



Exxon Valdez Oil Spill Trustee Council
Long-Term Research and Monitoring, Mariculture, Education and Outreach
Annual Project Reporting Form

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, 2023 – January 31, 2024

Submission Date: March 1, 2024

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.**
-

1. Summary of Work Performed:

The Seward Line was sampled in early May and mid-September of 2023. In summary, spring temperatures were below the long-term mean by about one third degree (Fig. 1), and one half degree below in fall. During spring, nitrate concentrations appeared to be moderate to high throughout the region, and phytoplankton chlorophyll biomass was modest and patchy. It appears that an extensive, intense bloom had yet to develop and likely occurred later than normal, possibly due to persistent cloud cover. Spring copepod biomass was below the long-term spring means while euphausiid biomass was above the mean (Fig. 2). Processing of samples continues year-round, and descriptive aspects evolve as more data become available.



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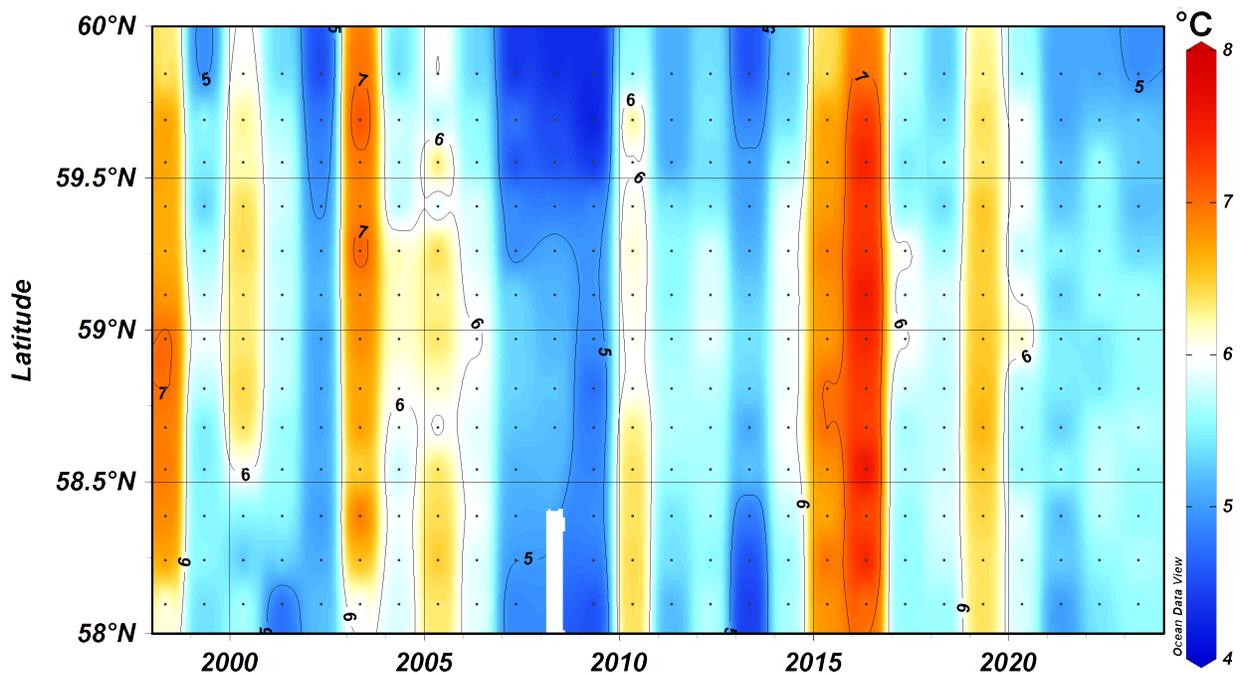


Figure 1. Average temperature in the upper 100m of the Seward Line during May oceanographic cruises.



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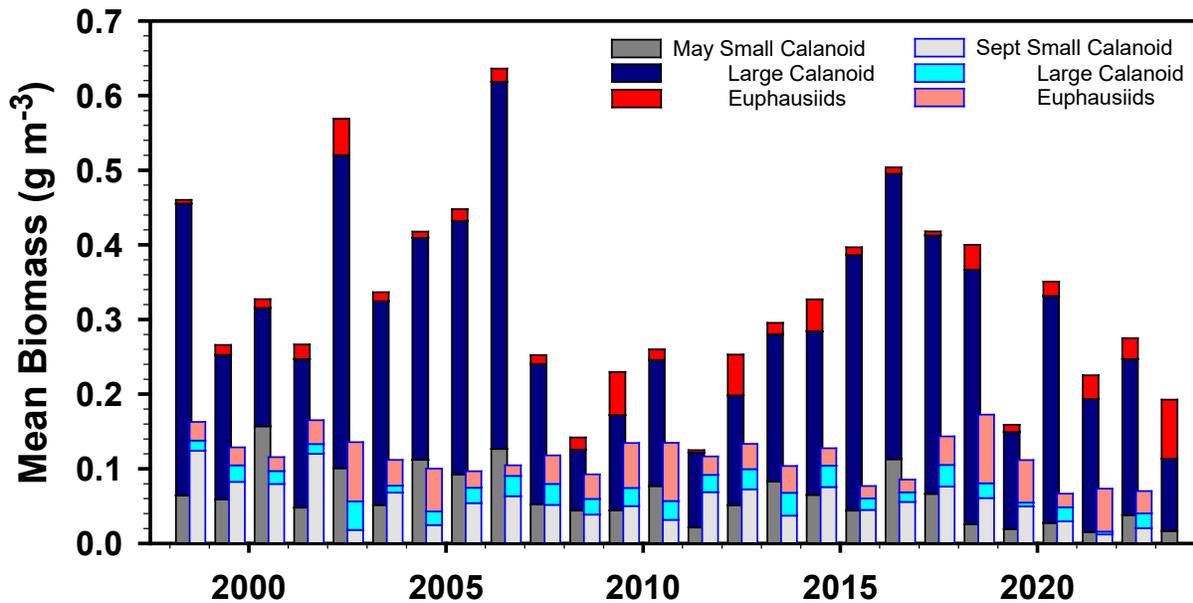


Figure 2. Average zooplankton wet-weight biomass along the Seward Line for major crustacean component. Data from 2021-2023 is preliminary, based on a subset of stations sampled.

2. Products:

Peer-reviewed publications:

Hauri, C., R. Pagès, K. Hedstrom, S. C. Doney, S. Dupont, B. Ferriss, and M. F. Stuecker. 2024. More than marine heatwaves: A new regime of heat, acidity, and low oxygen compound extreme events in the Gulf of Alaska. *AGU Advances* 5:e2023AV001039.

<https://doi.org/10.1029/2023AV001039>.

Monacci, N. M., J. N. Cross, W. Evans, J. T. Mathis, and H. Wang. 2024. A decade of marine inorganic carbon chemistry observations in the northern Gulf of Alaska – insights into an environment in transition. *Earth System Science Data* 16. <https://doi.org/10.5194/essd-16-647-2024>.



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- Strom, S. L., K. J. Bright, and K. A. Fredrickson. 2024. Widespread ciliate and dinoflagellate mixotrophy may contribute to ecosystem resilience in a subarctic sea: the northern Gulf of Alaska. *Aquatic Microbial Ecology* 90:1–21. <https://doi.org/doi:10.3354/ame02005>.
- Islas, H. M. C., and R. R. Hopcroft. 2023. Abundance, composition and distribution of carnivorous gelatinous zooplankton in the Northern Gulf of Alaska. *Journal of Plankton Research* 45:693–708. <https://doi.org/10.1093/plankt/fbad032>.
- Monell, K. J., V. Roncalli, R. R. Hopcroft, D. K. Hartline, and P. H. Lenz. 2023. Post-diapause DNA replication during oogenesis in a capital-breeding copepod. *Integrative Organismal Biology* 5:obad020. <https://doi.org/10.1093/iob/obad020>.
- Hartline, D. K., M. C. Cieslak, A. M. Castelfranco, B. Lieberman, V. Roncalli, and P. H. Lenz. 2023. De novo transcriptomes of six calanoid copepods (Crustacea): a resource for the discovery of novel genes. *Nature Scientific Data* 10:242. <https://doi.org/10.1038/s41597-023-02130-1>.
- Cushing, D. A., K. J. Kuletz, L. Sousa, R. H. Day, S. L. Danielson, E. A. Labunski, and R. R. Hopcroft. 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* :HEATav2. <https://doi.org/10.3354/meps14239>.
- Despins, M. C., R. P. Mason, A. M. Aguilar-Islas, C. H. Lamborg, C. R. Hammerschmidt, and S. E. Newell. 2023. Linked mercury methylation and nitrification across oxic subpolar regions. *Frontiers in Environmental Chemistry* 4:1109537. <https://doi.org/10.3389/fenvc.2023.1109537>.

Reports:

- Hopcroft, R. R. 2023. Spring and fall large copepod and euphausiid biomass: Seward Line. Pages 89-90 in B. E. Ferriss, editor. 2023. Ecosystem Status Report 2023: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. North Pacific Fishery Management Council, Anchorage, Alaska. <https://apps-afsc.fisheries.noaa.gov/REFM/docs/2023/GOAecosys.pdf>.

Popular articles:

No new contributions for this reporting period.



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Conferences and workshops:

- Arimitsu, M., M. A. Bishop, D. Cushing, S. Hatch, R. Kaler, K. Kuletz, L. Labunski, C. Matkin, J. Moran, D. Olsen, J. Piatt, A. Schaeffer, and J. Straley. 2024. Changes in marine predator and prey populations in the Northern Gulf of Alaska: Gulf Watch Alaska Pelagic update 2023. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Dias, B. S., T. Okey, R. Suryan, and R. Hopcroft. 2024. Ecosystem effects of marine heatwaves in Prince William Sound, Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Hopcroft, R. 2024. A deep-dive into the zooplankton of the Gulf of Alaska. Keynote presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Hopcroft, R., H. Cotea-Islas, H. Kepner, A. Poje, E. Stidham, and C. Smoot. 2024. Contribution of major zooplankton groups along the Seward Line in the northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Hopcroft, R., and C. Smoot. 2023. Twenty-five years of observations reveal strong influence of climate indices along the Seward Line. Oral presentation, Ocean Sciences Meeting, Palma Mallorca, Spain, June.
- Kepner, H., T. Kelly, and R. Hopcroft. 2023. Using in situ imaging to describe the gelatinous zooplankton communities of the Gulf of Alaska. Oral presentation, Ocean Sciences Meeting, Palma Mallorca, Spain, June.
- Kepner, H., T. Kelly, and R. Hopcroft. 2024. Fine-scale spatial patterns of gelatinous zooplankton in the northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Reister, I., S. Danielson, T. Hennon, and H. Statscewich. 2024. High-resolution horizontal structure of upper ocean waters in the northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Smoot, C., A. Poje, J. Questel, and R. Hopcroft. 2024. Zooplankton species and trait diversity in the Gulf of Alaska from the surface to the abyssopelagic. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.



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- Stidham, E., and R. Hopcroft. 2023. Two-decades of observations on pelagic tunicates and pelagic snails in the Northern Gulf of Alaska (NGA). Oral presentation, Ocean Sciences Meeting, Palma Mallorca, Spain, June.
- Strom, S., K. Bright, H. Busse, K. Fredrickson, A. Marvy, and M. O'Hare. 2024. Unexpected high importance of the smallest phytoplankton in the northern Gulf of Alaska. Oral presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Waga, H., T. Kelly, B. Lowin, S. Strom, and W. Burt. 2024. High-resolution measurements of primary production in the northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.
- Williams, K., and S. Strom. 2024. Comparing primary production and vertical export of *Synechococcus* in the Northern Gulf of Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Public presentations:

No new contributions for this reporting period.

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

No new contributions for this reporting period.

Data sets and associated metadata:

- Aguilar-Islas, A., and M. Kaufmann. 2023. Dissolved inorganic nutrient data from stations sampled on NGA-LTER seasonal cruises, 2018-2021. Research Workspace. 10.24431/rw1k586.
- Danielson, S. L. 2023. Hydrographic, optical, and meteorological parameters measured by R/V Sikuliaq's underway systems during the Northern Gulf of Alaska LTER cruises, 2018-2021.
- Danielson, S. L. 2023. Water columns properties measured by CTD sensors during seasonal cruises in the Gulf of Alaska for the Northern Gulf of Alaska LTER project, 2018-2022. Research Workspace. <https://doi.org/10.24431/rw1k459>.
- Hauri, C., and B. Irving. 2023. Inorganic Carbon data from water samples collected during CTD casts at stations during the Northern Gulf of Alaska LTER seasonal cruises, 2018-2022. Dataset. <https://doi.org/10.24431/rw1k45g>.



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- Hill, D. 2022. Gulf of Alaska Coastal Discharge Model Results, 2013-2021.
- Hopcroft, R. R. 2023. Gelatinous zooplankton abundance and wet weight biomass observations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018 - 2021. Research Workspace. 10.24431/rw1k58z.
- Hopcroft, R. R. 2023. Zooplankton abundance and biomass observations determined traditional microscopy, from Multinet samples collected during research cruises for the Northern Gulf of Alaska LTER site, 2018-2021. Research Workspace. 10.24431/rw1k591.
- Hopcroft, R. R. 2023. Zooplankton abundance and biomass observations obtained from the QuadNet, as analyzed by traditional microscopy, during NGA LTER seasonal cruises in the Northern Gulf of Alaska, 2018-2021. Research Workspace. 10.24431/rw1k587.
- Hopcroft, R. R., and S. L. Danielson. 2023. Temperature and Salinity measured by a flow-through thermosalinograph (TSG) during research cruises aboard the R/V Tiglax and R/V Woldstad for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021. Research Workspace. 10.24431/rw1k45o.
- Kelly, T. B. 2023. Carbon and Nitrogen flux and isotopic signatures from surface tethered sediment trap data collected on research cruises for the Northern Gulf of Alaska LTER site in 2019, 2021. Research Workspace. 10.24431/rw1k58y.
- Kuletz, K., D. Cushing, and E. Labunski. 2023. Marine bird survey observation and density data from Northern Gulf of Alaska LTER cruises, 2018-2022. Research Workspace. 10.24431/rw1k45w.
- Strom, S. L., and K. Fredrickson. 2023. Chlorophyll-a concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2022. Research Workspace. 10.24431/rw1k45f.
- Strom, S. L., and K. Fredrickson. 2023. Dissolved organic carbon concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021.
- Strom, S. L., and K. Fredrickson. 2023. Primary productivity estimates from NGA-LTER research cruises in the Gulf of Alaska, 2018-2021. Research Workspace. 10.24431/rw1k45b.
- Strom, S. L., K. Fredrickson, and K. Bright. 2023. Microzooplankton abundance and biomass from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021. Research Workspace. 10.24431/rw1k45e.



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Additional Products not listed above:

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

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 23120114-I, principal investigator [PI] Danielson), ocean acidification (project 23220202, PI Hauri), and Prince William Sound marine bird surveys (23120114-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 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.



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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

Over the past year, the Northern Gulf of Alaska Long Term Ecological Research program (NGA LTER; the GWA-LTRM Seward Line is part of the NGA LTER) has focused on creating learning experiences for schools along the coast of the Northern Gulf of Alaska, as well as for middle school students from across Alaska participating in the Alaska Native Science and Education Program (ANSEP).

In the Northern Gulf of Alaska, our efforts have centered on collaborating with the Chugach School District (CSD). CSD is a rural and remote school district in Prince William Sound and includes many Alaska Native students. Educators from the NGA LTER visited the school in Whittier for a day full of oceanography and marine ecology activities and visited the remote villages of Tatitlek and Chenega twice each during the 2022-2023 school year, with each visit lasting 2-3 days. Topics addressed during these visits included food webs, plankton, algae, intertidal invertebrates, and marine mammals. The food web activities utilized the video and species profile cards developed in 2020-2022 for the NGA LTER virtual field trip and were well-received by students and teachers alike. In addition, an NGA LTER graduate student focused on marine acoustics was able to accompany us to Tatitlek and guided the middle and high school students through the process of building their own hydrophone. We also started off the 2023-2024 school year with a week-long visit to Chenega to assist with the school's first annual Culture Week, themed *Qaigiat Quyakapet* (Sugt'stun language of the Sugpiaq people, which translates as "thankful for seals"). This week included students from both Tatitlek and Chenega (20 total), as well as local community members and Elders. We led seal anatomy activities with the younger kids, including an activity co-led by a local language speaker and an investigation of seal bones. We also took advantage of a rare sunny day to do guided plant and berry observation with them and some berry picking. The older students examined and arranged a seal skeleton and learned about seal bone adaptations from us. It was an honor to be invited to participate in this event.

During the 2022-2023 school year, our educators also led plankton, algae, and food web activities with students at Seward Elementary School and plankton, remotely operated vehicle,



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fish printing, algae pressing, and tidepooling activities during Sea Week at Port Graham School and Nanwalek School (all part of Kenai Peninsula Borough School District).

During the 2022-2023 school year, we partnered with the Kachemak Bay National Estuarine Research Reserve to deliver hands-on science lessons to 11 sessions of ANSEP’s middle school academies (a total of 500+ students and 50+ teachers and chaperones). Activities varied throughout the year and included plankton labs, water quality testing, a scavenger hunt for ecological relationships, an art activity focused on marine adaptations, and two different food web activities.

4. Response to EVOSTC Review, Recommendations and Comments:

No comments for FY23.

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	\$209,165
Travel		\$1,555	\$1,564	\$1,573	\$1,582	\$1,592	\$7,866	\$2,468
Contractual		\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$30,000	\$4,912
Commodities		\$1,059	\$1,265	\$1,476	\$1,693	\$1,915	\$7,408	\$6,874
Equipment		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Indirect Costs	Rate = 25%	\$43,323	\$44,405	\$45,515	\$46,654	\$42,402	\$222,299	\$54,965
non-equipment								
SUBTOTAL		\$216,613	\$222,026	\$227,577	\$233,269	\$212,008	\$1,111,494	\$278,384
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	

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