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

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

Annual Project Reporting Form

Project Number: 23120114-C

Project Title: Monitoring long-term changes in forage fish distribution, relative abundance, and body condition in Prince William Sound and the Northern Gulf of Alaska

Principal Investigator(s): Mayumi Arimitsu and John Piatt U. S. Geological Survey-Alaska Science Center

Reporting Period: February 1, 2023 – January 31, 2024

Submission Date: March 1, 2024

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.**

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1. Summary of Work Performed:

The Gulf Watch Alaska-Long Term Research and Monitoring (GWA-LTRM) program Forage Fish project has three main components including: 1) continuation of the longest time series on forage fish availability to seabirds in the Gulf of Alaska, i.e., a study that tracks the diets of adult and nestling seabirds at Middleton Island and is conducted in collaboration with Scott Hatch (Institute for Seabird Research and Conservation [ISRC]), 2) ship-based surveys including the Integrated Predator Prey (IPP) survey in Prince William Sound (PWS) conducted in collaboration with the humpback whale study (project 22120114-O, John Moran, National Oceanographic and Atmospheric Administration [NOAA], Lauren Wild, University of Alaska Southeast [UAS]) project, and 3) summer forage fish sampling - including aerial survey validation, forage fish sampling for condition in PWS, and juvenile salmon (*Oncorhynchus* spp.) otolith analysis (Fig. 1). In this report we describe work conducted in 2023.

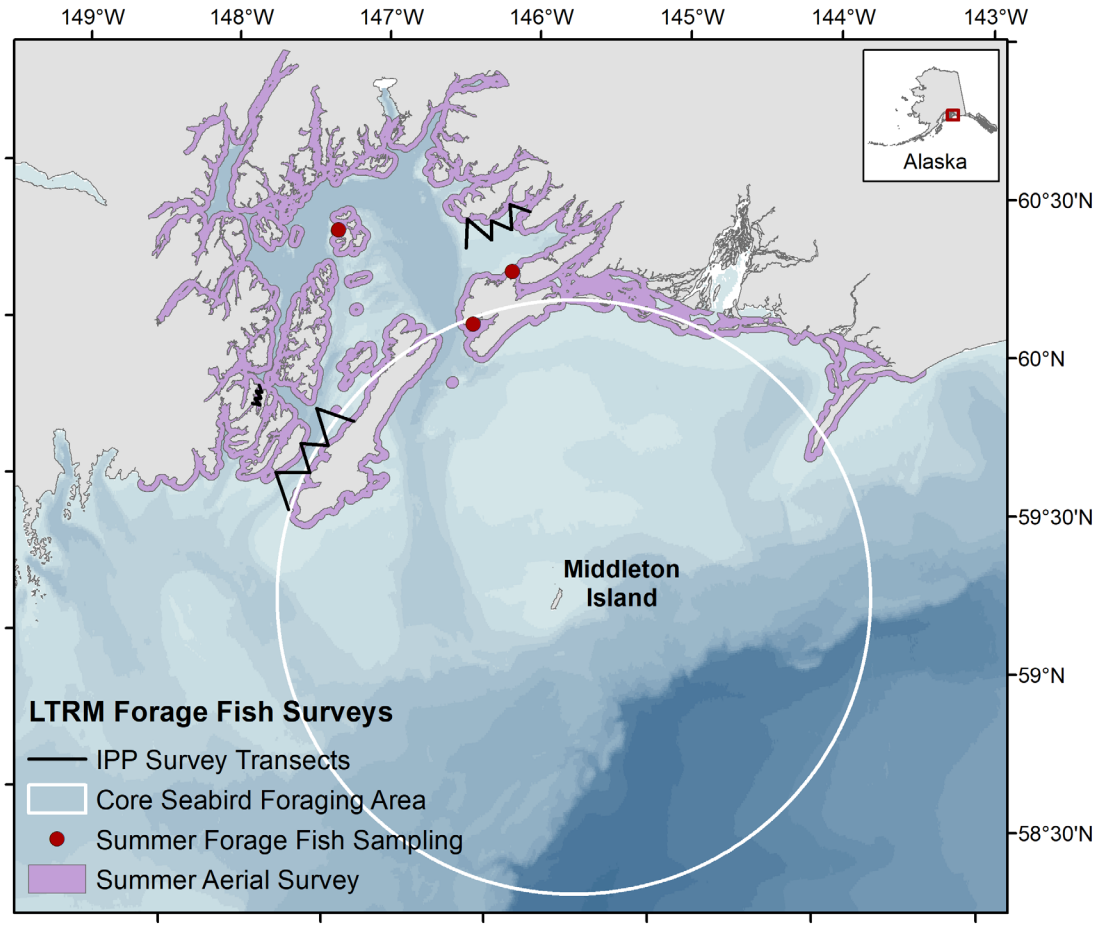

Figure 1. Distribution of Gulf Watch Alaska Long-Term Research and Monitoring (LTRM) seasonal forage fish survey effort in Prince William Sound and Middleton Island. Bathymetry is shown in blue with darker shades indicating deeper seafloor depth; IPP is the integrated predator prey survey.

Seabird Diets

Middleton Island seabird diet sampling was conducted by the ISRC scientific team according to schedule. We provide a brief summary of 2023 seabird diet results below, which were also reported in a contribution to NOAA's 2023 Gulf of Alaska Ecosystem Status Report.

Seabird diet information from Middleton Island integrates forage fish species composition and availability over broad areas of the Northern Gulf of Alaska, i.e., across coastal, shelf, and slope regions (Hatch 2013, Arimitsu et al. 2021). An in-depth analysis of rhinoceros auklet (*Cerorhinca monocerata*) diets, supplemented with data from GPS tags attached to foraging birds, showed that the seabirds can detect prey species in foraging areas where other survey types have found the prey to be sparse or absent (Cunningham et al. 2018). Seabird diets, including those from Middleton Island, are useful indicators of spatial and interannual variability in forage species in Alaska (Sydeman et al. 2017, 2021; Piatt et al. 2018; Thompson et al. 2019).

Seabird diet samples at Middleton Island were collected from 8 April to 19 August 2023. This included a total of 1121 diet samples from black-legged kittiwakes (*Rissa tridactyla*) and 183 diet samples from rhinoceros auklets. Capelin (*Mallotus catervarius*) made a robust return to the kittiwake diet in the spring of 2023 (relative occurrence of 31% in April and 46% in May) and became slightly less prevalent by late-summer (25% relative occurrence in July-August) (Fig. 2). After a post-heatwave re-emergence (2016-2022), Pacific sand lance (*Ammodytes personatus*) became less frequent in both seabird diets in 2023 (Fig. 2-3). While alternate prey species continue to comprise most of both the auklet and kittiwake diets, Hexagrammid species (i.e., kelp [*Hexagrammos decagrammus*] and rock greenlings [*H. lagocephalus*], lingcod [*Ophiodon elongatus*], and Atka mackerel [*Pleurogrammus monopterygius*]) declined further after surging over a 3-year period (2018–2020) post-heatwave (Figs 2-3). Pacific herring (*Clupea pallasii*) and juvenile salmon indices in rhinoceros auklet diets were above average in 2023 (Fig. 3).

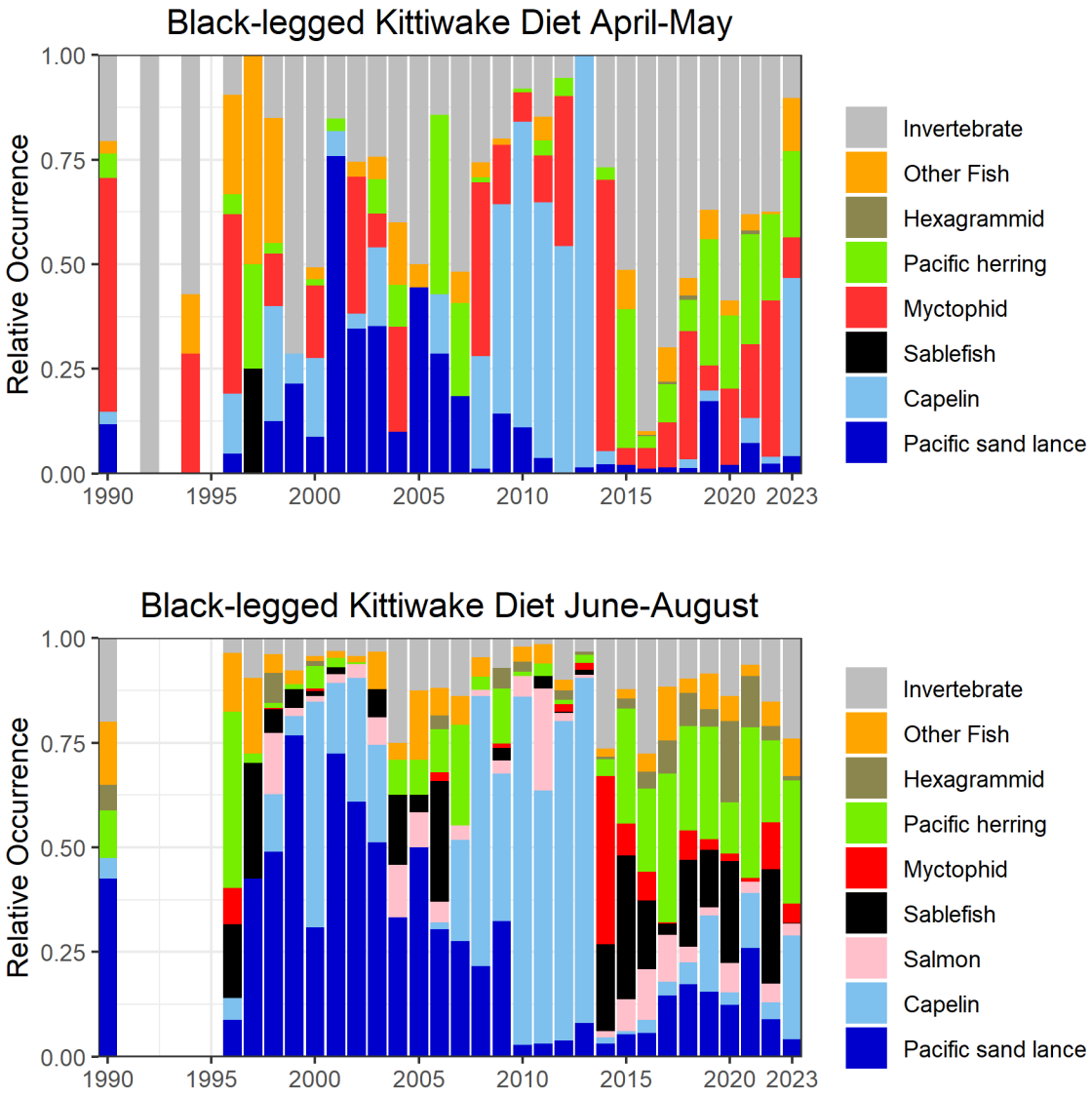

Figure 2. Interannual variation in diet composition of black-legged kittiwakes during spring (top) and summer (bottom) on Middleton Island.

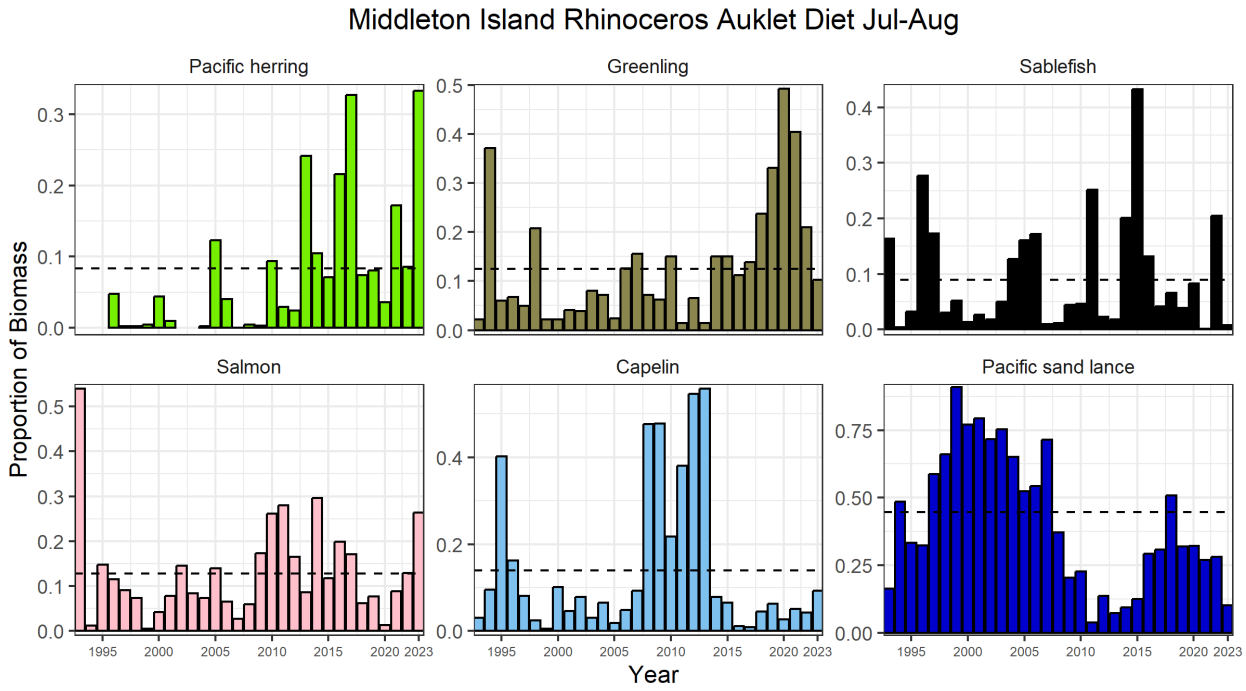

Figure 3. Interannual variation in rhinoceros auklet chick diets by species at Middleton Island. Dashed line indicates median values.

NOAA Alaska Fishery Science Center has determined that age-0 sablefish (*Anoplopoma fimbria*) growth information from seabird diets at Middleton Island may provide a useful indicator of sablefish recruitment. NOAA has requested annual updates on these sablefish data for use in their sablefish stock assessment efforts each fall. From samples of age-0 sablefish collected in diets over the chick rearing period, growth rate is calculated using the relationship between mean fish length and Julian date for each year, except in 1994 when data were omitted because of low sample size and effort conducted over only a short period of time. From this relationship we predict length for each year on the median sampling date (July 24).

When 2023 data were added to this year's model, we found that the interaction between Julian Day and year explain the majority of variability in age-0 sablefish length (OLS: $F = 26.78$, $p < 0.001$, $R^2 = 0.86$). In 2023 age-0 sablefish growth (1.7 mm/day) and the growth index anomaly

(-0.17 mm/day) was slightly below average (Fig. 4). Additionally, the predicted length (79 mm) was well below average (-21 mm) on the median sampling date (Jul 24) (Fig. 4). 2023 indices are based on measurements of 22 fish sampled by a slightly lower than average number of diet samples (n = 169, average = 179) because rhinoceros auklets had unusually low productivity in 2023 so fewer meals could be collected overall.

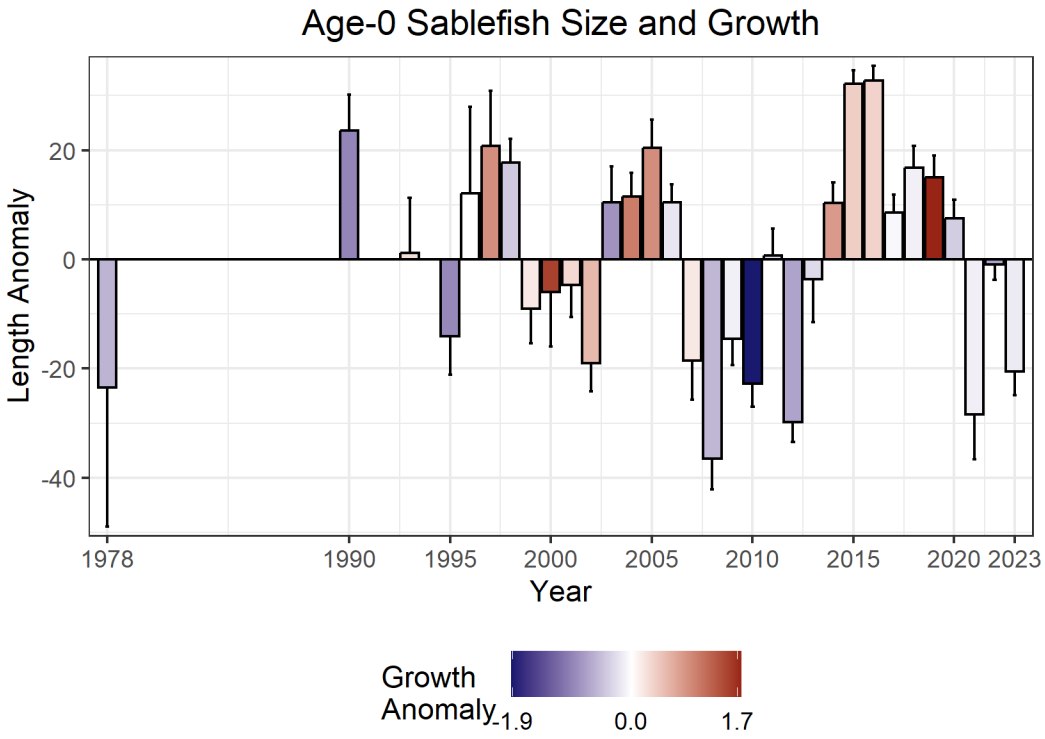

Figure 4. Interannual variability in predicted length anomaly (y-axis) and growth anomaly (color) for age-0 sablefish in seabird diets at Middleton Island, Alaska.

Size of age-0 sablefish at the end of July is important because frequency of occurrence of age-0 sablefish in seabird diets is positively related to predicted fish length ($p < 0.001$). It is likely that the seabirds avoid age-0 sablefish that are too small, either because they can't sense them as easily or because they are passing them up for higher energy food, resulting in a lower provisioning rate than would be if the fish were larger in size during the chick rearing stage.

Age-0 sablefish are not well sampled by other survey methods, and so time series of age-0 sablefish growth derived from seabird diet monitoring at Middleton Island are among the longest available from any Alaska location. Growth (or size) of age-0 sablefish may provide an early indication of recruitment because these indices may be related to survival of the cohort.

Fall Integrated Predator Prey Survey

The Fall IPP survey occurred on schedule during the second half of September. We conducted acoustic transects, trawls, marine bird surveys (with Anne Schaeffer, Prince William Sound Science Center [PWSSC]) and habitat sampling in Bainbridge Passage, Montague Strait, and Port Gravina as planned. Capelin and sand lance biomass estimates increased on acoustic surveys in 2023, however, macrozooplankton (primarily euphausiids) acoustic biomass indices for 2023 were well below 2022 levels (Fig. 5). Still, we observed most humpback whales (*Megaptera novaeangliae*) in the southwest Sound (Moran et al. 2024) and encountered seven humpbacks feeding on euphausiids during our acoustic survey in Bainbridge Passage on 9/21/2023. Prior to this survey, we had not observed humpbacks in Bainbridge Passage since September 2014.

Marine bird surveys conducted in conjunction with the acoustic surveys on IPP surveys in Prince William Sound found higher densities of seabirds in 2023 compared to 2022, and average densities in Port Gravina were more than twice as high as they were in Montague Strait or Bainbridge Passage in 2023 (Fig. 6). This was driven largely by higher densities of common murres and marbled murrelets. Future synthesis efforts will evaluate whale-foraging flock behavioral observations.

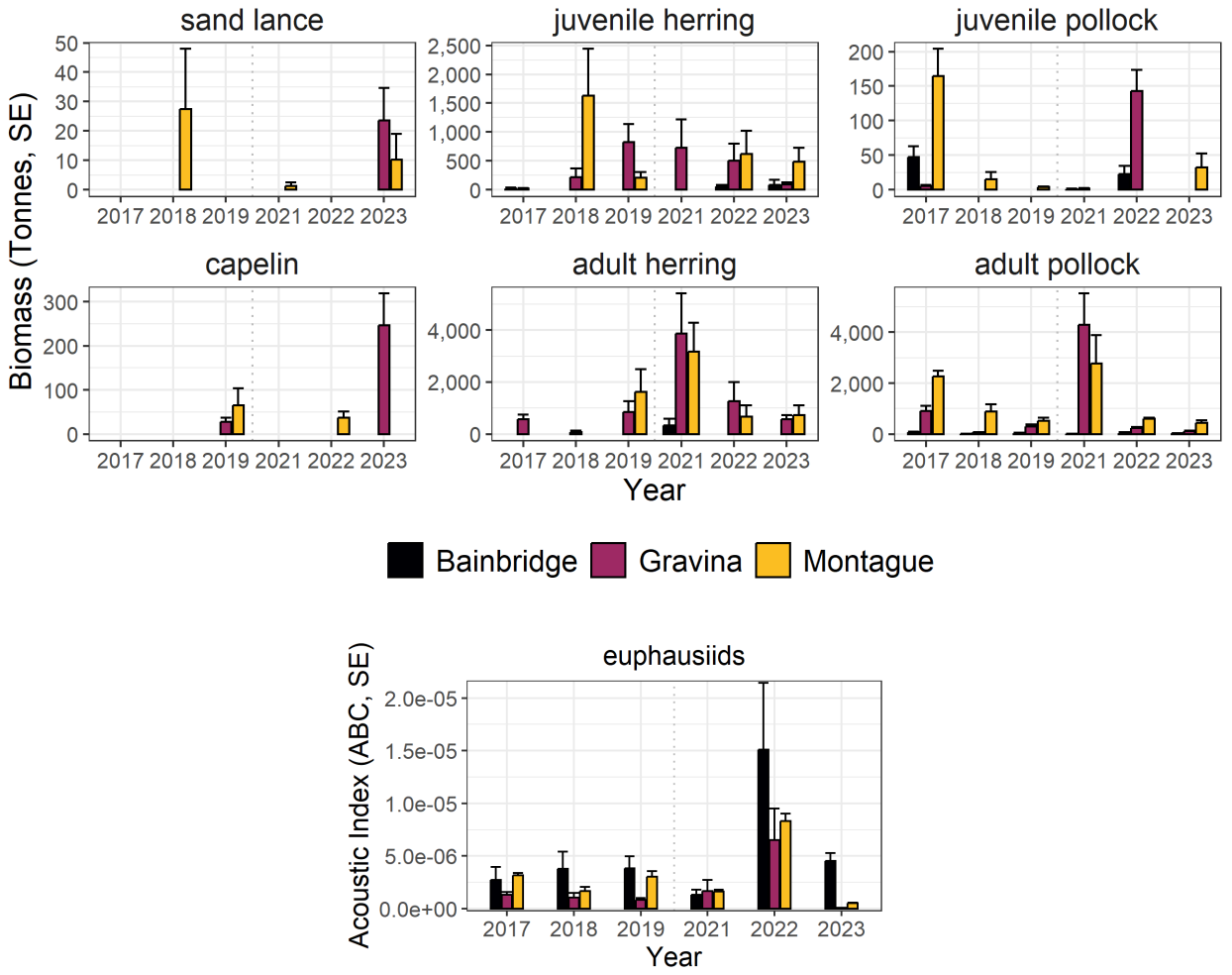

Figure 5. Forage fish biomass estimates and euphausiid acoustic indices derived from Integrated Predator-Prey surveys in three regions (color) within Prince William Sound.

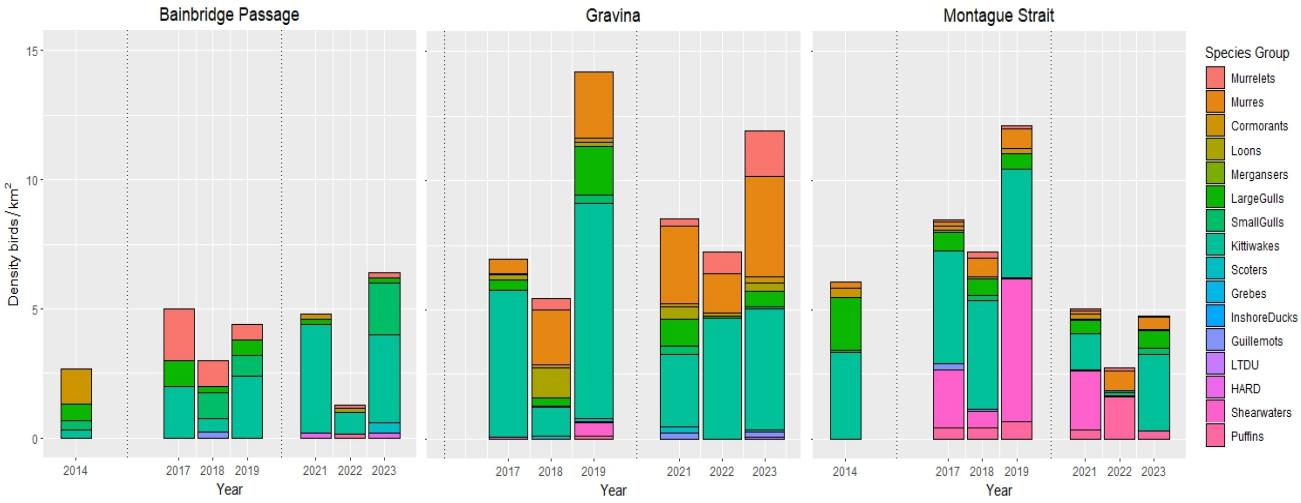

Figure 6. Interannual variability of marine bird densities by species group (color) on the Integrated Predator-Prey survey transects in Prince William Sound. Graphic credit: Anne Schaefer, PWSSC.

Summer Forage Fish Sampling

Validation surveys were conducted from Cordova, Alaska in support of the continuing GWA-LTRM aerial forage fish surveys during the second week of June when aerial surveys were conducted by Scott Pegau and Mike Collins. A boat-based team departed from Cordova to the general area identified by aerial observers. When both the aerial spotter plane and boat-based crew were on station, the spotter plane would locate a school of forage fish, make a visual identification of that school, and guide the boat-based crew to the school by giving verbal instructions over marine VHF radio. Once the skiff was over a school, the boat crew would identify fish either by catching fish with jigs, or by crewmembers seeing fish at the surface, or below the surface with a drop camera. During 2023, adverse weather conditions and a lack of forage fish schools in proximity to Cordova during in June resulted in limited opportunities for validation, and only five schools were validated. Overall, the validation efforts between 2014 and 2023 (93 validated schools) indicate a high level of correct species identification (96% for herring, 74% for sand lance) by the aerial observers. In 2023, relative density of forage fish schools during the June aerial surveys was lower than in 2021 and 2022, due mainly to lower

numbers of juvenile herring (Fig. 7). Spatial and temporal variation in aerial school densities were detailed further in a peer reviewed publication this year (Donnelly et al. *in press*).

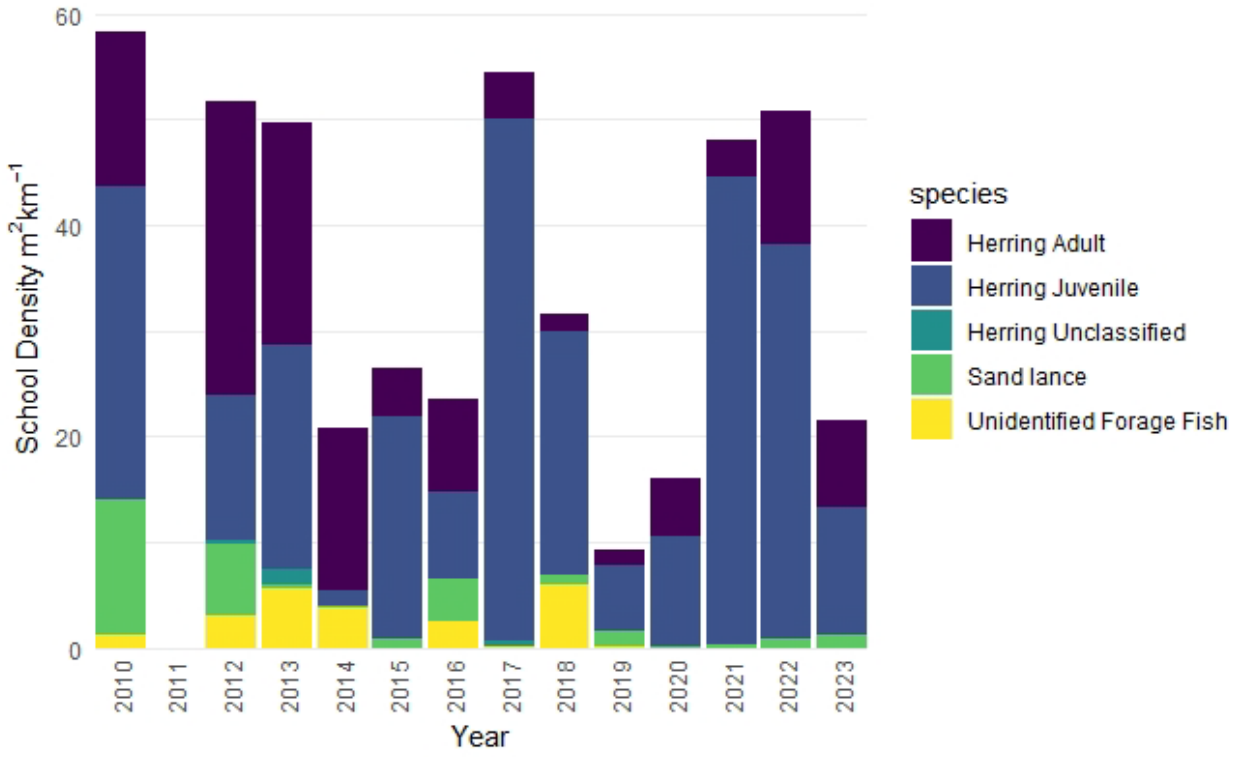

Figure 7. Forage fish school density (median surface area per shoreline km surveyed, m^2km^{-1}) observed June aerial surveys during 2010 to 2023. Species and age (for herring only) classifications are shown in color. Graphic credit: Dan Donnelly, USGS-ASC

Summer Forage Fish Condition

We collected forage fish in PWS during July 2023. Pacific sand lance samples were collected at Cabin Bay for age and energy processing. Although we visited Port Etches and looked for spawning capelin over several tidal cycles in July, we did not encounter any spawning capelin activity in the area. We also worked with John Johnson who runs the Nuuciq Spirit Camp, and contracted Rob Campbell (PWSSC) to search for spawning capelin in Port Etches in July but

none were observed that summer. We have developed a flier to help crowd source information on spawning capelin from Port Etches and other locations around Alaska (Appendix A). Spawning capelin samples were obtained from Glacier Bay National Park (April), Kodiak (May) and Sitka National Historic Park (Sep) in 2023. In 2023 spawning occurred on 4/18 on Gustavus Beach (pers comm. Craig Murdoch, NPS), on 5/20-6/9 (pers comm. Eric Munk, retired NOAA), and three spawning events were reported from Sitka on 9/4 (pers comm. Karen Johnson, social media inquiry), 9/10-9/11 (pers comm, Olivia Magni, NPS), and 9/16 (pers comm. Cliff Tincher, social media inquiry). From samples collected and aged with otoliths we found that the age structure of spawning capelin continues to be dominated by age-1 individuals from 2016 through 2023 (Fig. 8).

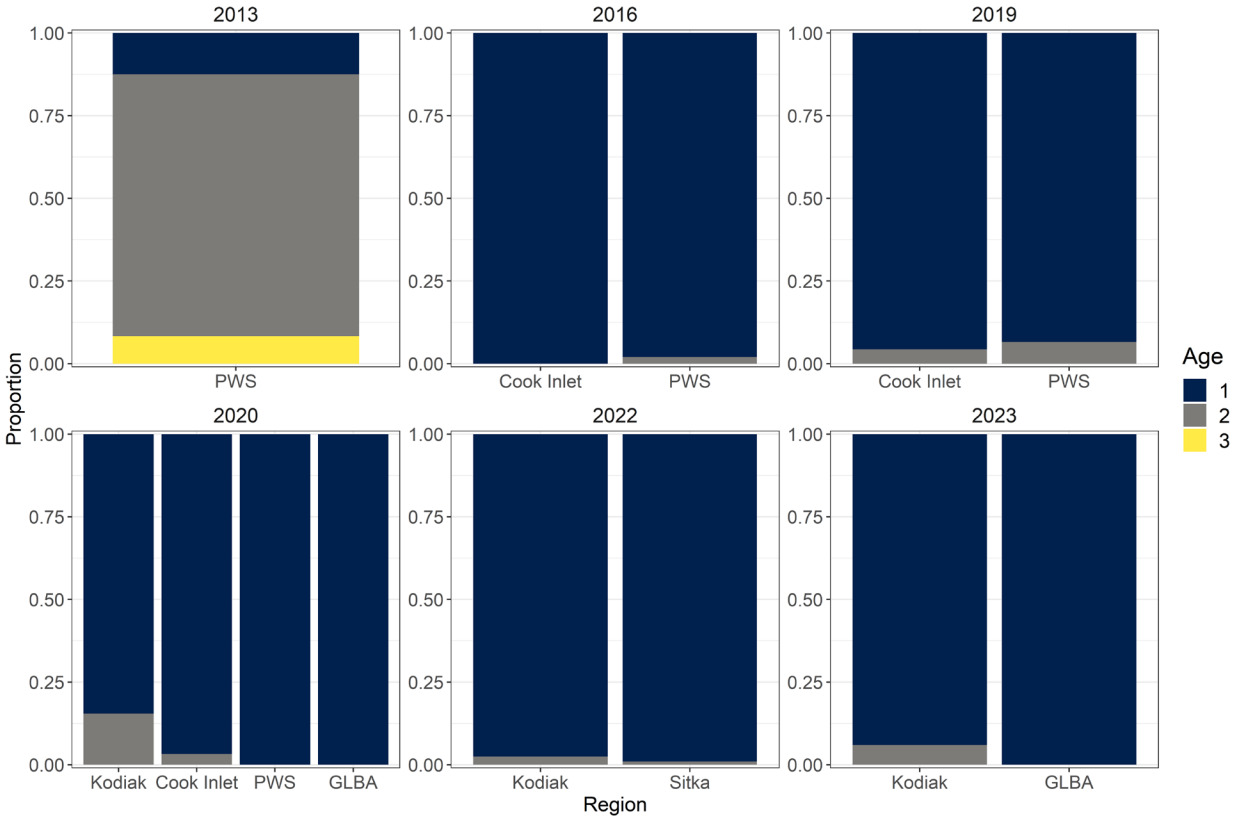

Figure 8. Spawning capelin age proportions (color) by year and region. Abbreviations: Prince William Sound (PWS), Glacier Bay (GLBA). Graphic credit: Caitlin Marsteller, USGS-ASC.

Juvenile Salmon Otoliths

Juvenile salmon were removed from archived Rhinoceros auklet bill load samples stored in freezers at the NOAA Ted Stevens Marine Research Institute (Juneau, Alaska). Bill loads were collected from nesting rhinoceros auklets on Middleton Island between 2010 and 2023 and were stored frozen. Otoliths were successfully recovered from 768 individual pink and chum salmon found in the bill load samples; however, otoliths from all samples collected in bill loads could not be recovered. Preparation and reading of otoliths followed procedures described in the Alaska Department of Fish and Game's Cordova otolith lab procedure manual (Fernandez and Moffit 2016). Hatchery origin salmon represented 58.7% of total identified salmon, while 41.3% of the sample set were wild origin salmon (Fig. 9). A subset of these fish (n=100) was also analyzed for energy density. Whole fish were freeze dried, then homogenized before being and processed for energy density using a Parr 6725 semimicro bomb calorimeter. Mean energy density was not significantly different between hatchery and wild origin salmon (two-tailed *t* test p = 0.9152, Fig. 10).

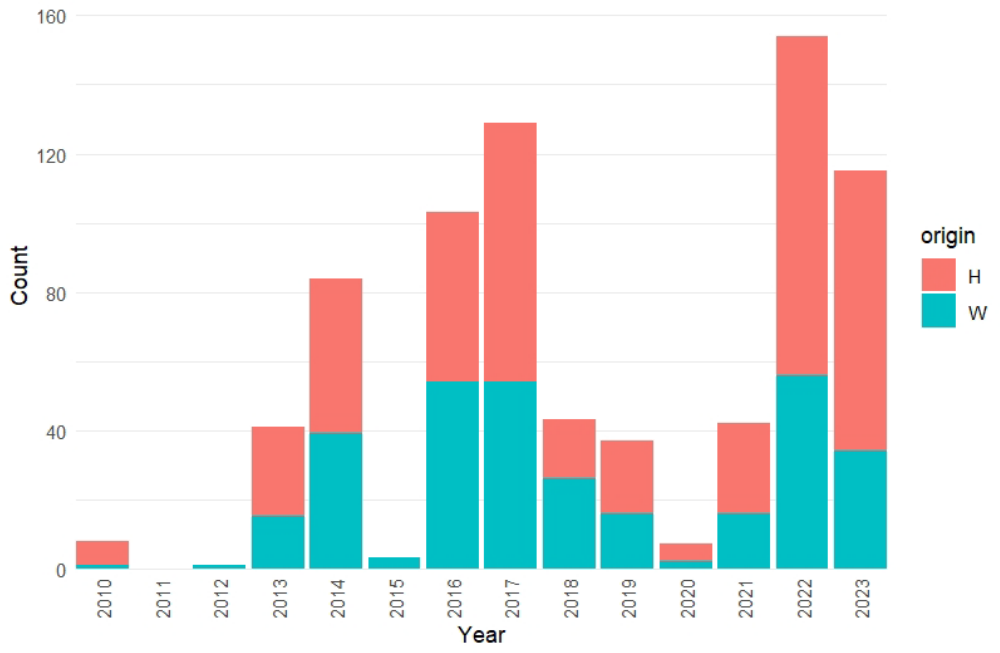

Figure 8. Counts of hatchery (H) and wild (W) juvenile salmon (n = 768) sampled by seabirds at Middleton Island during July–August. Graphic credit: Dan Donnelly, USGS-ASC.

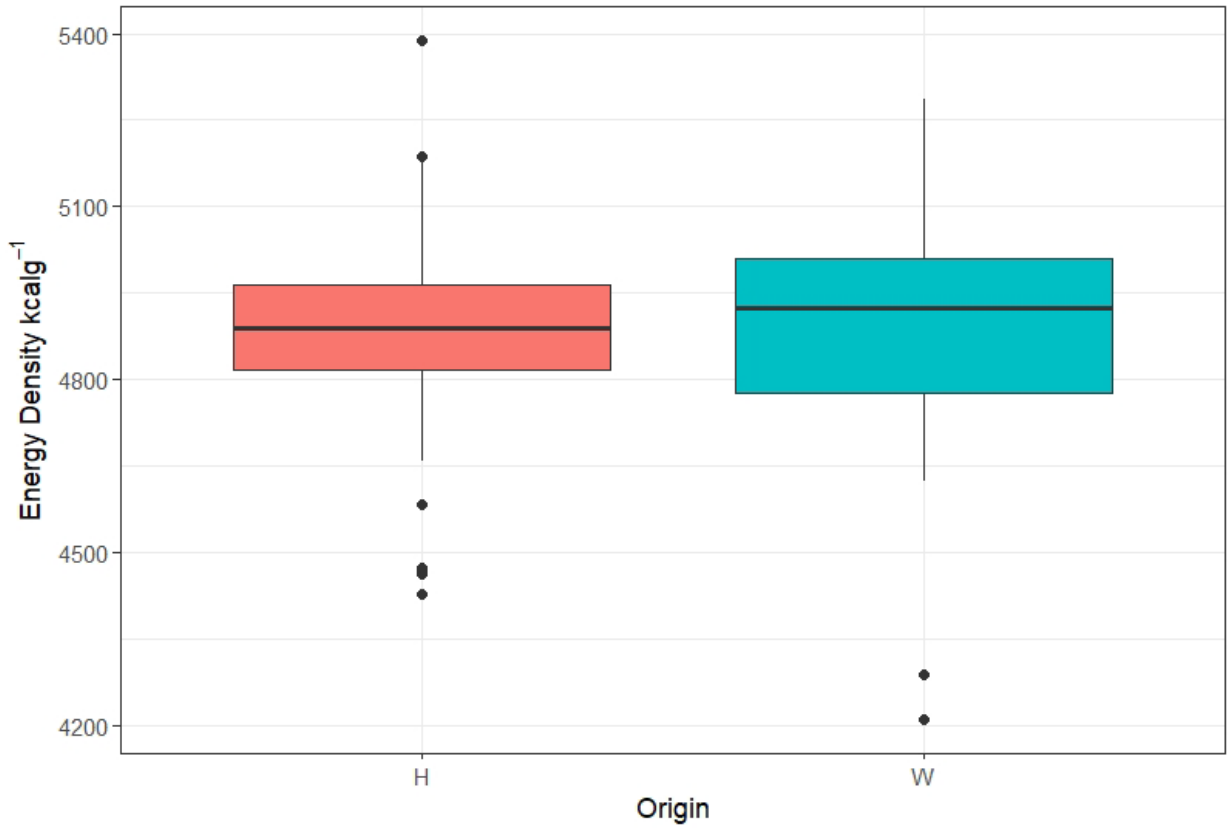

Figure 9. Energy density of hatchery (H) and wild (W) juvenile salmon sampled by seabirds at Middleton Island during July–August 2010 to 2023. Graphic credit: Dan Donnelly, USGS-ASC.

Acknowledgements

We thank Scott Hatch (ISRC), Shannon Whelan (ISRC), Dan Donnelly (U. S. Geological Survey [USGS]), Caitlin Marsteller (USGS), Scott Pegau (Oil Spill Recovery Institute), and Anne Schaefer (PWSSC) for their dedicated work in the field and also for key contributions to this report including data collection, data management, graphics, and project summaries. We are grateful for the efforts of the captains of the *R/V Alaskan Gyre*, Paul Tate and Rand Seaton, and for help in the field from Sam Stark (USGS), Sarah Schoen (USGS), Naomi Bargmann (USGS), John Moran (NOAA), Bree Witteveen (University of Alaska Fairbanks), and Rob Campbell (PWSSC). We appreciate efforts by Eric Munk (Kodiak), Craig Murdoch (Glacier Bay), Karen

Johnson (Sitka), Olivia Magni (Sitka), and Cliff Tincher (Sitka) to provide information and spawning capelin samples during 2023. We thank the scientific team of the GWA-LTRM program for their expertise and resources in support of this work.

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2. Products:

Peer-reviewed publications:

Arimitsu, M. L., J. F. Piatt, J. T. Thorson, K. J. Kuletz, G. Drew, S. K. Schoen, D. Cushing, C. Kroeger, and W. J. Sydeman. 2023. Joint spatiotemporal models to predict seabird densities at sea. Frontiers in Marine Science. 10-2023. https://www.frontiersin.org/articles/10.3389/fmars.2023.1078042/full.

Crowell, A., and M. L. Arimitsu. 2023. Climate change and pulse migration: Intermittent Chugach Inuit occupation of glacial fiords on the Kenai coast, Alaska. Frontiers in Environmental Archeology. 2-2023. https://www.frontiersin.org/articles/10.3389/fearc.2023.1145220/full.

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Marsteller, C., M. L. Arimitsu, S. Schoen, S. Stark, and J. Piatt. *In Press*. How avian predators contributed to common murre breeding failures in Cook Inlet, Alaska after the Pacific marine heatwave. Marine Ornithology.

Robinson, C. L. K., D. F. Bertram, H. Shannon, V. R. von Biela, W. Greentree, W. Duguid, and M. L. Arimitsu. 2023. Reduction in overwinter body condition and size of Pacific sand lance has implications for piscivorous marine predators during marine heatwaves. Marine Ecology Progress Series. https://doi.org/10.3354/meps14257.

Schoen, S. K., M. L. Arimitsu, C. E. Marsteller, and J. F. Piatt. 2022. Lingering impacts of the 2014-2016 northeast Pacific marine heatwave of seabird demography in Cook Inlet, Alaska. Marine Ecology Progress Series. https://doi.org/10.3354/meps14177.

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Reports:

Arimitsu, M. L., and S. Hatch. 2023. Age-0 sablefish size and growth indices from seabird diets at Middleton Island, Gulf of Alaska. U. S. Geological Survey Open File Report 2023-1049. https://pubs.usgs.gov/of/2023/1049/ofr20231049.pdf.

Arimitsu, M. L., J. F. Piatt, S. Hatch, C. Marsteller, D. Donnelly, and S. Whelan. 2023. Monitoring long-term changes in forage fish distribution, abundance, and body condition in Prince William Sound. *Exxon Valdez* Oil Spill Long-term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project 21120114-C), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Whelan, S., and S. A. Hatch. 2023.Seabird-derived forage fish indicators from Middleton Island. Pages 105-109 in B. E. Ferris, editor. Ecosystem Status Report 2023: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. North Pacific Fishery Management Council. Anchorage, Alaska.

Popular articles:

Arimitsu, M. 2023. In Hot Water: How Climate Change Affects Marine Ecosystems. Scientia Global, December 18. https://www.scientia.global/wp-content/uploads/Dr-Mayumi-Arimitsu.pdf

Conferences and workshops:

Arimitsu, M., D. Cushing, J. Durban, S. Hatch, R. Kaler, K. Kuletz, L. Labunski, C. Matkin, J. Moran, D. Olsen, S. Pegau, J. Piatt, J. Straley, and S. Whelan. 2023. Changes in marine predator and prey populations in the Northern Gulf of Alaska: Gulf Watch Alaska Pelagic update 2022. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Arimitsu, M. L., J. F. Piatt, S. K. Schoen, C. Marsteller, S. Stark, D. Donnelly, and N. Bargmann. 2023. Interactions of prey abundance, prey quality, and predator disturbance

following an ecosystem reset in the Gulf of Alaska. Oral presentation, Pacific Seabird Group Annual Meeting, La Jolla, California, February.

Arimitsu, M. L., J. F. Piatt, J. Thorson, S. Speckman, S. Schoen, C. Marsteller, and S. Stark. 2023. Persistent spatiotemporal patterns between seabird and small pelagic fish communities provide early indications of ecosystem change. Invited oral presentation, PICES Marine Symposium, Seattle, Washington, October.

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.

Donnelly, D., M. Arimitsu, S. Pegau, and J. Piatt. 2023. Detecting spatial and temporal variation in forage fish school densities using broad-scale aerial surveys. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Marsteller, C., M. Arimitsu, J. Piatt, V. Von Biela, and D. Donnelly. 2023. Age-at-spawning and energy density of Pacific capelin across a regional gradient following NE Pacific marine heatwave. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Schoen, S. K., N. Bargmann, M. Arimitsu, J. Piatt, C. Marsteller, S. Stark, D. Donnelly, M. Smith, C. Van Hemert, and D. Gerik. 2023. Investigating HAB toxin prevalence in seabirds and their food webs to help understand ecological relevance. Oral presentation, Alaska Harmful Algal Bloom Workshop, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Schoen, S. K., G. S. Drew, J. F. Piatt, M. L. Arimitsu, H. Coletti, M. Hood, R. Kaler, K. Kuletz, E. Labunski, S. Stark, and C. Swingley. 2023. The North Pacific Pelagic Seabird Database (NPPSD) v4. Oral presentation, Pacific Seabird Group Annual Meeting, La Jolla, California, February.

Stark, S., S. Schoen, M. Arimitsu, C. Marsteller, A. Harding, and J. Piatt. 2023. Distribution and foraging behavior of common murres and black-legged kittiwakes in lower Cook Inlet. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Stark, S., S. Schoen, M. Arimitsu, C. Marsteller, and J. Piatt. 2023. Foraging behavior of black-legged kittiwakes and common murres in relation to prey distribution and density. Oral presentation, Pacific Seabird Group Annual Meeting, La Jolla, California, February.

Stark, S., M. Arimitsu, S. Schoen, A. Harding, C. Marsteller, and J. Piatt. 2023. Foraging behavior of black-legged kittiwakes and common murres in relation to prey distribution and density. Oral presentation, Alaska Bird Conference, Anchorage, Alaska, December.

Stark, S., S. Schoen, M. Arimitsu, C. Marsteller, A. Harding, and J. Piatt. 2024. Distribution and foraging behavior of common murres and black-legged kittiwakes in lower Cook Inlet. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Turner, L., C. Cunningham, and M. Arimitsu. 2023. Combining predator diet and survey data to understand spatial and temporal patterns of forage fish in Alaska. Poster presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January.

Turner, L., M. Arimitsu, J. Piatt, G. Ekert, and C. Cunningham. 2024. Combining predator diet and survey data to understand spatial and temporal patterns of forage fish in Alaska. Oral presentation, Alaska Marine Science Symposium, Anchorage, Alaska, January. [Winner: Best Student Oral Presentation].

Public presentations:

Arimitsu, M. 2023. Seabirds as ocean sentinels. Invited presentation, Juneau Marine Naturalist Symposium, Juneau, Alaska, April.

Arimitsu, M. L. 2023. Joint spatiotemporal models to predict seabirds at sea. Spatiotemporal modeling group meeting, virtual, May.

Arimitsu, M., and S. Schoen. 2023. Seabirds as ocean sentinels in Prince William Sound. Invited presentation, Prince William Sound Natural History Symposium, Whittier, Alaska, May.

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. 2023. Changes in marine predator and prey populations in the Northern Gulf of Alaska: Gulf Watch Alaska Pelagic update 2022. Poster presentation, Seward Science Symposium, Seward, Alaska, September.

Marsteller, C., M. Arimitsu, and J. Piatt. 2023. Forage fish monitoring in Prince William Sound and Cook Inlet. Chugach Regional Resource Commission Memorial Gathering, Anchorage, Alaska, March.

Schoen, S. K., M. Arimitsu, J. F. Piatt, C. M. Marsteller, S. B. Stark, N. Bargmann, and D. Donnelly. 2023. USGS seabird and forage fish monitoring in lower Cook Inlet. Invited presentation, Kachemak Bay Birders group, Homer, Alaska, March.

Smith, M., S. K. Schoen, C. Van Hemert, M. L. Arimitsu, N. Bargmann, D. Gerik, and J. F. Piatt. 2023. Harmful algal toxins in Alaskan seabirds: Updates and ongoing research. Oral presentation, Northwest Campus, University of Alaska Fairbanks Strait Science Series, Virtual, March.

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

Piatt, J. F., R. M. Suryan, W. J. Sydeman, M. L. Arimitsu, S. A. Thompson, R. P. Wilson, and K. H. Elliott, editors. 2022. How do marine heatwaves impact seabirds? Marine Ecology Progress Series HEAT special issue inspired by the heatwave impacts symposium at the 3rd World Seabird Conference held in October 2021. This theme session includes 13 manuscripts that demonstrate impacts on seabirds from marine heatwaves and propose specific mechanisms that explain how ocean heating precipitates changes in seabird biology and behavior. https://www.int-res.com/journals/meps/theme-sections/heat.

Data sets and associated metadata:

Arimitsu, M. L., and S. A. Hatch. 2023. Age-0 sablefish size and growth indices from seabird diets at Middleton Island, Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/P94KVH9X.

Arimitsu, M. L., J. F. Piatt, B. Heflin, and C. E. Marsteller. 2023. Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 3.0, March 2023): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z.

Arimitsu, M., J. Piatt, and C. Marsteller. 2023. Pelagic: Forage fish distribution, abundance, and body condition. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aoos.org/#metadata/3ca497e2-3421-4fa4-a550-f4d397a73c07/project.

Arimitsu, M. L., J. F. Piatt, J. T. Thorson, K. J. Kuletz, G. S. Drew, S. K. Schoen, D. A. Cushing, C. Kroeger, and W. J. Sydeman. 2023. Gridded seabird density estimates in lower Cook Inlet, Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/P94NDFRI.

Arimitsu, M. L., S. K. Schoen, J. F. Piatt, and C. E. Marsteller. 2024. Assessing the status and trends of seabirds and forage fish in lower Cook Inlet, Alaska (ver. 3.0, January 2024): U. S. Geological Survey data release, https://doi.org/10.5066/P961LWWE.

Drew, G. S., S. K. Schoen, M. D. Hood, M. L. Arimitsu, and J. F. Piatt. 2023. North Pacific Pelagic Seabird Database (NPPSD) (ver 4.1, May 2023): U. S. Geological Survey data release, https://doi.org/10.5066/F7WQ01T3.

Hatch, S. A., M. L. Arimitsu, J. F. Piatt, S. Whelan, and C. E. Marsteller. 2023. Seabird diet data collected on Middleton Island, Gulf of Alaska: U. S. Geological Survey data release, https://doi.org/10.5066/P93I0P67.

Additional Products not listed above:

No new contributions for this reporting period.

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

We work closely with PWSSC scientists on several aspects of our work: Scott Pegau on validation of aerial surveys, Mary Anne Bishop and Anne Schaefer on fall/winter marine bird data, and planning discussions with Pete Rand (and Kristen Gorman [University of Alaska Fairbanks] and Jenni Morella [Alaska Department of Fish and Game]) regarding juvenile salmon samples, otolith protocols, and opportunities for sharing information and resources across projects.

EVOSTC Long-Term Research and Monitoring Projects

Mayumi Arimitsu is on the GWA-LTRM science coordinating committee serving as lead for the GWA-LTRM pelagic component, which includes five monitoring projects including marine birds, humpback whales, killer whales, and forage fish. Her duties in this role have included leading science synthesis activities, coordinating pelagic program science products and

information transfer, leading presentations at conferences and principal investigators meetings, and facilitating communications between the program management team and the pelagic component project leaders.

Under the pelagic component of the GWA-LTRM program, the forage fish project shares a research platform and common goals of the humpback whale project (22120114-O) also associated with the IPP surveys. Summer forage fish surveys and information regarding Middleton Island seabird diets also provide a means to understand trends in piscivorous marine birds (project 22120114-M).

EVOSTC Mariculture Projects

We engaged with *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) mariculture projects group at the GWA-LTRM principal investigator (PI) meetings in November 2022 and January 2023 and we are looking forward to working with the mariculture team as our sampling goals and geographic regions are complimentary.

EVOSTC Education and Outreach Projects

We engaged with the EVOSTC education and outreach projects with this group at the GWA-LTRM PI meetings in November 2022, January 2023, and November 2023 and we are looking forward to working with them to expand our capacity for bringing our science to new audiences.

Individual EVOSTC Projects

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

Trustee or Management Agencies

Data and fish samples gathered as part of the GWA-LTRM forage fish study is used by NOAA National Marine Fisheries Science annual stock assessments (e.g., Bridget Ferriss and Stephani Zador Ecosystems Status Report and Kalei Shotwell et al. Sablefish Ecosystem and Socioeconomic Profile to the North Pacific Fisheries Management Council). The GWA-LTRM forage fish work is also complimentary to a related USGS outer Continental Shelf and Bureau of Ocean Energy Management funded study of forage fish and seabird trends in areas of oil and gas

development in Cook Inlet. This continued coordination and collaboration with GWA-LTRM PIs and other researchers (Liz Labunski and Robb Kaler, U. S. Fish and Wildlife Service; Kris Holderied, NOAA) in Cook Inlet and Kachemak Bay increases the scope of ecosystem monitoring in the Northern Gulf of Alaska.

Native and Local Communities

We are working with John Johnson (Chugach Alaska Corporation) regarding sample collection and spawning capelin observations in Port Etches. We presented information on this work and related projects at the Chugach Regional Resources Commission Subsistence Memorial Gathering in March 2023.

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	$155,284	$126,623	$132,135	$137,923	$144,000	$695,965	$246,439
Travel	$14,492	$14,854	$15,226	$15,606	$15,996	$76,175	$38,654
Contractual	$106,800	$109,470	$112,207	$115,012	$117,887	$561,376	$215,602
Commodities	$32,000	$32,000	$32,000	$32,000	$32,000	$160,000	$65,741
Equipment	$10,650	$10,916	$11,189	$11,469	$11,756	$55,980	$41,977
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
SUBTOTAL	$319,226	$293,864	$302,757	$312,010	$321,639	$1,549,495	$608,413
General Administration (9% of subtotal)	$28,730	$26,448	$27,248	$28,081	$28,947	$139,455	N/A
PROJECT TOTAL	$347,956	$320,312	$330,005	$340,091	$350,586	$1,688,950	
Other Resources (In-Kind Funds)	$482,500	$482,500	$482,500	$482,500	$482,500	$2,412,500	

Differences between proposed and actual spending are due in part to the differences in fiscal year periods between EVOSTC and USGS, and because expenditures in some categories were split between FY22 and the FY20-21 budgets that were complicated by the COVID-19 pandemic. We

anticipate that spending categories will ultimately reflect our proposed amounts as the project progresses. USGS will continue to make a substantial in-kind contributions of salary for pelagic component lead and PI (6 months GS-13 at $90K), and field equipment required to conduct the work including hydroacoustic echosounders ($141K), oceanography sampling equipment ($55K), a trawl depth monitor system ($21.5K), small boats ($20K), a marine scale ($10K), and net sampling and camera gear ($6K) for forage fish work in Prince William Sound. ISRC will also make substantial in-kind contributions for the use of facilities ($120K) at Middleton Island. However, USGS funds included as in-kind or as contributions are included for planning purposes only and nothing contained in this proposal shall be construed as binding the USGS to expend in any one fiscal year any sum in excess of its appropriations or funding in excess or what it has received for the collaborative work outlined in this proposal or involving the Federal government in any obligation to pay money before funds have been appropriated for that purpose unless otherwise allowed by law.

See FY24 Proposal amendment for budget adjustments.

Appendix A.

Spawning Capelin Flier posted at the Nuuciq Spirit Camp at Port Etches and on social media.