



Exxon Valdez Oil Spill Trustee Council

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

Annual Project Reporting Form

Project Number: 22120114-M

Project Title: Prince William Sound Marine Bird Surveys and Associated Shelf Waters

Principal Investigator(s): Robert Kaler, U.S. Fish and Wildlife Service

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

Submission Date (Due March 1 immediately following the reporting period): September 14, 2023

Project Website: <https://gulfwatchalaska.org/>

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

Project progress is on schedule.

Project used carryover funds (2017-2021 funding cycle) for a July 2022 Prince William Sound Survey, otherwise 2022 would have been a non-survey year (2023, 2025). Seward Line/Northern Gulf of Alaska-Long Term Ecological Research is on schedule; however, a bout of Covid-19 stymied the July 2022 cruise and we were not able to find a replacement surveyor.

Project progress is delayed.

N/A

Budget reallocation request.

N/A

Personnel changes.

N/A

1. Summary of Work Performed:

We conducted marine bird surveys in Prince William Sound (PWS) and the Northern Gulf of Alaska (NGA). For the PWS component, we conducted small boat surveys to monitor abundance of marine birds in PWS during July 2022 by using carryover funds from the previous funding cycle (2017-2021) to continue the time series used to monitor population trends for marine birds



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following the 1989 *T/V Exxon Valdez* oil spill (EVOS). For the offshore component, at-sea seabird surveys were conducted in spring and fall (a bird and mammal observer was not available for the summer cruise) in collaboration with the multi-disciplinary Seward Line and the Northern Gulf of Alaska Long Term Ecosystem Research (NGA-LTER; 2018-present) and assess how seabird abundance and distribution responds to environmental drivers and lower trophic level changes.

Our PWS results indicate that recovery is underway for many taxa. We conclude bald eagles, cormorants, and harlequin ducks are recovering, while mergansers, murrelets, pigeon guillemots, and terns are not recovering. The population status of black-legged kittiwakes, black oystercatchers, bufflehead, goldeneyes, grebes, loons, short-billed (mew) gulls, murres, and scoters is unknown. Mergansers, murrelets, pigeon guillemots, and terns, all of which are piscivorous, continue to decrease in oil affected areas of PWS.

Along the Seward Line, different marine bird groups had contrasting responses to temperature variability over a two-decade period. Three out of four evaluated species of tubenoses were positively associated with warmer upper-ocean temperatures, while three out of four alcids and gulls were negatively affected. During and after the Pacific marine heatwave, murres, kittiwakes, and gulls became less abundant on the shelf and concentrated near the coast, concurrent with reproductive failures and die-off events. Negative effects of this heatwave on piscivorous marine birds highlight their susceptibility to ongoing ecological changes in the region. Taken as a whole, our results suggest that food-web mechanisms are probably a primary factor behind the failure of some species of marine birds to recover from mortality caused by the oil spill.

2. Products:

Peer-reviewed publications:

Arimitsu, M. L., J. F. Piatt, J. T. Thorson, K. Kuletz, G. Drew, S. K. Schoen, D. A. Cushing, C. Kroeger, and W. J. Sydeman. 2023. Joint spatiotemporal models to predict seabird densities at sea. *Frontiers in Marine Science*. doi: 10.3389/fmars.2023.1078042.

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* <https://doi.org/https://doi.org/10.3354/meps14239>.



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Reports:

Arimitsu, M., D. Cushing, B. Drummond, S. Hatch, T. Jones, R. Kaler, E. Labunski, J. Lindsey, J. F. Piatt, H. Renner, and S. Whelan. 2022. Seabird Synthesis. *In* Feris B. E. and S. Zador, editors. Ecosystem Status Report 2022: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council.
<https://www.fisheries.noaa.gov/resource/data/ecosystem-status-report-2022-gulf-alaska>.

Popular articles:

None

Conferences and workshops:

Cushing, D. A., K. J. Kuletz, L. Sousa, R. H. Day, S. L. Danielson, E. A. Labunski, and R. R. Hopcroft. 2022. Two decades of spring seabird observations along the Seward Line, Gulf of Alaska. Oral presentation. Alaska Marine Science Symposium, Virtual, January.

Public presentations:

None

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

None

Data sets and associated metadata:

Kaler, R. 2022. Prince William Sound Marine Bird Surveys, July 2022, Gulf Watch Alaska Pelagic Component. Research Workspace. Uploaded December 2022.

Kaler, R., and K. Kuletz. 2023. Prince William Sound Marine Bird Surveys, July 2012 to 2018, Gulf Watch Alaska Pelagic Component. Research Workspace. 10.24431/rw1k21k, version: 10.24431_rw1k21k_20230307T231301Z.

Additional Products not listed above:

None



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3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

Our summer marine bird surveys in PWS provide a comparison with year-round marine bird surveys conducted by the Alaska SeaLife Center in Resurrection Bay, a region downstream of PWS in the oil spill affected area.

EVOSTC Long-Term Research and Monitoring Projects

The Principal Investigator (PI) Robert Kaler and retired past PI Kathy Kuletz have been participating in discussions and meetings to explore opportunities to integrate the July PWS marine bird data with the other projects, including those within the Gulf Watch Alaska-Long Term Research and Monitoring (GWA-LTRM) Pelagic and Environmental Drivers components. Additionally, the PIs have been coordinating with Heather Coletti (GWA-LTRM Nearshore Component lead) and the GWA-LTRM Science Coordinator (Rob Suryan) to merge GWA-LTRM marine bird data sets into a broader geographic analysis of population trends.

Collaboration within the GWA-LTRM Pelagic Component (forage fish, humpback whale, killer whale, and marine bird projects), and between the Pelagic and Herring Research and Monitoring programs, will continue to focus on physical and biological features of locations where whales and seabirds have been found to overlap in time and space. The seabird component of the NGA-LTER also collaborates with the Environmental Drivers Component of GWA-LTER. The seabird surveys are conducted from the NGA-LTER research vessel, and we will be integrating the seabird data with environmental and zooplankton data collected during concurrent cruises. The NGA-LTER is funded by a National Science Foundation grant to Dr. Russell Hopcroft of the University of Alaska Fairbanks. The NGA-LTER is conducted in conjunction with the GWA-LTRM Seward Line project, also led by Dr. Hopcroft.

EVOSTC Mariculture Projects

Currently no collaboration but PWS marine bird data are available in some areas proposed for mariculture activities and would inform a Before/After/Control/Impact study design.

EVOSTC Education and Outreach Projects

None at this time; however, the results of the PWS and NGA-LTER were shared at the Prince William Sound Natural History Symposium in 2021.



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Individual EVOSTC Projects

The PWS marine bird surveys will provide population estimates and trends that will improve our ability to interpret results from the EVOS Project 19110853 – Pigeon Guillemot Restoration Program. The Pigeon Guillemot Recovery project is monitoring pigeon guillemot numbers at islands in central PWS following removal of introduced mink and is obtaining an index of black-legged kittiwake reproductive success across PWS.

Trustee or Management Agencies

Marine bird data from this study collected at the Naked Island group (Naked, Storey, and Peak islands in PWS) will be used to help evaluate the recovery of pigeon guillemots and other marine bird species (e.g., Arctic tern, parakeet auklet, tufted puffin) that were extirpated by mink introduced to the island group. It thus supports the management directives of U.S. Fish and Wildlife Service (USFWS) to conserve and maintain populations of migratory birds. Additionally, the pigeon guillemot remains listed by the EVOS Trustee Council as “not recovered” following the oil spill. These survey data provide information important for the continued monitoring of guillemot recovery.

The marine bird data collected as part of the GWA-LTRM and NGA-LTER have provided the USFWS and National Oceanographic and Atmospheric Administration (NOAA) with data on location, habitat use, and abundance of short-tailed albatross and two other albatross species. The short-tailed albatross is listed under the Endangered Species Act and is thus a concern in NOAA’s regulation of commercial fishing in the Gulf of Alaska. All three albatross species are subject to incidental take in commercial long-line fisheries, along with other species such as northern fulmar, shearwaters, and gulls. The Bureau of Ocean Energy Management (BOEM) has also requested our pelagic survey data from the Gulf of Alaska, to incorporate into their internal database. The Anchorage office of BOEM is responsible for environmental assessment of Cook Inlet oil and gas lease sales; assessments include adjacent waters and resources that could be impacted by development or accidents associated with these sales.

Native and Local Communities

Working with the Chugach Regional Resource Commission (CRRC) Board of Directors, changes in densities of marine birds in PWS from 1989 to 2018 were used to update the CRRC’s list of identified subsistence marine bird species harvested by Alaska Natives in the Chugach region. The updated list provides information on changes in species distribution and abundance and provides an opportunity to combine information from boat-based surveys with Indigenous knowledge, particularly following the 2014-2016 marine heat wave in the Gulf of Alaska, and likely affecting abundance of subsistence species in PWS.



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4. Response to EVOSTC Review, Recommendations and Comments:

The Science Panel had no specific comments.

May 2021 EVOSTC Science Panel Comment: Ecosystem Monitoring Component. The PIs identify an additional \$358,954 in matching funds over the next 10 years. Surveys have occurred on the same set of randomly selected transects every even year since 2010. The PIs are well-qualified to undertake the important long-term research they propose, and have very strong collaborations. The PIs have contributed to various peer-reviewed publications, but apparently have no first-authored journal papers reporting results of their GOA work to date—none are listed in either of the proposers' CVs or in the Literature Cited section of the proposal.

PI Response: Thank you for the comment regarding first-author publications. Upon completion of the 2017-2021 PWS marine bird report to the EVOSTC, we intend to prepare a first-authored manuscript summarizing population estimates, trends, and associated factors influencing patterns, 1989-2018. Unfortunately, postponing the 2020 July marine bird surveys in PWS due to COVID-19 restrictions has been a setback. Building off efforts taken over the past five years to synthesize the marine bird data (including the Cushing et al. 2018 publication), we plan to do more directed synthesis products over the next 10 years. These synthesis products will use marine bird data collected across GWA components. While we have not been first authors on synthesis articles during the earlier funding cycle, we were part of two GWA synthesis products (Arimitsu et al. 2021, Suryan et al. 2021). We have also been collaborating with the Nearshore Component to integrate our shoreline survey data from PWS for a community analysis of nearshore marine birds with respect to spatial-temporal factors.

May 2021 EVOSTC Science Panel Comment: While we see the value of continuing this project, we suggest that the case for funding could be improved by developing some mechanistic, predictive hypotheses focused on change in abundance and/or distribution. We note that with the data already in hand, this should be possible, and would show clearly that the PIs are thinking about how data can be used and may also provide insights into analytical/modeling approaches for their data. We would like justification for continuing the pelagic surveys in connection with the NSF LTER project. How do data collected on those surveys improve on improve on the information on variability in seabird abundance and distribution gathered from the Seward Line? How much additional cost is associated with this aspect of the proposal?

PI Response: We agree that for the next 10-year cycle, it would be useful to continue these surveys and our analyses within a framework of hypotheses, and we can build these into the project description. In fact, we have been working on a number of hypothesis-based papers and



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analyses using data from the PWS and Northern Gulf of Alaska (NGA)-LTER surveys. While some of these hypotheses and products could focus more specifically on the PWS and NGA-LTER surveys, we think results are more robust and compelling when integrated with other marine bird data from these regions. For example, combined with data in the North Pacific Pelagic Seabird Database, the PWS and NGA-LTER data will be important components of a project recently granted by the North Pacific Research Board (NPRB) to PIs W. Sydeman and K. Kuletz (Modeling seabird distribution and abundance in Alaskan large marine ecosystems: synthesis of change; July 2021 to July 2023). This project, and related publications, will use VAST modeling to derive population estimates for the NGA to address hypotheses for seabirds related to: (1) at-sea vs colony-based trends in populations, (2) seasonal fluxes of distribution and abundance, (3) whether and how seabirds track the velocity of climate change. The hypotheses associated with these components include: (1a) At-sea population estimates will be significantly greater than colony-based estimates and (1b) trends for species with high-quality colony data will better track at-sea data than that of burrow-nesting (difficult to assess) species; (2a) Timing of within-season shifts in community structure will vary by ecological region depending on species-specific habitat preferences and regional timing in oceanographic dynamics and (2b) within-season community assemblages will shift composition more drastically (at decadal-scale) in regions impacted by sea ice (i.e., NGA will show less change than the northern Bering or Arctic seabird communities); and (3) seabird distribution tracks sea surface isothermal shifts within regions (i.e., within the NGA).

Our preliminary analyses have been presented in numerous professional and public fora, as well as in reports and associated integrative publications. They illustrate the link between the PWS and NGA-LTER as reflected in the seasonal and interannual shifts in seabird distribution from inner PWS to the outer shelf. Another example is the 2014 influx of murre (and other species) into the inner shelf and PWS prior to and during the 2014-2016 marine heat wave; a significant signal of ecosystem shift (Arimitsu et al. 2021). Seabirds shift locations seasonally as well as in response to interannual and decadal changes in the environment, thus looking only at PWS patterns of abundance limits our ability to understand the influence of climate change. The greater spatial and seasonal scope of the NGA-LTER surveys will expand our ability to interpret patterns observed in PWS, across the NGA shelf, and for the Nearshore Component surveys. The NGA-LTER surveys only began in 2018, thus full analysis of the broader cross-shelf and along-shelf comparisons has yet to be examined. We anticipate that the three-season and along-shelf gradients will greatly improve our understanding of patterns for these interconnected oceanographic regions. We will soon be submitting the first long-term examination of seabird



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response to NGA dynamics based on Seward Line data, a subset of the NGA-LTER with a longer time frame (Cushing *et al.* in prep).

Thus, the PWS and NGA-LTER surveys will be important components of analyses that improve our understanding of changes in seabird populations and communities over time. The information will benefit seabird management and conservation, including the use of seabirds as ecological indicators for ecosystem-based management of Alaska's fisheries. The PWS and NGA-LTER surveys are currently being examined as seabird indicators for the Ecosystem Chapter/ Gulf of Alaska for the North Pacific Fisheries Management Council. The NGA-LTER surveys comprise between 10% (PWS survey years) and 45% (PWS non-survey years) of the annual cost of this project and is heavily leveraged by support of the Seward Line via NPRB grants and USFWS in-kind contributions.

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

Cushing, D. A., K. J. Kuletz, L. Sousa, R. H. Day, S. L. Danielson, E. A. Labunski, and R. R. Hopcroft. Seabird responses to physical variability along a cross-shelf transect in the northern Gulf of Alaska during spring, 1998-2019. *In prep.*

Cushing, D. A., D. D. Roby, and D. B. Irons. 2018. Patterns of distribution, abundance, and change over time in a subarctic marine bird community. *Deep-Sea Research Part II: Topical Studies in Oceanography* 147:148–163.

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



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Ecosystem response persists after a prolonged marine heatwave. Scientific Reports 11:6235 <https://doi.org/6210.1038/s41598-41021-83818-41595>.

September 2021 EVOSTC Science Panel Comment: The PIs indicated that they intend to produce a manuscript summarizing data collected in 1989-2018 upon completion of their current report to EVOSTC. The PIs noted that they are coauthors on the two synthesis papers that were published this year—Arimitsu et al. (21 authors) and Suryan et al. (49 authors). The PIs further noted that they intend to produce “more directed synthesis products over the next 10 years” and that they are “working on a number of hypothesis-based papers and analyses” but did not provide examples of what those papers are. The two hypotheses they did propose in their revised proposal were elementary. They did offer reasonable hope that hypotheses will be formulated and tested during a recently initiated project funded by NPRB in 2021-2023 and gave some examples, which the SP found to be insufficient. Nevertheless, we believe the NPRB project will be of great benefit to the overall program. The response of the PIs to the question of how data from the NGOA-LTER project improved on data collected on the Seward Line and in PWS was not compelling. The NGOA-LTER program seeks to better understand upstream-downstream ecosystem dynamics across the shelf of the NGOA. Tying patterns of seabird distribution and abundance to those data might be interesting. It is not clear how much added value there would be compared to the value of data from just PWS and the Seward Line in tracking pelagic seabird dynamics in response to physical forcing, but it is reasonable to assume that after ten years additional insights would emerge. The total budget for the entire 10-y project is reasonable. The NGOA-LTER ship-of-opportunity is an economical platform for this project.

PI Response:

Response from PI is pending.



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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		\$28,907	\$122,278	\$31,869	\$136,816	\$37,377	\$357,247	\$28,907
Travel		\$2,168	\$20,913	\$2,193	\$21,384	\$2,219	\$48,877	\$2,168
Contractual		\$43,500	\$110,058	\$45,702	\$113,952	\$48,016	\$361,228	\$43,500
Commodities		\$0	\$21,020	\$6,000	\$27,613	\$6,000	\$60,633	\$0
Equipment		\$13,500	\$102,250	\$0	\$4,400	\$0	\$120,150	\$13,500
Indirect Costs	Rate = 0%	\$0	\$0	\$0	\$0	\$0	\$0	\$0
SUBTOTAL		\$88,075	\$376,519	\$85,764	\$304,165	\$93,612	\$948,135	\$88,075
General Administration (9% of subtotal)		\$7,927	\$33,887	\$7,719	\$27,375	\$8,425	\$85,332	N/A
PROJECT TOTAL		\$96,001	\$410,406	\$93,483	\$331,540	\$102,037	\$1,033,467	
Other Resources (In-Kind Funds)		\$29,053	\$30,429	\$32,841	\$33,841	\$35,879	\$162,043	
<p>COMMENTS: Prince William Sound (PWS) marine bird surveys will be conducted in July every other year, beginning FY23 (2023, 2025, 2027, 2029). Owing to Dr. Kathy Kuletz's (FWS-Migratory Bird Management Seabird Coordinator) retirement in February 2022, Dr. Erik Osnas (FWS-Migratory Bird Management Biometrician) has provided In-Kind matching contributions. Funds carried-over via a "No Cost Extension" for the FY17-21 funding cycle were used for the July 2022 marine bird survey in PWS and amounted to ~\$162K. The funds were used for: personnel (\$57K), travel (\$12K), vessel contract (\$50K), and Northern Gulf of Alaska/Long-Term Ecological Research seabird survey contract (\$43K). Cost share includes: FWS Biometrician (GS-13, 2 months/year = \$20K); GIS Biologist (GS-11, 1 months/year = \$7K). Total In-Kind contribution from USFWS listed in Other Resources row.</p>								
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Spending for the project is on track for FY22. PWS field work in summer 2022 was funded through carry-over funds from the FY17-21 funding cycle and those expenditures were reported with the FY17-21 final report.

FY22 funds were used for salary. That is in addition to the FY17-21 funds that FWS was approved to carry over to FY22. Funds were also used for a contract with Pole Star LLC for the Northern Gulf of Alaska-LTER surveys.