel from COVID-19 we moved $6.7K to commodities and the remaining balance for publication fees.

PM II

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

Budget Category:	Proposed FY 17	Proposed FY 18	Proposed FY 19	Proposed FY 20	Proposed FY 21	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$128.4	$134.4	$207.7	$213.8	$228.1	$912.5	$605.4
Travel	$32.3	$31.8	$18.0	$0.0	$0.0	$82.0	$39.7
Contractual	$87.1	$87.1	$118.2	$137.5	$124.9	$554.8	$419.7
Commodities	$6.4	$5.9	$7.0	$7.5	$16.1	$42.9	$17.5
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Indirect Costs (*waived*)							
SUBTOTAL	$254.2	$259.1	$350.9	$358.8	$369.1	$1,592.1	$1,082.3
General Administration (9% of subtotal)	$22.9	$23.3	$31.6	$32.3	$33.2	$143.3	N/A
PROJECT TOTAL	$277.1	$282.4	$382.5	$391.1	$402.3	$1,735.4	
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

In FY21, we requested the transfer of $19.8K from Travel to split between Personnel ($7.7K), Commodities ($6.1K), and Contractual ($6K). Future travel will use carryforward funds from past

years. Travel expenses were very low in FY21 due to the COVID-19 pandemic. Some but not all members of the program administration team as well as three out of five members of the Science Review Panel were able to attend the EVOSTC synthesis workshop in Anchorage in late February 2020. The fall PI meeting was virtual, as was the Jan. 2021 AMSS. Pandemic conditions have not yet permitted community engagement in PWS villages. The aforementioned shifted funds have supported program interpretation, outreach, and engagement. There was no net change to the overall FY21 budget.

In FY20 we removed $21K from travel and split it between Commodities ($6K) and Contractual ($15K). In FY19, we moved the GWA Program Coordinator position and associated program coordination expenses from the PM I budget to the PWS Science Center PMII as follows: FY19 ($72K personnel); FY20 ($74.1K personnel; $2.9K contractual); FY21 ($76.3K personnel; $5.7K contractual). This supported the transition of the program coordinator from employment at NOAA to employment at PWSSC. FY19: We shifted funds between categories, from SRP travel to information technology in contractual for a no-net-impact change to the budget. SRP travel was overestimated and IT was underestimated in the original budget. Not all SRP members have been able to travel to all in-person meeting opportunities.

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