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

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

**Annual Project Reporting Form**

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**Project Number:** 22120114-L

**Project Title:** Seward Line

**Principal Investigator(s):** Prof. Russell Hopcroft, University of Alaska Fairbanks, Dr. Seth Danielson, University of Alaska Fairbanks

**Reporting Period:** February 1, 2022 – January 31, 2023

**Submission Date (Due March 1 immediately following the reporting period):** March 1, 2023

**Project Website:** https://gulfwatchalaska.org/, https://nga.lternet.edu/

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.**

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## 1. Summary of Work Performed:

The Seward Line was sampled in early May and mid-September of 2022. Reports from those cruises are online and can be found at https://nga.lternet.edu/about-us/documents/. In summary, spring temperatures were slightly below the long-term mean by about a quarter degree (Fig. 1) and fall warmer by about a quarter degree (Fig. 2). 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. More synthetic analyses of long-term patterns were produced in our final report for 2017-2021 and shall not be repeated here given the limited time difference between the production of that report and this one. A notable exception is for zooplankton (Fig. 3) where a mistake appeared in Spring 2020 euphausiid biomass and additional data have now been incorporated.

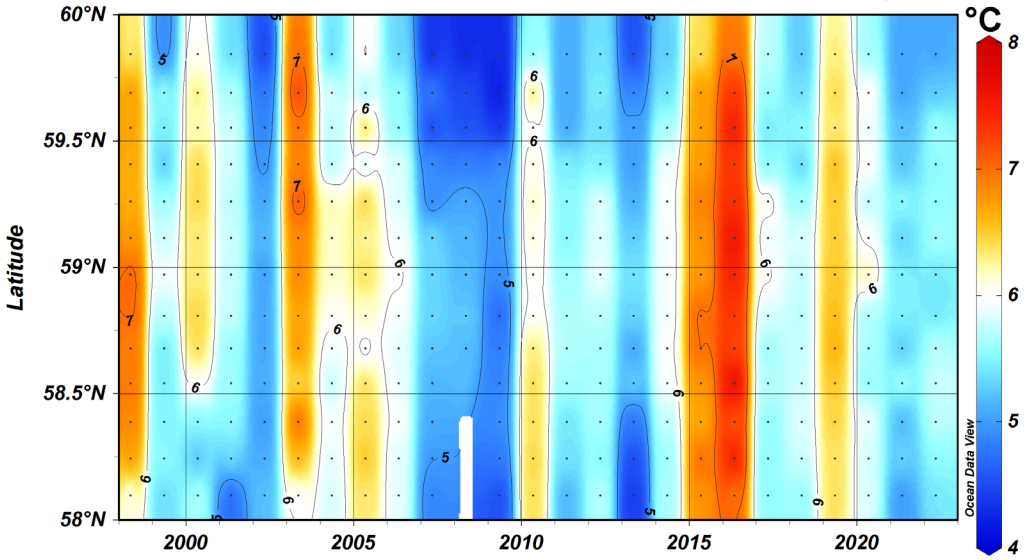


*Figure 1. Average temperature in the upper 100m of the Seward Line during May oceanographic cruises.*

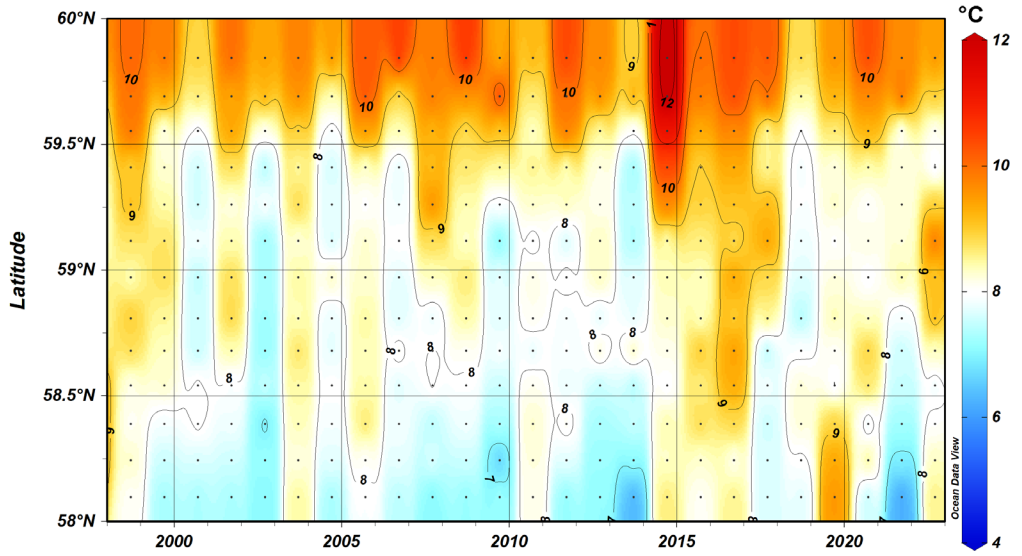


*Figure 2. Average temperature in the upper 100m of the Seward Line during September oceanographic cruises.*

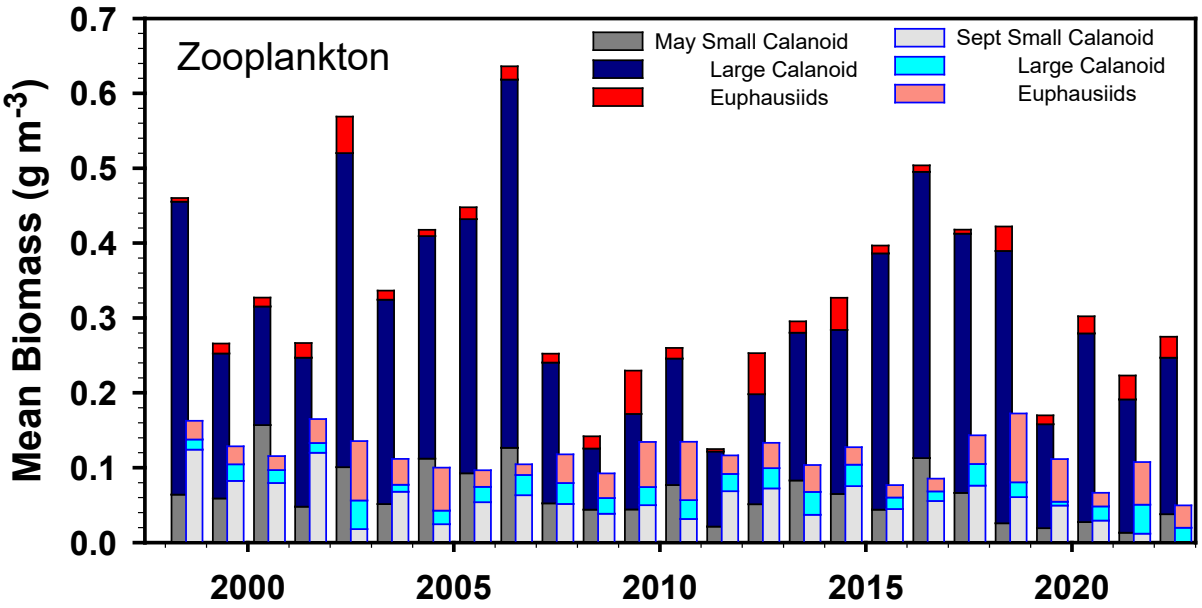


*Figure 3. Average zooplankton wet-weight biomass along the Seward Line for major crustacean component. Data from 2020-2022 are preliminary, based on a subset of stations sampled.*

## 2. Products:

*Peer-reviewed publications:*

Cushing, D. A., Kuletz, K. J., Sousa, L., Day, R. H., Danielson, S. L., Labunski, E. A., and Hopcroft, R. R. 2023. Differential response of seabird species to warm- and cold-water events in a heterogeneous cross-shelf environment in the Gulf of Alaska. Marine Ecology Progress Series https://doi.org/https://doi.org/10.3354/meps14239

Danielson, S. L., T. D. Hennon, D. H. Monson, R. M. Suryan, R. W. Campbell, S. J. Baird, K. Holderied, and T. J. Weingartner. 2022. Temperature variations in the northern Gulf of Alaska across synoptic to century-long time scales. Deep Sea Research Part II: Topical Studies in Oceanography 203. https://doi.org/https://doi.org/10.1016/j.dsr2.2022.105155

Ducklow, H., M. Cimino, K. H. Dunton, W. R. Fraser, R. R. Hopcroft, R. Ji, A. J. Miller, M. D. Ohman, and H. M. Sosik. 2022. Marine pelagic ecosystem responses to climate variability and change. BioScience *72*:827–850 https://doi.org/https://doi.org/10.1093/biosci/biac050

Roncalli, V., J. Niestroy, M. C. Cieslak, A. M. Castelfranco, R. R. Hopcroft, and P. H. Lenz. 2022. Physiological acclimatization in high-latitude zooplankton. Molecular Ecology 31:1753–1765 https://doi.org/10.1111/mec.16354

Strom, S., and Northern Gulf of Alaska Long-Term Ecosystem Research Team. 2023. Recent Marine Heatwaves Affect Marine Ecosystems from Plankton to Seabirds in the Northern Gulf of Alaska. Oceanography 36 https://doi.org/https://doi.org/10.5670/oceanog.2023.s1.9

*Reports:*

Hopcroft, R. R. 2022. Spring and fall large copepod and euphausiid biomass: Seward Line. In Ferriss, B. E., and S. Zador. Ecosystem Status Report 2022: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, Alaska 99501.

Callahan, M., S. L. Danielson, R. R. Hopcroft, E. Fergusson, N. Laman, K. Siwicke, L. Rogers, and C. Worton. 2022. Ocean temperature: Gulf of Alaska synthesis. In Ferriss, B.E., Zador, S., Ecosystem Status Report 2022: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, Alaska 99501.

Hopcroft, R. R., S. L. Danielson, S. L. Strom, and K. J. Kuletz. 2023. The Seward Line: Marine ecosystem monitoring in the Northern Gulf of Alaska. *Exxon Valdez* Oil Spill Long-term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project 21120114-L), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

*Popular articles:*

None

*Conferences and workshops:*

Brauner, M. 2023. Co-occurrence networks of marine microbes in the Northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Cohen, J. 2022. Impacts of a marine heatwave on microbial communities in the Gulf of Alaska. Poster presentation, LTER All Scientists Meeting, Virtual, September.

Cohen, J. 2023. Investigating the impact of the 2019 marine heatwave on microbial community composition in the Gulf of Alaska. Oral presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Coleman, D. 2022. Lipid accumulation in Neocalanus copepods in the Northern Gulf of Alaska (NGA). Oral presentation, Ocean Sciences Meeting, Virtual, March.

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.

Danielson, S. 2022. GAK1 and Seward Line Physical Hydrography. Oral presentation, Spring Preview of Ecosystem and Economic Conditions (PEEC) Workshop, NOAA Integrated Ecosystem Assessment Program, May.

Gavenus, K. A. 2022. NGA LTER near & far: Spatial & temporal scales of our education efforts. Poster presentation, LTER All Scientists Meeting, Asilomar, CA, September.

Hennon, G., and J. Fiechter. 2022. Variability and trends in the Northern Gulf of Alaska ecosystem. Poster presentation, LTER All Scientists Meeting, Asilomar, CA, September.

Hopcroft, R. 2022. Seward Line & LTER spring zooplankton. Oral presentation, Spring Preview of Ecosystem and Economic Conditions (PEEC) Workshop, NOAA Integrated Ecosystem Assessment Program, May.

Hopcroft, R. 2022. Spatial gradients in the Northern Gulf of Alaska. Poster presentation, LTER All Scientists Meeting, Asilomar, CA, September.

Hopcroft, R. 2023. Twenty-five years of observations reveal strong influence of climate indices along the Seward Line. Oral presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

Kelly, T. 2022. Characterization of a marine Ecosystem through Autonomous Bio-optics. Poster presentation, LTER All Scientists Meeting, Virtual, September.

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.

Kepner, H. E. 2022. Using in situ imaging to describe zooplankton communities in the Northern Gulf of Alaska. Poster presentation, LTER All Scientists Meeting, Virtual, September.

Kepner, H. E. 2023. Using in situ imaging to describe zooplankton communities in the Northern Gulf of Alaska. 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.

Ortega, E. 2022. Temporal and spatial variability of particulate metals in the Northern Gulf of Alaska. Oral presentation, Ocean Sciences Meeting, Virtual, March.

Ortega, E. 2022. Spatial and temporal distribution of particulate iron in the Northern Gulf of Alaska. Poster presentation, LTER All Scientists Meeting, Virtual, September.

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.

Reister, I. 2022. Fate of the Copper River plume. Poster presentation, Ocean Sciences Meeting, Virtual, March.

Reister, I. 2022. Fate of the Copper River Plume. Poster presented at the LTER All Scientists Meeting, Virtual, September.

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.

*Public presentations:*

None

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

None

*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.

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.

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.

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.

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. research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2019. Research Workspace. 10.24431/rw1k45e.

*Additional Products not listed above:*

None

## 3. Coordination and Collaboration:

*The Alaska SeaLife Center or Prince William Sound Science Center*

The Seward Line project collaborates with Prince William Sound Science Center (PWSSC) at a programmatic level because members of the Gulf Watch Alaska-Long-Term Research and Monitoring (GWA-LTRM) program management team work for PWSSC and PWSSC is the fiscal agent for the University of Alaska's grant through the National Oceanic and Atmospheric Administration (NOAA).

*EVOSTC Long-Term Research and Monitoring Projects*

Seward Line is part of the GWA-LTRM program and coordinates with GAK1 (project 22120114-I, principal investigator [PI] Danielson), ocean acidification (project 22220202, PI

Hauri), and Prince William Sound marine bird surveys (22120114-M, PI Kaler) sampling and meets quarterly with other GWA-LTRM projects.

*EVOSTC Mariculture Projects*

None at this time.

*EVOSTC Education and Outreach Projects*

The Seward Line project has participated in meetings with members of the CORaL network funded by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) to evaluate ways the programs can work together on outreach activities.

*Individual EVOSTC Projects*

The Seward Line provided infrastructure for and coordinates with the Ocean Acidification project by Hauri.

The Seward Line project works with the Data Management program to ensure data collected by the project are properly reviewed, have current metadata, and are posted to the Gulf of Alaska data portal within required timeframes. Seward Line PIs will work with other individually funded EVOSTC projects if collaborative efforts make sense based on data collected.

*Trustee or Management Agencies*

The Seward Line coordinates with NOAA by proving samples for larval fish analysis from each spring cruise, and two-way sharing of data streams from physics to seabirds.

*Native and Local Communities*

None at this time.

## 4. Response to EVOSTC Review, Recommendations and Comments:

*May 2021 EVOSTC Science Panel Comment:* The goal of this project is to characterize and understand how climate influences biological conditions both seasonally and interannually. Oceanographic observations along a 150-mile cross-shelf transect south of Seward began in 1997. The PIs propose to extend this time series for another 10 years beginning in 2022. Cruises occur in May, July, and September so that they span the spring bloom, summer, and fall

transition. Observations include physical-chemical ocean measurements, phytoplankton, microzooplankton, mesozooplankton, seabirds and marine mammals.

We recognize the importance of long-term observations of ocean conditions and lower trophic levels as critical to identifying long-term trends, regime shifts, and shorter period fluctuations, such as marine heat waves, on the Gulf of Alaska ecosystem. The Seward Line is particularly valuable as it represents the most comprehensive long-term multidisciplinary oceanographic sampling program in the Gulf of Alaska. The proposal continues the well-documented sampling design used in previous years. We note that this project has been productive in terms of peer-review publications and master's student theses in recent years, as reported in the recent FY20 annual report.

*PI Response: We thank the Science Panel for their positive views regarding our work.*

*May 2021 EVOSTC Science Panel Comment:* We request the PIs to clarify why the budget is so much higher in the first 5 years. We appreciate that matching funds cannot be reported because they are not required, but also noted the contributions to the project by NSF-LTER, NPRB and AOOS and would appreciate further clarification about specifically what EVOSTC funds cover. In other words, if EVOSTC funds were not forthcoming, what pieces of this project would be lost?

*PI Response: Perhaps not sufficiently obvious in the proposal, the Seward Line budget contains the postdoc funds that will contribute to synthesis and integration across the entire Environmental Drivers Component (and beyond to other GWA components as appropriate). Specifically, and in consultation with the Science Coordinator, we will use the funds to support two postdocs part-time –a zooplankton ecologist and a physical oceanographer – who hope to transition into permanent positions at UAF over the next few years. We have spread that salary for each across the first 5 years with the hope that after that they will have both built up their research portfolios and will be taking over duties currently undertaken by Hopcroft and Danielson, respectively. In this way we are paving the way for PI transitions most likely to occur over this decadal period.*

*As the Science Panel realizes, the NGA/Seward Line is a highly leveraged consortium. The LTER budget, in particular, was built assuming the core Seward Line activities of the past two decades would still be covered primarily by the AOOS/EVOSTC/NPRB consortium and as such, LTER funds were used to add new stations, new cruises, new measurements, new investigators, and*

*graduate students. In short, it does not duplicate any EVOSTC funding but leverages off it. EVOSTC funding supports the technician who analyzes all our towed zooplankton nets for the Spring and September cruises, supports biological and nutrient sampling during the monthly GAK-1 cruises, and covers costs of chlorophyll and nutrients analyses at all of our PWS stations (in addition to PWS zooplankton), modest field supplies, and travel costs to PI meetings. Loss of EVOSTC funding would thus stop the analyses that best report on large-bodied copepods during spring, and euphausiids year-round. Furthermore, EVOSTC funding ensures that the Seward Line cruises continue to place a high priority on attaining samples within PWS on all cruises. Loss of EVOSTC funding would reduce our emphasis here and result in western PWS data gaps.*

*May 2021 EVOSTC Science Panel Comment:* Finally, we offer the following comment regarding synthesis to all five oceanography projects: PWS oceanography, Cook Inlet oceanography, GAK1, Seward line, and CPR. Specifically, we recommend an integrative synthesis of all five environmental driver projects to be included in the proposal(s). In addition to reporting project results separately for each area as proposed, there is opportunity for a region-wide synthesis that draws all results together for a broader perspective. For example, a synthesis might address connectivity of PWS and Cook Inlet to the northern GOA, predictability of Cook Inlet oceanography from PWS oceanography, and so on. We defer to the program managers and project PIs to determine the best approach to tackle this synthesis; one suggestion is to recruit some of the postdoctoral fellows proposed under the broader LTRM heading to address this region-wide synthesis of oceanographic conditions using already existing data.

*PI Response: Continued integration among all GWA projects, including Environmental Drivers, is a priority for the next 10 years of GWA-LTRM. For Environmental Drivers, the Danielson et al. (in review) paper provides examples of spatial and temporal scales of variability in near-surface ocean temperatures across the GOA from all sources within and various sources outside GWA. We will expand on these efforts on the physical environment by conducting similar analyses with sub-surface temperatures and salinity, which strongly link to nutrients. Additional integration steps will focus on similar analyses for phytoplankton and zooplankton, ultimately integrating the two approaches to propose mechanisms of change in species abundance and composition, onshore vs. offshore production, etc. Correct, the Environmental Drivers component will be using their three years of postdoc funding to support these efforts. Furthermore, Environmental Driver PIs will work with the GWA Synthesis and Modeling component over the next 10 years to highlight integrated analyses within work plans and annual reports.*

*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. Marine temperature variations in the northern Gulf of Alaska across years of marine heatwaves and cold spells. Submitted to Deep-Sea Research II Special Issue.*

*September 2021 EVOSTC Science Panel Comment:* 150-mile cross-shelf transect off Seward, AK, by another 10 years. Cruises occur in May, July, and September so that they span the spring bloom, summer, and fall transition. Observations include physical-chemical ocean measurements, phytoplankton, microzooplankton, mesozooplankton, seabirds and marine mammals. These observations, which began in 1997, have been invaluable to understanding ecosystem changes on various time scales.

We appreciate the PI's explanation about the joint AOOS/EVOSTC/NPRB funding for this project, the specific use of new LTER funds, and clarification about the specific use of EVOSTC funding.

In its review of draft proposals, we provided a comment to all of the oceanographic proposals. That comment was that there are opportunities for broader synthesis of oceanographic conditions across the northern Gulf of Alaska. We went on to suggest that an integrative synthesis should be included in the revised proposals. The PIs noted a recent synthesis by Danielson et al. (which the SP has not yet seen) and indicated that the intention is to conduct similar analyses of subsurface temperatures and salinity, similar analyses for phytoplankton and zooplankton, and to develop an integration that will propose mechanisms of change in species abundance and composition, contrast onshore vs. offshore production, etc. We seek clarification specifically about how the PI of this project (22120114-L) will contribute to these syntheses. What data would be used and how would they fit into the overall analysis and what will be the role of the PI?

*PI Response: We appreciate the Science Panel's continued identification of the need for synthesis across the Environmental Drivers component projects. The Environmental Drivers component PIs also recognize this need but are limited by funding and time restrictions in leading such an effort because they are all highly committed to generating data for their projects. This is why postdocs will be engaged to help move this effort forward under direction from Seward Line PI Hopcroft. Such efforts will focus on the biological responses, as the Danielson et al. (2022) effort has already focused on the physical environment. The recent Ducklow et al. (2022) publication provides the first quantitative linkage to major atmospheric indices to explain the patterns observed in zooplankton on the Gulf of Alaska shelf, and we are currently working on publications that better describe the mechanisms behind these correlations.*

*A next step will be to see if the same relationships emerge for other Environmental Drivers component projects.*

*Danielson, S. L., T. D. Hennon, D. H. Monson, R. M. Suryan, R. W. Campbell, S. J. Baird, K. Holderied, and T. J. Weingartner. 2022. Temperature variations in the northern Gulf of Alaska across synoptic to century-long time scales. Deep Sea Research Part II: Topical Studies in Oceanography 203. https://doi.org/10.1016/j.dsr2.2022.105155*

*Ducklow, H., M. Cimino, K. H. Dunton, W. R. Fraser, R. R. Hopcroft, R. Ji, A. J. Miller, M. D. Ohman, and H. M. Sosik. 2022. Marine pelagic ecosystem responses to climate variability and change. BioScience 72:827–850 https://doi.org/10.1093/biosci/biac050*

## 5. Budget:

***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 | $164,676 | $168,792 | $173,013 | $177,340 | $160,099 | $843,922 | $85,551 |
| Travel | $1,555 | $1,564 | $1,573 | $1,582 | $1,592 | $7,866 | $8 |
| Contractual | $6,000 | $6,000 | $6,000 | $6,000 | $6,000 | $30,000 | $0 |
| Commodities | $1,059 | $1,265 | $1,476 | $1,693 | $1,915 | $7,408 | $5,908 |
| Equipment | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Indirect Costs Rate = 25% non-equipment | $43,323 | $44,405 | $45,515 | $46,654 | $42,402 | $222,299 | $22,867 |
| SUBTOTAL | $216,613 | $222,026 | $227,577 | $233,269 | $212,008 | $1,111,494 | $114,334 |
| General Administration (9% of subtotal) | $19,495 | $19,982 | $20,482 | $20,994 | $19,081 | $100,034 | N/A |
| PROJECT TOTAL | $236,108 | $242,009 | $248,059 | $254,264 | $231,089 | $1,211,529 | |
| Other Resources (In-Kind Funds) | | | | | | $0 | |

COMMENTS:
Spending is behind plans and expectations because of the EVOSTC delay in releasing funds and delay in issuance of the NOAA grant.

| FY22-26 | Project Number: 22120114-L<br>Project Title: Seward Line<br>PI(s): Hopcroft & Danielson (UAF) | NON-TRUSTEE AGENCY SUMMARY PAGE |
|---|---|---|

Spending is behind plans and expectations because of the EVOSTC delay in releasing funds and the delay in issuance of the NOAA grant.