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

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

Annual Project Reporting Form

Project Number: 24120114-H

Project Title: Nearshore ecosystems in the Gulf of Alaska

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Reporting Period: February 1, 2024 – January 31, 2025

Submission Date (Due March 1 immediately following the reporting period): March 1, 2025

Project Website: https://gulfwatchalaska.org/

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

☒ **Project progress is on schedule.**

☐ **Project progress is delayed**

☐ **Budget reallocation request.**

☒ **Personnel changes.**

Brian Robinson moved on from the U. S. Geological Survey and Gulf Watch Alaska-Long Term Research and Monitoring in 2023; however, his contributions to the program and its success have been significant. For FY24 field operations, the nearshore component hired a seasonal employee to assist with data collection and logistics in Brian's absence. Federal hiring freezes are precluding a full-time hire of this key role in FY25, thus far.

1. Summary of Work Performed:

We conducted nearshore marine ecosystem monitoring in four regions within the spill-affected area of the northern Gulf of Alaska (GOA): Western Prince William Sound (WPWS), Kenai Fjords National Park (KEFJ), Kachemak Bay (KBAY), and Katmai National Park and Preserve (KATM). 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. Our nearshore monitoring has been carefully designed, with coordinated sampling of all metrics, to detect changes and provide insights into drivers of change observed at different spatial and temporal scales. Our objectives are as follows:

- Determine status and detect patterns of change in a suite of nearshore species and communities.
- Identify temporal and spatial extent of observed changes.
- Identify potential causes of change in biological communities, including those related to climate change.
- Communicate observations to the public and resource managers to conserve and manage nearshore resources.
- Continue restoration efforts to evaluate the current status of spill-injured resources and identify factors potentially affecting present and future trends in population and ecosystem status.

The design features of the Nearshore Component include a rigorous site selection process that allows statistical inference over various spatial scales (e.g., GOA and regions within the GOA) as well as the capacity to evaluate potential effects from more localized sources, and especially

those resulting from human activities, including lingering effects of the *Exxon Valdez* oil spill (EVOS). In addition to detecting change at various spatial scales, design features incorporate both static (e.g., substrate, exposure, bathymetry) and dynamic (e.g., variation in oceanographic conditions, productivity, and predation) drivers as potential mechanisms responsible for change. More than 200 species dependent on nearshore habitats, many with well recognized ecological roles in the nearshore food web, are monitored annually within four regional blocks in the GOA. Evaluation of change in those species over time in relation to well defined drivers supports accurate measures of change, provides defensible conclusions related to causes and supports management and policy needs regarding nearshore resources.

In 2024, we completed all aspects of the nearshore monitoring component across all four regions. The status of all measured metrics was reported on recently (Coletti et al. 2023) through 2021. For the 2024 annual report, we report on intertidal water temperature and several intertidal indicators that represent key nearshore ecosystem processes, including primary production and prey abundance. As a top predator in the nearshore marine ecosystem, we also report on abundance and diet of sea otters across the study region. We anticipate that with continued observable changes in prey availability, a response by upper-trophic level species may occur.

Nearshore water temperature across the GOA from Prince William Sound (PWS) to the Alaska Peninsula was elevated from 2014 through 2016 across all regions and into 2017 in WPWS and KEFJ (Danielson et al. 2022; Fig. 1). These results confirm that the 2014-2016 Pacific marine heatwave (PMH) in the GOA was expressed in intertidal zones in addition to known patterns in open ocean environments. While temperatures returned to cooler conditions in 2017, another heat spike was recorded in all regions in 2019. Temperatures then started to cool again the following year, although with higher among-region variability, than was observed prior to the heatwave. In 2024, at the time of collection (mid-summer), all four regions remain cooler than the average through the data record, though somewhat warmer than 2007-2014.

We examined rocky intertidal community structure at 21 sites across our four regions, spanning 1,200 km of coastline. Sites were monitored annually at mid and low tidal strata. During and after the PMH (2015-2019), we found that macroalgal foundation species (e.g., kelps and perennial seaweeds) declined across the study regions (Weitzman et al. 2021) and is evident here by the decline in *Fucus distichus* following the PMH at the 0.5 m (Fig. 2) and less evident at the 1.5 m tidal elevation (Fig. 3). The GOA-wide shift from a macroalgal dominated rocky intertidal to a filter-feeder dominated state concurrent with the changing environmental conditions

associated with a marine heatwave event suggests the PMH had Gulf-wide impacts to the structure of rocky intertidal communities (Weitzman et al. 2021). Similarities in community structure increased across regions, leading to a greater homogenization of these communities and lower species diversity (Fig. 4). This was due to declines in macroalgal cover, driven mostly by a decline in the rockweed, *Fucus distichus*, and other fleshy red algae in 2015, followed by an increase in barnacle cover in 2016, and an increase in mussel cover in 2017 (Figs. 2 and 3). Increases in diversity were evident at the 0.5 m tidal elevation following the PMH and have stabilized in recent years (Fig. 4). Trends in diversity are less obvious at 1.5 m (Fig. 4). However, variability in community structure and increases in macroalgae following the PMH may be an indication of the ecosystem returning to one dominated by local-scale conditions compared to the large-scale effect of the PMH.

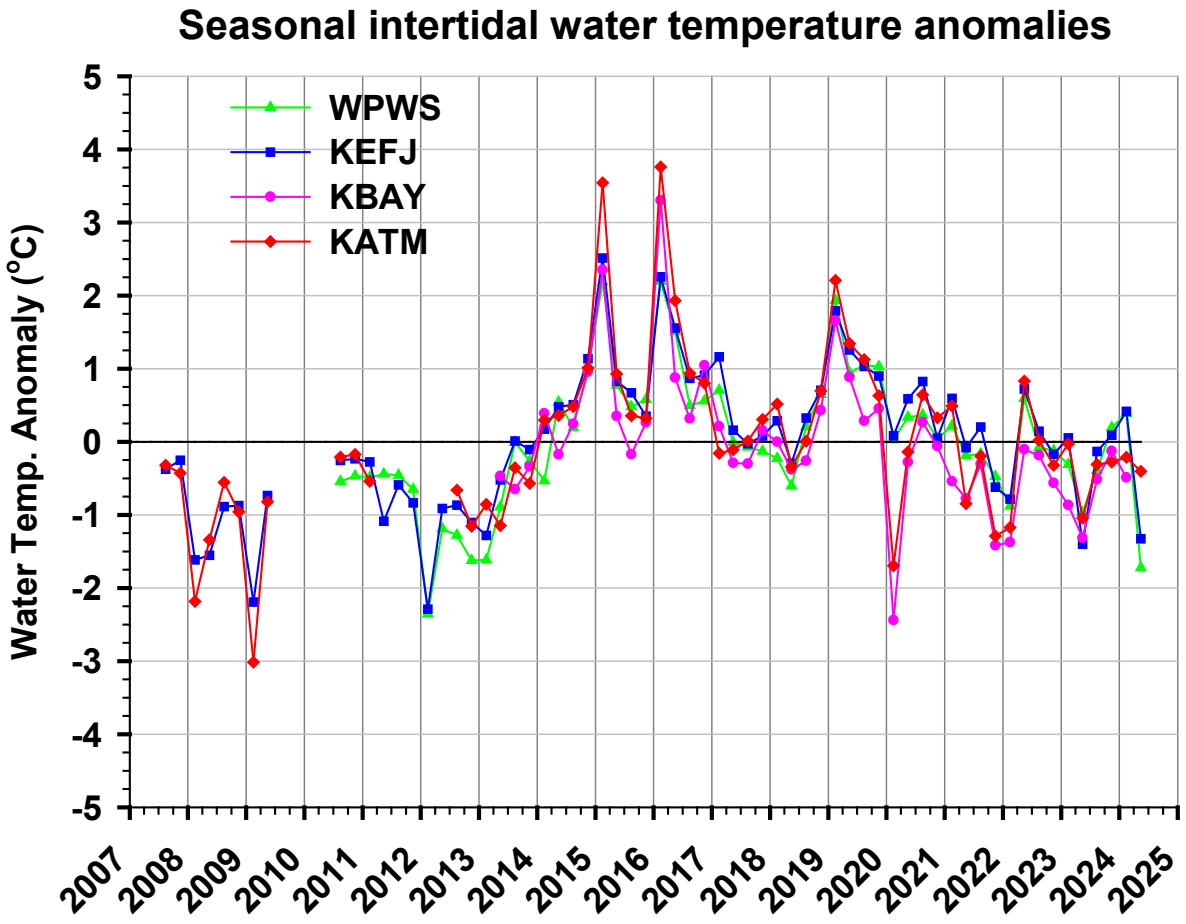

Figure 1. Seasonal intertidal water temperature anomalies at the 0.5 m tide level four regions of the western Gulf of Alaska (west of 144°W), western Prince William Sound (WPWS; 2011-2024), Kenai Fjords National Park (KEFJ; 2008-2024), Kachemak Bay (KBAY; 2013-2024), and Katmai National Park adjacent to Shelikof Strait (KATM; 2006-2024). Long tick marks indicate the start of the calendar year (January) while short tick marks are quarterly divisions within the year (April, July, October). Data sources are listed below.

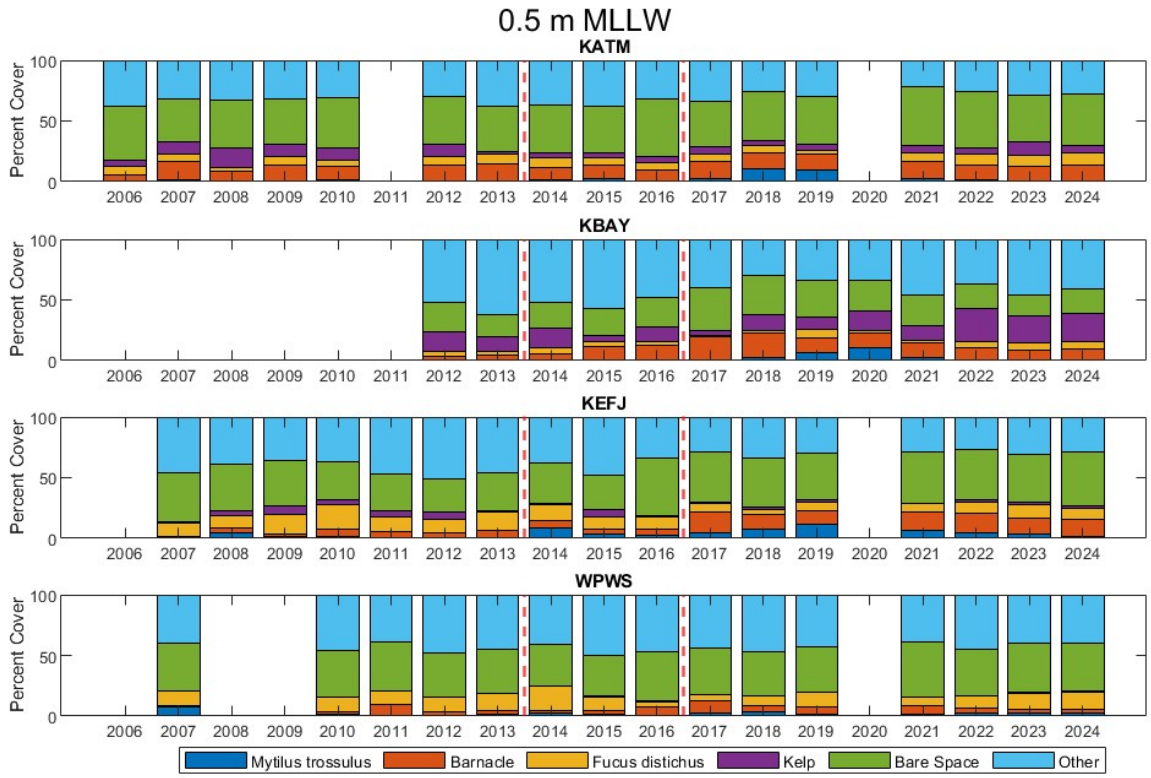

Figure 2. Percent cover of Mytilus trossulus, barnacles, Fucus distichus, kelps, and bare substrate at the 0.5 m tidal elevation across the four Gulf Watch Alaska regions: Katmai National Park and Preserve (KATM), Kachemak Bay (KBAY), Kenai Fjords National Park (KEFJ), and Western Prince William Sound (WPWS), 2006-2024. "Other" includes all other macroalgae and sessile invertebrates. Dashed red line indicates the start and end of the Pacific marine heatwave. Data sources are listed below.

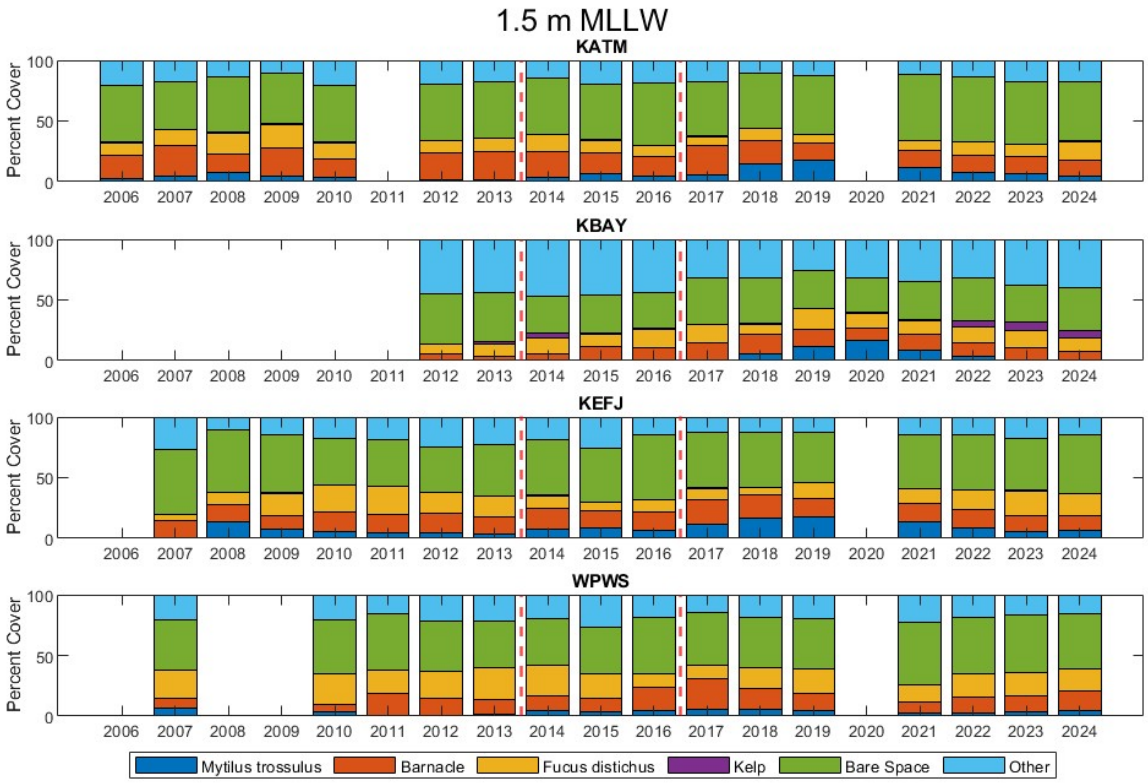

Figure 3. Percent cover of Mytilus trossulus, barnacles, Fucus distichus, kelps, and bare substrate at the 1.5 m tidal elevation across the four Gulf Watch Alaska regions: Katmai National Park and Preserve (KATM), Kachemak Bay (KBAY), Kenai Fjords National Park (KEFJ), and Western Prince William Sound (WPWS), 2006-2024. "Other" includes all other macroalgae and sessile invertebrates. Dashed red line indicates the start and end of the Pacific marine heatwave. Data sources are listed below.

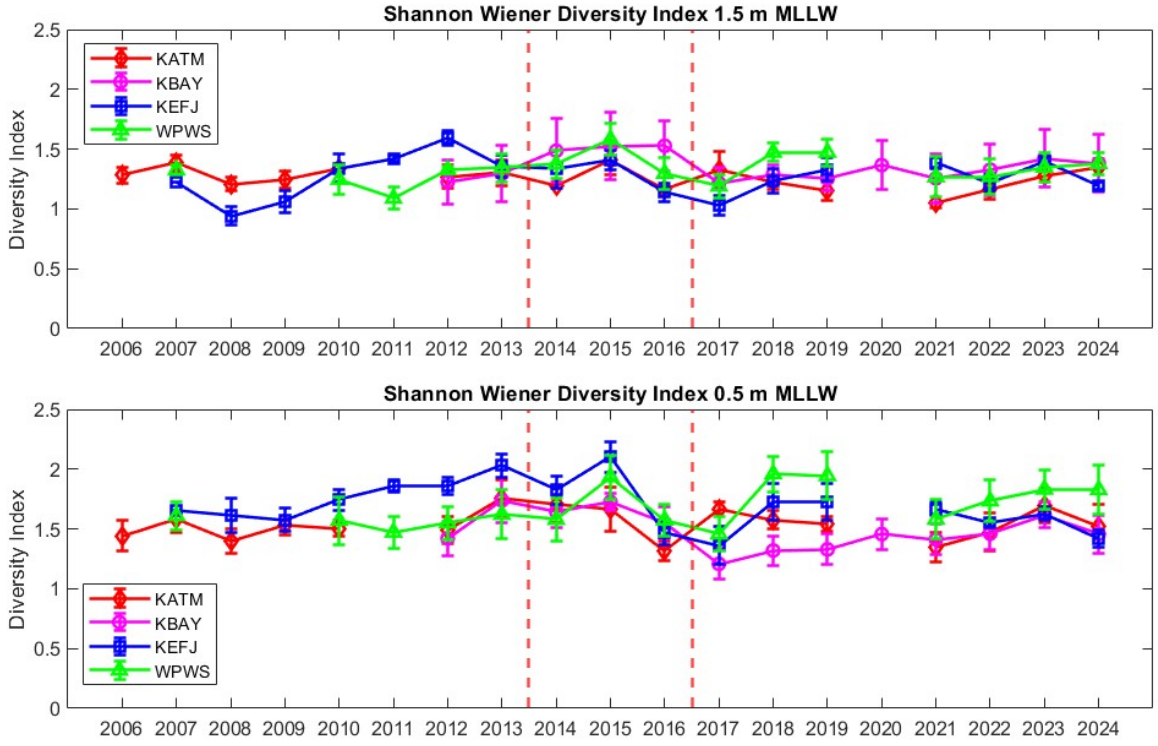

Figure 4. Shannon Wiener Diversity Index for all macroalgae and invertebrates at the 1.5 m and 0.5 m tidal elevation relative to mean lower low water (MLLW) across the four Gulf Watch Alaska regions: Katmai National Park and Preserve (KATM), Kachemak Bay (KBAY), Kenai Fjords National Park (KEFJ), and Western Prince William Sound (WPWS), 2006-2024. Error bars indicate ±1SE. Dashed red line indicates the start and end of the PMH. Data sources are listed below.

Specific mussel beds are sampled at each site within each region every year. Large mussel densities (≥ 20 mm) showed an overall positive trend across regions concurrent with timing of the PMH through 2019, although not consistent in timing across regions (Fig. 5). However, starting in 2022, KATM experienced declines in large mussel density, concurrent with positive trends in sea star abundance. This trend continued through 2024 (Figs. 5 and 6). Patterns in the other three regions are less clear. KBAY and KEFJ have had positive trends in large mussel density through 2023, but negative in 2024. Conversely, WPWS was the only region in 2024 with a positive trend in large mussel density, the first positive trend observed in the WPWS

region since 2018 (Fig. 5). As oceanographic conditions return to cooler temperatures, variability in mussel abundance at these regional spatial scales supports our conclusion that, in the absence of broad-scale perturbations like the PMH, other variables, including local conditions are more important drivers of mussel abundance (Bodkin et al. 2018, Traiger et al. 2022, LaBarre et al. 2023).

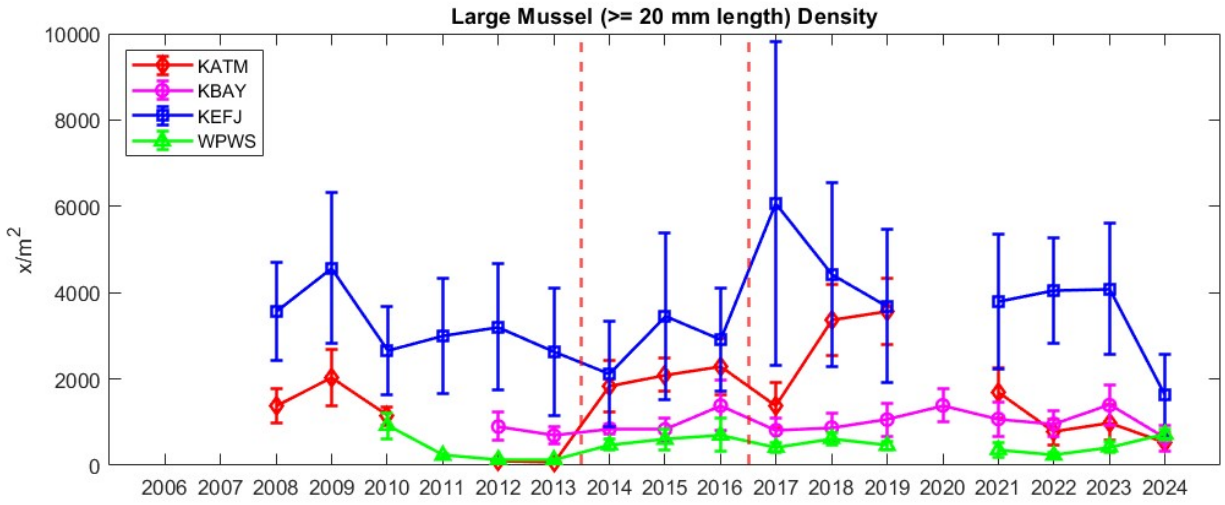

Figure 5. Large (>= 20 mm) mussel (Mytilus trossulus) density across four regions at mussel sites through 2024. Sampling started in 2008 in Kenai Fjords National Park (KEFJ), Katmai National Park and Preserve (KATM), and Western Prince William Sound (WPWS). Kachemak Bay (KBAY) mussel bed sampling began in 2012. Error bars indicate ±1SE. Dashed red line indicates the start and end of the Pacific marine heatwave. Data sources are listed below.

Variability in density and species composition of sea stars differed greatly among regions through 2015. Starting between 2015 and 2017, densities declined and remained strongly negative across all regions through 2019 (Fig. 6), with average to below average densities continuing through 2021. Declines were likely due to sea star wasting (Konar et al. 2019), possibly exacerbated by the PMH (Harvell et al. 2019). However, 2024 is the first year since monitoring began that all four regions have exhibited positive trends, although to varying degrees. Density estimates indicated that WPWS and KBAY were approximately just above average compared to the long-term mean density within each respective region. KATM density was strongly positive (highest sea star density recorded in KATM since monitoring began) and

KEFJ density remained strongly positive starting in 2022 through 2024. Data from 2024 also indicated that variability in sea star species composition among (and within) regions has increased. For example, in 2023 *Pisaster* was dominant in KEFJ (72%) and KATM (76%). However, in KEFJ during 2024 sampling, *Pisaster* only accounted for 46% with increased densities of *Dermasterias* and *Evasterias* at 34% and 18%, respectively. In KATM, *Evasterias* dominated the sea star assemblage with 66% (up from 19% in 2023) and *Pisaster* accounting for only 32%. In WPWS, *Dermasterias* continues to be the dominant species with 54% (an increase from 34% in 2023), followed by *Evasterias* at 10% (down from 26% in 2023), *Pisaster* at 4% (down from 19% in 2023), and *Pycnopodia* increasing to 32% (up from 20% in 2023). In KBAY, densities were slightly higher than average. *Orthasterias* was proportionally dominant at 64% in 2023, but that proportion declined to 8% in 2024. *Evasterias* dominated the observed sea star assemblage in 2024 with 83% (up from 14% in 2023). Variability in the sea star assemblage (both by density and species composition) among regions and across years within regions may be an indication of the ecosystem returning to one dominated by local-scale conditions as opposed to driven by large-scale perturbations such as sea star wasting and the PMH.

Collectively, these indicators demonstrate that consistent, broad-scale responses in nearshore ecosystems occurred coincident with the PMH throughout much of the Northern GOA, including areas both inside (WPWS, KBAY) and outside (KEFJ and KATM) of protected marine waters. A comprehensive analysis of rocky intertidal community structure indicated a change of autotroph-macroalgal dominated communities to heterotroph-filter-feeder communities, ultimately resulting in homogenization of community structure across all four regions (Weitzman et al. 2021). During this same time period, we found that the loss of sea stars allowed for the increase in mussel density due to a decline in predation pressure (Traiger et al. 2022). In addition, we note that the decline in *Fucus* observed across our study regions opened space in the intertidal for mussels to settle, further allowing for the increase in mussels across the Gulf. However, other factors such as predation pressure from nearshore vertebrates, shifts in primary productivity, and changes in environmental variables (salinity) may also influence mussel density (Traiger et al. 2022).

The contribution of phytoplankton versus macroalgal derived carbon to the diet of three nearshore species, the black rockfish, kelp greenling and the mussel *Mytilus trossulus* was assessed using stable isotope analysis. All three nearshore species derived a large majority of the carbon in their tissues from macroalgae (70-88%), compared to phytoplankton, regardless of their different lifestyle and feeding habits (Corliss et al. 2024). The proportion of macroalgal

carbon to mussels decreased during the PMH, likely reflecting the decline in macroalgae during that time (Weitzman et al. 2021). However, macroalgae continued to play a large role in supporting mussel growth during the PMH, indicating that macroalgae may be an important pathway to support mussels during marine heatwaves. This work further supports the premise that macroalgae play a major role in providing the primary productivity that fuels the nearshore food web and may be especially critical as climate scenarios predict increased frequency of marine heatwaves (Gruber et al. 2021).

With these shifts in lower-trophic community structure, we hypothesized that responses to the PMH by upper-trophic level species, such as sea ducks and sea otters, would likely occur. For example, we examined the response in relative abundance of marine bird benthivores, like sea ducks, to the change in prey availability documented by the Nearshore Component. In general, marine bird species reliant on benthic marine invertebrates fared better than their piscivorous counterparts foraging on the pelagic marine ecosystem, indicating the food availability for benthivores mediated negative responses to the PMH (Robinson et al. 2023). This was particularly evident for Barrows Goldeneye and the Black Oystercatcher, both of which rely on mussels in their diet. Long-term trend data on sea otter abundance indicates that sea otter populations have increased within WPWS and KBAY monitoring blocks over time and appear generally stable elsewhere, despite differences in total estimated abundance among blocks (Fig. 7) with no apparent response to the PMH (Coletti et al. 2024).

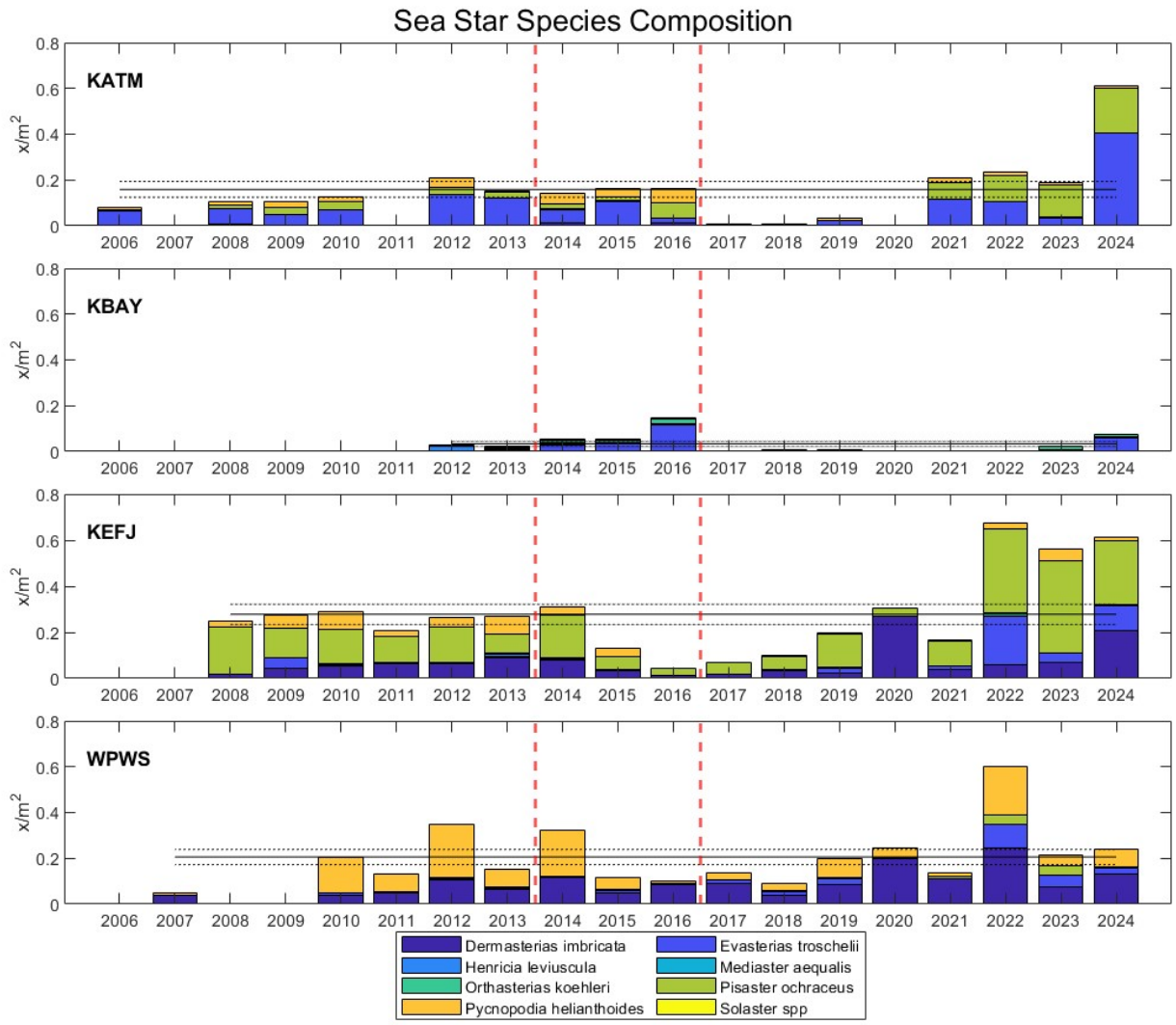

Figure 6. Sea star species composition and density across all four Gulf Watch Alaska regions through 2024: Katmai National Park and Preserve (KATM), Kachemak Bay (KBAY), Kenai Fjords National Park (KEFJ), and Western Prince William Sound (WPWS). Solid horizontal line shows long-term mean total sea star density and dashed lines show standard error. Dashed red line indicates the start and end of the Pacific marine heatwave. Data sources are listed below.

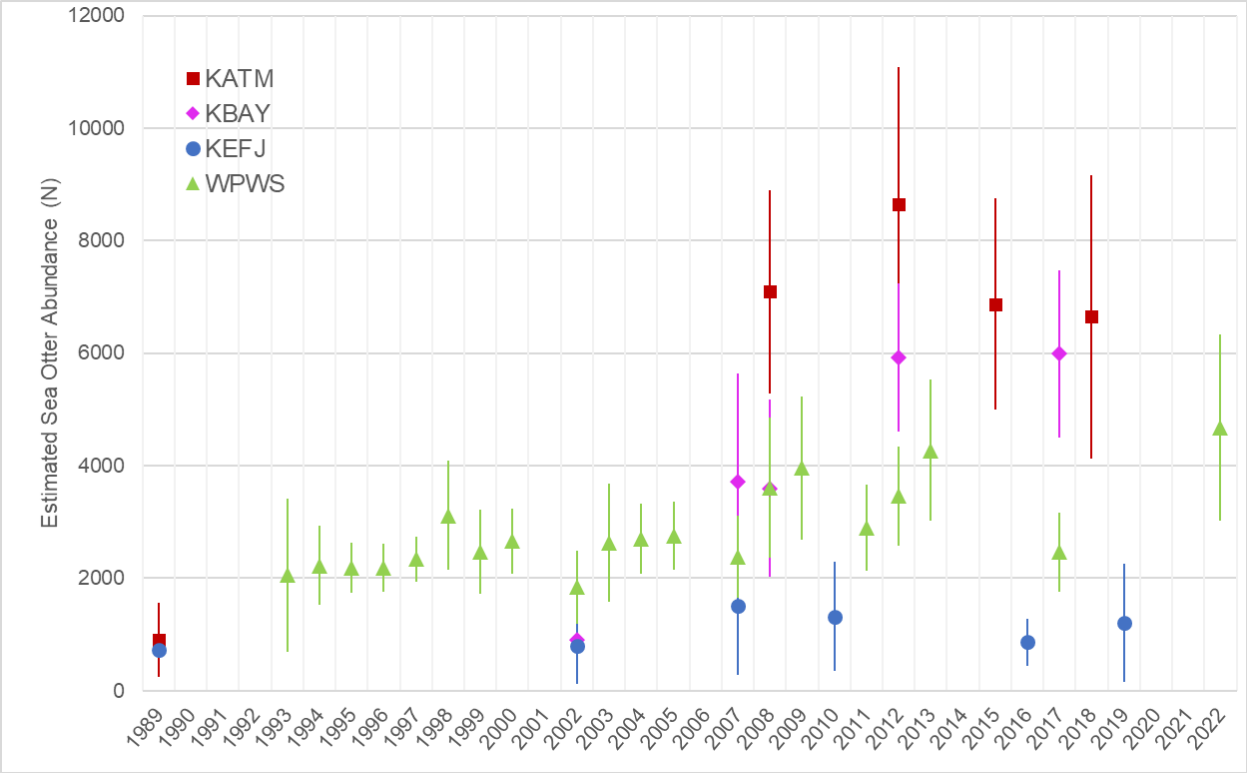

Figure 7. Mean estimated sea otter abundance (±95CI) by year for Katmai (KATM red), Kachemak Bay (KBAY purple), Kenai Fjords (KEFJ blue), and Western Prince William Sound (WPWS green). Data sources are listed below.

Intertidal and nearshore ecosystems provide valuable habitat for early life stages of various commercially important species in the GOA, including Dungeness crab (*Metacarcinus magister*), Pacific cod (*Gadus macrocephalus*), salmonids (*Oncorhynchus spp.*) and several species of rockfish (*Sebastes* spp.). Our indicators suggest that some nearshore biological responses to the PMH appeared to continue into 2021 in some regions and could have affected recruitment and survival of commercially important species whose life stages rely on nearshore habitat. For some metrics, evidence of return to more average conditions in nearshore habitats suggests that PMH effects, both positive and negative, continue to dissipate. A major pattern that is emerging; however, is that the variability of biological indicators across regions is larger than it was before the PMH. Marine heatwaves are expected to become more common and widespread as a

consequence of climate change (Frölicher et al. 2018). From primary producers to top-level consumers, our studies offer insight as to the varying extent of species' responses to these wide-scale perturbations and the timescales over which effects are expressed. Further, we also hypothesize that in the long term, we may see responses of nearshore-reliant, upper trophic level species (such as sea otters and sea ducks) to shifts in prey availability from changing ocean conditions across the GOA.

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Relative importance of macroalgae and phytoplankton to nearshore consumers and growth across climatic conditions in the northern Gulf of Alaska. Estuaries and Coasts doi: 10.1007/s12237-024-01371-6

Conferences and workshops:

Coletti, H., D. Esler, K. Iken, B. Konar, S, Traiger, B. Ballachey, J. Bodkin, G. Esslinger, K. Kloecker, M. Lindeberg, D. Monson, B. Robinson, R. Suryan, and B. Weitzman. 2024. Long-term monitoring documents change in nearshore ecosystems of the Gulf of Alaska. Poster presentation, Kachemak Bay Science Conference, Homer, Alaska, March.

Coletti, H., D. Esler, G. Esslinger, B. Weitzman, P. Schuette, J. Eisaguirre, and others. 2024. Gulf Watch Alaska Nearshore monitoring of sea otters and their habitats. Oral presentations, Chugach Imaq Research Collaborative Workshop, Cordova, Alaska, September.

Coletti, H., D. Esler, K. Iken, B. Konar, B. Ballachey, J. Bodkin, G. Esslinger, K. Kloecker, M. Lindeberg, D. Monson, S. Traiger, and B. Weitzman. 2025. Gulf Watch Alaska Nearshore Component 2024 update: Monitoring species and processes to detect change and infer cause. Poster Presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Hughes, M., K. Iken, S. Traiger, H. Coletti, and B. Konar. 2025. Direct and cascading effect of sea star wasting on rocky intertidal communities. Oral presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Schuette, P, and B. Weitzman. 2024. Sea otter efforts across the Southeast Alaska stock. Oral presentation, Southeast Alaska Tribal Conservation District Regional Gathering, Ketchikan, Alaska, August.

Traiger, S. B., R. Campbell, H. Coletti, D. Esler, K. Holderied, C. McKinstry, D. Monson, M. Renner, B. Robinson, R. Suryan, and B. Weitzman. 2024. Barnacle larvae variability and relationships to intertidal abundance in Kachemak Bay. Oral presentation, Kachemak Bay Science Conference, Homer, Alaska, March.

Traiger, S. B. 2024. Ecological impacts of the sea star wasting epidemic. Oral presentation, U. S. Geological Survey Wildlife Disease Community of Practice, Virtual, May.

Traiger, S. B., J. Bodkin, H. Coletti, K. Iken, K. Kloecker, B. Konar, D. Monson, B. Weitzman. 2025. Effects of site-specific characteristics on northern Gulf of Alaska clam assemblages. Alaska Marine Science Symposium, Anchorage, Alaska, January.

Vayder, Z., K. Iken, and H. Coletti. 2025. Temperate effects on Pacific blue mussels (*Mytilus trossulus*. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Public presentations:

Cunningham, R., H. Coletti, A. Schaefer, M. Rehberg, M. Piche, B. Weitzman, B. Mahoney, H. M. Garcia-Ladd, J. Keating, and J. Shaff. 2024. Chugach Imaq: Past, Present & Future Marine Mammal Research & Monitoring in the Chugach Region. Oral mini-presentations by the Chugach Imaq Research Collaborative for the Prince William Sound Science Center Tuesday Night Talk Series, Cordova, Alaska, September.

Traiger, S. B. 2024. Curiosity Unleashed STEAM, Thunder Mountain High School, Juneau. Sea otter foraging observation activity for K-5 families, February.

Traiger, S. B. 2024. Recent changes in the Gulf of Alaska nearshore ecosystem revealed by long-term monitoring. Virtual presentation to Prince William Sound Science Center and Center for Alaskan Coastal Studies, February.

Traiger, S. B. 2024. Ocean Science Festival, Cordova High School, Cordova. Sea otter foraging observation activity for 167 students, October.

Traiger, S. B. 2024. Kachemak Currents radio program episode "Barnacles" https://www.kbbi.org/show/kachemak-currents, November.

Traiger, S. B. 2024. Six Minute Science radio program episode 19 "Barnacles" https://ktna.org/six-minute-science/, December.

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

The Nearshore Component generates a large volume of data on an annual basis. We have a data management process in place that dictates data handling in the field, data QA/QC, and archiving, which is allowing us to get all of these data released and archived consistently and prior to *Exxon*

Valdez Oil Spill Trustee Council (EVOSTC) deadlines. Data are posted and available to the public at:

Gulf of Alaska Data Portal: Project metadata: GWA Nearshore Component Posted Data

Data also are archived in permanent repositories at USGS and Data One. A listing of citations of archived data is below.

Data sets and associated metadata:

Coletti, H. A., K. A. Kloecker, J. L. Bodkin, and T. A. Dean. 2017. Gulf Watch Alaska nearshore component: monitoring site locations from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park: U. S. Geological Survey data release, https://doi.org/10.5066/F78S4N3R.

Iken, K., and B. Konar. 2024. Long-term Monitoring of Ecological Communities in Kachemak Bay, 2012-2024, Gulf Watch Alaska Nearshore Component. https://doi.org/10.24431/rw1k6cw.

Iken, K. 2024. Stable carbon and nitrogen isotope data of nearshore producers and consumers in four regions of the Gulf of Alaska, 2014-2024. https://doi.org/10.24431/rw1k8e2.

Iken, K. 2024. Growth measurements of mussels and fish in the Gulf of Alaska, 2014-2021. https://doi.org/10.24431/rw1k8e3.

Kloecker, K. A., and D. H. Monson. 2020. Gulf Watch Alaska Nearshore Component: sea otter mortality age data from Katmai National Park and Preserve, Kenai Fjords National Park, and Prince William Sound, Alaska, 2006-2017: U. S. Geological Survey data release, https://doi.org/10.5066/F7H993CZ.

U. S. Geological Survey - Alaska Science Center, National Park Service - Southwest Alaska Inventory and Monitoring Network, and University of Alaska Fairbanks - College of Fisheries and Ocean Sciences. 2017. Black Oystercatcher nest and diet data from Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park, and Prince William Sound (ver. 3.0, October 2024): U. S. Geological Survey data release, https://doi.org/10.5066/F7WH2N5Q.

U. S. Geological Survey - Alaska Science Center, National Park Service - Southwest Alaska Inventory and Monitoring Network, and University of Alaska Fairbanks - College of Fisheries and Ocean Sciences. 2016. Intertidal temperature data from Kachemak Bay, Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 5.0, October 2024): U. S. Geological Survey data release, https://doi.org/10.5066/F7WH2N3T.

U. S. Geological Survey - Alaska Science Center, and National Park Service - Southwest Alaska Inventory and Monitoring Network. 2017. Marine bird and mammal survey data from Kachemak Bay, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 2.0, July 2024): U. S. Geological Survey data release, https://doi.org/10.5066/F7416V6H.

U. S. Geological Survey - Alaska Science Center, and National Park Service - Southwest Alaska Inventory and Monitoring Network. 2016. Intertidal mussel (Mytilus) data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 5.0, August 2024): U. S. Geological Survey data release, https://doi.org/10.5066/F7FN1498.

U. S. Geological Survey - Alaska Science Center, and National Park Service - Southwest Alaska Inventory and Monitoring Network. 2022. Rocky intertidal data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 3.0, October 2024): U. S. Geological Survey data release, https://doi.org/10.5066/F7513WCB.

U. S. Geological Survey - Alaska Science Center, National Park Service - Southwest Alaska Inventory and Monitoring Network, and University of Alaska Fairbanks - College of Fisheries and Ocean Sciences. 2022. Sea otter spraint data from Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park and Prince William Sound (ver 4.0, August 2024): U. S. Geological Survey data release, https://doi.org/10.5066/P9EDM6NL.

U. S. Geological Survey - Alaska Science Center, National Park Service - Southwest Alaska Inventory and Monitoring Network, and University of Alaska Fairbanks. 2018. Intertidal soft-sediment bivalves from Prince William Sound, Kachemak Bay, Katmai National Park and Preserve, and Kenai Fjords National Park (ver 3.0, October 2023): U. S. Geological Survey data release, https://doi.org/10.5066/F71834N0.

U. S. Geological Survey - Alaska Science Center, and National Park Service - Southwest Alaska Inventory and Monitoring Network. 2017. Sea otter forage observations from Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park and Prince William Sound (ver. 2.0, November 2024): U. S. Geological Survey data release, https://doi.org/10.5066/F7N29V4R.

U. S. Geological Survey - Alaska Science Center, and National Park Service - Southwest Alaska Inventory and Monitoring Network. 2024. Eelgrass (*Zostera marina*) percent cover data from Katmai National Park and Preserve, Kenai Fjords National Park, and Prince William Sound, Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/F7RV0KV9.

Additional Products not listed above:

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

The nearshore project works with Prince William Sound Science Center (PWSSC) on a regular basis. Principal investigators (PIs) Iken and Konar, University of Alaska Fairbanks (UAF), are subawardees on the National Oceanic and Atmospheric Administration (NOAA) grant for EVOSTC funds administered by PWSSC. Nearshore team members also coordinate meetings, reporting, and other activities through PWSSC. PIs from the Nearshore component have given presentations on Gulf Watch Alaska-Long Term Research and Monitoring (GWA-LTRM) at teacher workshops hosted by the Alaska SeaLife Center.

EVOSTC Long-Term Research and Monitoring Projects

The nearshore project is a component of the GWA-LTRM program, which is funded by the EVOSTC. In addition to collaborations within the Nearshore component, PIs collaborated with Environmental Drivers component PIs to develop a synthesis manuscript on the effects of meroplankton abundance on intertidal benthic abundance of barnacles in Prince William Sound and Kachemak Bay with a paper published in Journal of Plankton Research (Traiger et al. 2024).

The Nearshore component is inextricably linked with the Lingering Oil component. In FY24, as prescribed by an update to the Lingering Oil proposal, mussels were collected from all Nearshore

component sampling sites across the spill affected region for inclusion in NOAA's Mussel Watch program. Mussel Watch analyzes a large number of contaminants in mussels, including polycyclic aromatic hydrocarbons (PAHs), which are of most relevance as a contribution to the Lingering Oil proposal. In addition, a team of Nearshore component PIs conducted sampling in September 2024 at Lingering Oil sites known to retain oil; this work included sediment excavation and oil sample archiving, as well as collection of mussels for inclusion in Mussel Watch. Gear, personnel, and vessels are shared between Nearshore and Lingering Oil components.

EVOSTC Mariculture Projects

Mariculture Research and Restoration Consortium (Mariculture ReCon) is a multiyear program funded by the EVOSTC with overlapping researchers and study regions with the Nearshore component of GWA-LTRM. Within Kachemak Bay, Mariculture ReCon and GWA-LTRM share logistics and field crews.

Members of GWA-LTRM and U. S. Fish & Wildlife Service (H. Coletti, R. Kaler, K. Kloecker, B. Weitzman, P. Schuette, and A. Kirkham) participated in coordination and logistics planning with Mike Rehberg (Alaska Department of Fish and Game [ADF&G]) and Anne Schaefer (PWSSC) to ensure comparability with GWA-LTRM and to build collaborative engagement.

EVOSTC Education and Outreach Projects

The Nearshore component supports a "Floating teacher workshop" every summer during the sampling period in Kenai Fjords National Park. The program is supported by the National Park Service (NPS) Ocean Alaska Science and Learning Center and Alaska Geographic with the goal of bringing teachers and scientists together in the field. Teachers learn about field sampling methods and create appropriate curriculum.

PIs from the Nearshore component have given presentations on GWA-LTRM at teacher workshops hosted by the Alaska SeaLife Center. Similar to the Floating Teacher Workshops, the goal is for teachers to learn from scientists and others while building appropriate curriculum to take back to their classrooms.

Individual EVOSTC Projects

Nearshore PIs coordinate with the Data Management program to ensure data are reviewed for quality control and assurance and posted to the Gulf of Alaska Data Portal annually within

required timeframes. The Nearshore component under GWA-LTRM does not currently coordinate with other individually funded EVOSTC projects.

Trustee or Management Agencies

In addition to the logistical, administrative, and in-kind support that the NPS, U. S. Geological Survey (USGS), NOAA, and UAF have provided to ensure success of the GWA-LTRM Nearshore component, there are several additional projects with Trustee and management agencies that the Nearshore component of GWA-LTRM has collaborated with. Below are several recent examples. We expect to continue these kinds of related projects in the future.

NOAA Fisheries

The Nearshore component (all PIs) contributed nearshore indices to NOAA Fisheries for the annual GOA Ecosystems Considerations Report to the North Pacific Fisheries Management Council. The health of nearshore ecosystems informs managers on essential fish habitat and sensitive early life stages of federally managed fish species mandated through the Magnuson-Stevens Act.

NPS Nearshore ecosystem responses to glacial inputs

Nearshore GWA-LTRM PIs (Esler, Coletti, and Weitzman), in collaboration with NPS, have initiated work aimed at documenting variation in nearshore physical oceanography in relation to tidewater glacial input, and quantify biological responses to that variation across trophic levels in KEFJ. This work will allow prediction of changes in nearshore ecosystems in the face of ongoing glacier mass loss and retreat from the marine environment. This work relies heavily on GWA-LTRM nearshore monitoring data and will build on our understanding of nearshore marine processes.

NPS

Nearshore GWA-LTRM PIs (Ballachey, Bodkin, Monson, Kloecker, and Coletti) are working with NPS and others to examine linkages between terrestrial and marine ecosystems and is funded by the National Park Foundation. Field work was initiated in July 2015 with in-kind support from our GWA-LTRM KATM vessel charter. National Parks in Southwest Alaska are facing a myriad of management concerns that were previously unknown for these remote coasts, including increasing visitation, expanded commercial and industrial development, and environmental changes due to natural and anthropogenic forces. These are concerns because of

their potential to significantly degrade and potentially impair resources in coastal systems. There are several components which include (but are not limited to): (1) brown bear fitness and use of marine resources, (2) status of bivalves (clams and mussels), (3) wolf use of marine resources, (4) sea otter diet and abundance and (5) an integrated outreach program. We (GWA-LTRM Nearshore component) assisted with the collection of a variety of samples from the coast of KATM as well as support sea otter forage data collection in and outside KBAY. This project will increase our understanding of how various stressors may affect both marine intertidal invertebrates and bear populations at multiple spatial and temporal scales.

Bureau of Ocean Energy Management

GWA-LTRM PIs (Monson, Kloecker, both USGS ASC) work closely with USGS PIs on an Alaska Science Center Nearshore Marine Ecosystems project funded by the Bureau of Ocean Energy Management that is conducting sea otter research in Cook Inlet. This Cook Inlet Sea Otter Research (CISOR) project focuses on quantifying sea otter abundance, distribution and habitat use in lower Cook Inlet (LCI). Specific CISOR activities that dovetail well with GWA-LTRM nearshore studies include seasonal aerial sea otter surveys in LCI, LCI benthic habitat surveys and sea otter foraging, and activity observation along the east side of LCI. All these activities intersect and overlap to various degrees at Kachemak Bay while also providing additional data outside the GWA-LTRM study areas that will aid in interpreting and contrasting GWA-LTRM data sets. CISOR PIs include Dan Monson, Kim Kloecker, and Nicole Laroche, who also participate in GWA-LTRM field work and data analysis.

U. S. Fish and Wildlife Service Marine Mammals Management

The Nearshore component (all PIs) contributed sea otter abundance data to U. S. Fish and Wildlife Service, Marine Mammals Management for incorporation into updated Stock Assessment Reports (SARs) for the Southcentral and Southeast Alaska stocks of northern sea otters. The updated SARs provide managers with minimum population estimates and suggested harvest management limits of sea otters, based on the population status and regional harvest patterns over recent history.

Alaska Native and Local Communities

Nearshore PIs and U. S. Fish and Wildlife Service are collaborating with CRRC on research across the Chugach region to promote consistency and comparability of data collection by CRRC and available baseline information provided by GWA-LTRM. Should survey efforts be

undertaken, CRRC and Nearshore PIs are coordinating to develop complementary survey designs that can all be incorporated into future Stock Assessment Reports.

PI Traiger continues to be a mentor to high school students throughout the year (including 2024) as part of the Sealaska Heritage Institute Mentorship Program.

4. Response to EVOSTC Review, Recommendations and Comments:

September 2024 EVOSTC Science Panel Comment:

This project conducts nearshore marine ecosystem monitoring in four regions within the spill-affected area of the northern Gulf of Alaska (GOA) to determine status and detect patterns of change in key species and ecosystems. The PIs have conducted all sampling and continue to publish both on the core dataset and through their data being leveraged for publications more broadly. The Science Panel had minimal clarifying comments over the last 2 reviews and responses were straightforward. The annual reports continue to be thorough

The Science Panel has no concerns about this project.

PI Response:

We appreciate the continued support of the *EVOSTC* Science Panel.

2024 EVOSTC Executive Director Comments

I concur with the Science Panel. Funding for this project is managed by NOAA. The expenses on the annual reports are well documented and easy to track. The Fiscal Manager is responsive to budget questions. Staff do not have any concerns at this time.

2024 EVOSTC PAC Comments

Stekoll asked about intertidal surveys, seaweed fucus, and tide height. Coletti stated they chose intertidal sites at random. They selected some sites that were historic or chosen by a community, but due to funding limitations they were constricted to random intertidal sites. They had horizontal transects with a gridded quad, which included all species, but they also picked a charismatic and dominant seaweed (fucus) in the intertidal. They looked at two tide heights, with sea star and invertebrate counts at different elevations.

Stephens asked about exposure and changes in bio-band elevation. Coletti stated they picked two elevations for simplicity and noted another study looking at various seaweed species and elevations and documenting declines of micro-algae. Fucus was a poster child for this project. Stephens also noted a UAF dataset with vertical transects for intertidal species on Prince of Wales that looked for climate effects.

Whissel asked what happened with the oil tanks and Mount Redoubt eruption. Coletti stated the lahar went around tanks with the help of a retaining wall. Whissel introduced a motion to proceed with no concerns. Stephens seconded, and there was no opposition. The motion passed unanimously.

5. Budget:

The Nearshore Component was underspent in FY24 relative to the proposed budget because: (1) delayed arrival of funds required coverage from elsewhere, and (2) funds carried over from FY17-21 were used to cover a significant proportion of FY22 costs within all Nearshore Component entities. Nearshore Component residual funds from FY17-21 (resulting from a reduction in field efforts during the COVID-19 global pandemic) were EVOSTC-approved for carry-over and expenditure during FY22. In addition, reduced contractual costs for FY23 were covered by base funding from National Park Service due to unfilled positions at the agency. Unspent funding from FY22-24 will continue to support staffing and field operations for nearshore monitoring activities for the duration of the program.

***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	$354,453	$367,215	$377,899	$264,718	$271,730	$1,636,014	$681,870
Travel	$14,837	$14,895	$14,955	$15,017	$15,080	$74,784	$82,340
Contractual	$170,600	$173,400	$191,065	$191,600	$189,600	$916,265	$356,034
Commodities	$26,000	$26,975	$27,999	$22,730	$21,000	$124,704	$87,442
Equipment	$25,937	$37,247	$38,417	$33,645	$34,935	$170,181	$37,512
Indirect Costs (varies by proposer)	$21,670	$22,897	$23,507	$24,137	$24,788	$116,999	$35,489
SUBTOTAL	$613,497	$642,629	$673,842	$551,847	$557,133	$3,038,947	$1,280,687
General Administration (9% of subtotal)	$55,215	$57,837	$60,646	$49,666	$50,142	$273,505	N/A
PROJECT TOTAL	$668,712	$700,465	$734,488	$601,513	$607,275	$3,312,453	
Other Resources (In-Kind Funds)	$572,400	$577,500	$567,700	$573,100	$578,700	$2,869,400	

COMMENTS:
This is the combined budget for the individual Coletti/Esler and Iken/Konar budgets that follow.

The Nearshore Component was underspent in FY24 relative to the proposed budget because: (1) delayed arrival of funds required coverage from elsewhere, and (2) funds carried over from FY17-21 were used to cover a significant proportion of FY22 costs within all Nearshore Component entities. Nearshore Component residual funds from FY17-21 (resulting from a reduction in field efforts during the COVID-19 global pandemic) were EVOSTC-approved for carry-over and expenditure during FY22. In addition, reduced contractual costs for FY23 were covered by base funding from NPS due unfilled positions at NPS. Unspent funding from FY22-24 will continue to support staffing and field operations for nearshore monitoring activities for the duration of the program.

FY22-26	**Project Number: 24120114-H** **Project Title: Nearshore** **PI(s): Coletti (NPS), Esler (USGS), & Iken & Konar (UAF)**	SUMMARY TABLE