



Exxon Valdez Oil Spill Trustee Council

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

Annual Project Reporting Form

Project Number: 23120114-O

Project Title: Long-term monitoring of humpback whale predation on Pacific herring in PWS

Principal Investigator(s): John R. Moran, Auke Bay Laboratories, National Marine Fisheries Service, and Lauren A. Wild, University of Alaska Southeast Sitka Campus

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

Submission Date: March 1, 2023

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.

Lauren Wild replaced Jan Straley as PI. Her CV was included with the FY22-31 proposal.

1. Summary of Work Performed:

Overview

We continue to monitor the steep decline of the local humpback whale (*Megaptera novaeangliae*) population in Prince William Sound, Alaska following the 2014-2016 northeast Pacific marine heatwave (PMH) (Table 1). Prior to the heatwave, humpback whales in Prince William Sound fed primarily on adult Pacific herring (*Clupea pallasii*), especially when herring aggregated in large shoals during the spring, fall, and winter. Following the PMH, juvenile herring and euphausiids are more common in the diet of whales. We used the unique marking of the flukes to identify and “photographically mark” individual whales. Population estimates from 2007-2022 were derived using both closed and open mark/recapture models (Fig. 1 and 2). We identified a slight increase in whale abundance relative to the previous six years during 2022 and 2023, but numbers are still below pre-heatwave estimates. This increase is also likely driven by new arrivals to the population rather than previously marked whales returning to Prince William



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Sound. In 2021, we estimated that 4.3% of the pre-spawning biomass of herring was consumed by whales. This contrasts sharply with the peak consumption of 38.1% in 2013. Consumption rates for 2022 and 2023 remained low. The decline in the number of whales in Prince William Sound, either through mortality or emigration, along with a shift towards euphausiid as a prey source, has removed some of the predation pressure on herring, potentially aiding the modest recovery of herring seen within Prince William Sound (Fig.2).

Table 1. Counts of humpback whales and encounter rates for fall surveys in Prince William Sound, Alaska.

Month-year	Counts of whales	km surveyed	Encounter rate (Whales/km)
Sep-2008	71	763	0.09
Oct-2011	62	817	0.08
Sep-2012	81	822	0.10
Sep-2013	113	657	0.17
Sep-2014	181	791	0.23
Sep-2017	12	1006	0.01
Sep-2018	17	1002	0.02
Sep-2019	35	1061	0.03
Sep-2020	14	613	0.02
Sep-2021	23	972	0.02
Sep-2022	19	933	0.02
Sep-2023	34	920	0.04



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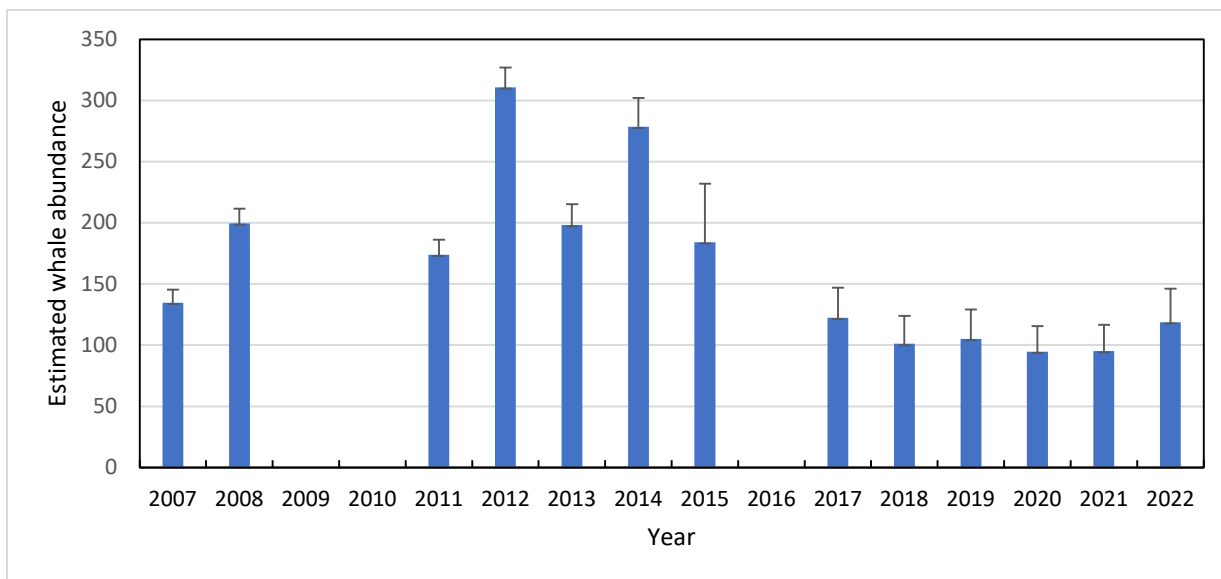


Figure 1. Estimated humpback whale abundance in Prince William Sound, Alaska using the Chapman-Petersen open population model.

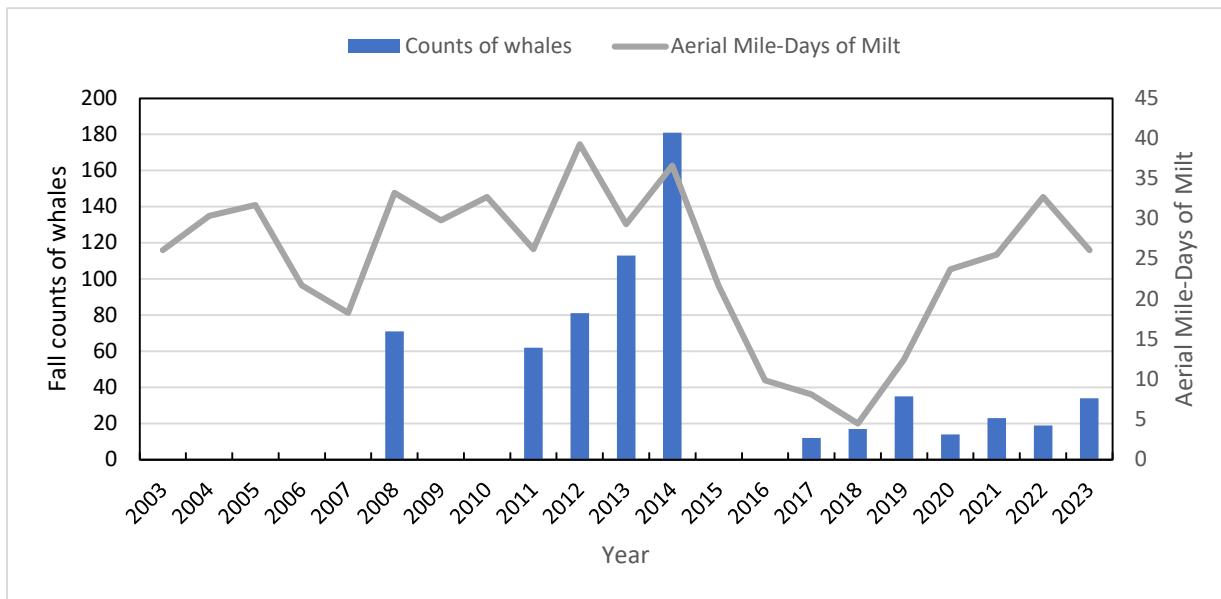


Figure 2. Fall counts of humpback whales and herring mile-days of milt (an index of spawning population size) from Prince William Sound, Alaska.



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Field work

We completed April and September 2023 Gulf Watch Alaska Long-term Research and Monitoring (GWA-LTRM) humpback whale surveys as planned. In April, prey was abundant with spawning herring being the main prey for humpback whales. AE10 killer whales (*Orcinus orcas*) were photographed in Port Fidalgo; two females, Petal and Heather, both had calves. Approximately 40 killer whales, AJ8 and AJs, were photographed in Montague Entrance.

During the September survey, humpback whale numbers were slightly up in the Sound compared to 2020-2022 with 29 individual whales seen during the cruise including three calves. The whales appeared to be healthy with several individuals that were very robust (Fig. 3). A small pod of five killer whales (AK2s) were photographed near the Southwest side of Glacier Island. Photos were forwarded to C. Matkin with the GWA-LTRM killer whale monitoring project (23120114-N) for identification and cataloging. Counts and locations for harbor (*Phocoena phocoena*) and Dall's porpoises (*Phocoenoides dalli*) were recorded during the daylight hours of the cruise. The Steller sea lion (*Eumetopias jubatus*) haulouts at the Needle, Bullhead, Dutch Group, and East Perry were photographed and provided to Alaska Department of Fish and Game's sea lion program personnel.



Figure 3. Humpback whales appeared to be healthy (rounded back indicating a thick blubber layer) during the Sept. 2023 survey.



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2. Products:

Peer-reviewed publications:

Atkinson, S., T. A. Branch, A. A. Pack, J. M. Straley, J. R. Moran, C. Gabriele, K. L. Mashburn, K. Cates, and S. Yin. 2023. Pregnancy rate and reproductive hormones in humpback whale blubber: Dominant form of progesterone differs during pregnancy. *General and Comparative Endocrinology* 330:114151.

Atkinson, S., V. Melica, S. Teerlink, K. Mashburn, J. Moran, and H. Pearson. 2023. Use of hormones in assessing reproductive physiology of humpback whales (*Megaptera novaeangliae*) from Juneau, Alaska. *Theriogenology Wild* 3:100050.

Cheeseman, T., K. Southerland, J. M. Acebes, K. Audley, J. Barlow, L. Bejder, C. Birdsall, A. L. Bradford, J. K. Byington, J. Calambokidis, R. Cartwright, A. Masterman, J. Moran, et al. 2023. A collaborative and near-comprehensive North Pacific humpback whale photo-ID dataset. *Scientific Reports* 13:10237.

Cheeseman, T., K. Southerland, J. M. Acebes, K. Audley, J. Barlow, L. Bejder, C. Birdsall, A. L. Bradford, J. K. Byington, J. Calambokidis, R. Cartwright, A. Masterman, J. Moran, et al. *Accepted*. Bellwethers of change: population modeling of North Pacific humpback whales from 2002 through 2021 reveals shift from recovery to climate response. *Royal Society Open Science*.

Wild, L. A., H. E. Riley, H. C. Pearson, C. M. Gabriele, J. L. Neilson, A. Szabo, J. Moran, J. M. Straley, and S. DeLand. 2023. Biologically Important Areas II for cetaceans within US and adjacent waters—Gulf of Alaska Region. *Frontiers in Marine Science* 10:763.

Reports:

Moran, J. R., J. M. Straley, J. M. Maselko, L. A. Wild, and T. A. Bare. 2023. Long-term monitoring of humpback whale predation on Pacific herring 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-O)*, Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

Moran, J., and J. Straley. 2023. Fall surveys of humpback whales in Prince William Sound. Pages 205-206 in B. E. Ferris and S. Zador, editors. 2023. *Ecosystem Status Report 2023*:



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Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, Anchorage, Alaska.

<https://www.fisheries.noaa.gov/resource/data/ecosystem-status-report-2023-gulf-alaska>.

Dorn, M. W., B. S. Fadely, O. A. Ormseth, L. A. Rogers, R. M. Suryan, M. Szymkowiak, R. P. Angliss, M. G. Dalton, B. E. Ferriss, K. K. Holsman, J. K. Jansen, E. A. Laman, B. J. Laurel, E. P. Lemagie, M. A. Litzow, J. M. London, D. W. McGowan, J. R. Moran, J. H. Moss, W. A. Palsson, J. L. Pirtle, P. H. Ressler, C. K. Seung, K. E. W. Shelden, and B. C. Williams 2023. Gulf of Alaska Regional Action Plan to Implement the NOAA Fisheries Climate Science Strategy Through 2024. NOAA Technical Memorandum NMFS-AFSC-478. <https://www.fisheries.noaa.gov/news/alaska-gulf-alaska-regional-action-plan>.

Popular articles:

Straley, J., L. Wild, and J. Moran. 2023. What happened to the humpback whales of Prince William Sound? Delta Sound Connections 2023-2024. <https://pwssc.org/wp-content/uploads/2023/05/DSC-2023-FINAL-LR.pdf>.

Pester, P. 2023. Humpback whales: Facts about the singers of the sea. Live Science. Interview with J. Moran. <https://www.livescience.com/58464-humpback-whale-facts.html>.

Conferences and workshops:

Arimitsu, M., D. Cushing, J. Durban, S. Hatch, R. Kaler, E. Labunski, C. Matkin, J. Moran, D. Olsen, W. S. Pegau, J. Piatt, S. Whelan, and L. Wild. 2024. Gulf Watch Alaska long-term monitoring program: Pelagic component update 2023. Poster presentation, Alaska Marine Science Symposium. Anchorage, Alaska, January.

Moran, J., J. Straley, L. Wild, J. Maselko, H. Riley, and B. Witteveen. 2024. Long-term monitoring of humpback whales in Prince William Sound, Alaska. Poster presentation, Alaska Marine Science Symposium. Anchorage, Alaska, January.

Nielson, J., C. Gabriele, J. Straley, T. Cheeseman, and C. S. Baker. 2024. Inferred mass mortality of humpback whales in Southeast Alaska since the Northeast Pacific marine heatwave. Oral presentation, Alaska Marine Science Symposium. Anchorage, Alaska, January.



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Teerlink, S., H. Pearson, J. Moran, S. Atkinson, and S. Wright. 2024. Focused humpback whale photo ID effort used to document sublethal human interactions. Poster presentation, Alaska Marine Science Symposium. Anchorage, Alaska, January.

Public presentations:

Moran, J. 2023. The decline of humpback whales in Prince William Sound, Alaska following the 2014–2016 Northeast Pacific marine heatwave. Presentation, Alaska Student Chapter of the Marine Mammal Society. Juneau, Alaska, October.

Moran, J. 2023. What's Happening in Alaska? Whale Tales Maui global check-in segment, 7th Annual Whale Tales, Kapalua, Hawaii, February.

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

Humpback whale blubber samples were sent to Shannon Atkinson, University of Alaska Fairbanks, for stress and reproduction hormone assays.

Humpback whale data were provided to the NOAA Fisheries Unusual Mortality Event working group.

Data sets and associated metadata:

Moran, J., and J. Straley. 2023. CastAway CTD data: 2017-2019 and 2022-2023 Gulf Watch Alaska pelagic component, long-term monitoring of humpback whale predation on Pacific herring in Prince William Sound. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/41844522.

Straley, J., and J. Moran. 2023. Dall's and harbor porpoise survey data, Prince William Sound, Alaska: 2007-2008, 2011-2015, and 2017-2023, Gulf Watch Alaska pelagic component. Gulf of Alaska Data Portal: https://gulf-of-alaska.portal.aos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2514142.

Straley, J., and J. Moran. 2023. Lipid analyses for Pacific herring, invertebrates and humpback whales in the Gulf of Alaska, 2012-2021 and 2022-2023, Gulf Watch Alaska pelagic component. Gulf of Alaska Data Portal: <https://gulf-of->



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alaska.portal.aaos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2510153.

Straley, J., and J. Moran. 2023. Prince William Sound humpback whale fluke ID catalog, 2006-2023. Gulf of Alaska Data Portal: https://alaska.portal.aaos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2510153.

Straley, J., and J. Moran. 2023. Significance of whale predation on natural mortality rate of Pacific herring in Prince William Sound, Alaska: 2006-2009, 2011-2015, 2017-2023, Gulf Watch Alaska pelagic component. Gulf of Alaska Data Portal: https://alaska.portal.aaos.org/#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/41873807.

Additional Products not listed above:

Fleming, H. 2023. Humpback whales in PWS. Field Notes recording. <https://pwssc.org/education/field-notes/>.

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

The humpback whale team collaborates with Prince William Sound Science Center (PWSSC) at a programmatic level because members of the 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). Principal investigators (PIs) have also contributed to the PWSSC Field Notes series regarding PWS humpback whales.

EVOSTC Long-Term Research and Monitoring Projects

The humpback whale project is part of the Pelagic component of the GWA-LTRM program. We collaborate regularly with other pelagic projects. In particular, we conduct the integrated predator-prey surveys with the forage fish project (23120114-C) and exchange killer whale and humpback whale sighting data with the killer whale project (23120114-N). We also work closely with Herring Research and Monitoring component projects regarding herring predation by



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humpback whales, including contributing data to the herring modeling (23120111-C) project for their Bayesian age-structured assessment model.

EVOSTC Mariculture Projects

The humpback whale project has not collaborated with the mariculture projects, but would be happy to discuss issues with humpback whales were they to arise. As an example, PI Wild has engaged with students on possible mariculture gear modifications related to humpback whale entanglement (see below).

EVOSTC Education and Outreach Projects

PIs Moran and Wild led discussion groups for high school and undergraduate students at Sitka Whale Fest.

PI Wild is mentoring an undergraduate student at University of Alaska Southeast Sitka Campus in testing potential gear modifications to increase likelihood of whales breaking free or shedding mariculture gear if an entanglement occurs.

PI Moran assisted Marshall Kain at the Malvern Preparatory School on her research project.

PI Moran participated Yaakoosgé Daakahídi Alternative High School – Ted Stevens Marine Research Institute Tour and Career Panel.

Examples of our study in Prince William Sound is used by Heather Riley during discussions of current research when teaching her Introduction to Oceanography online course through University of Alaska Anchorage/Kodiak College.

Individual EVOSTC Projects

The humpback whale 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

In addition to PI Moran being a NOAA employee, the project makes numerous contributions to NOAA reports and databases, including the following:



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- Humpback whale abundance indicator to the NOAA Gulf of Alaska Ecosystem Status Report for the North Pacific Fishery Management Council
- Humpback whale data were contributed to a model of the North Pacific humpback whale abundance, based on public efforts and the North Pacific Humpback Whale Photo-ID collaboration, and being produced for a potential report to the International Whaling Commission.

The project also provides photographs of sea lion haulouts and brands to the Alaska Department of Fish and Game.

Native and Local Communities

PIs Moran and Wild participated in Sitka Whalefest 2023 as members of the science symposium committee and moderators, and engaged with community members from across Alaska and the US.

4. Response to EVOSTC Review, Recommendations and Comments:

No comments for FY23.



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5. Budget:

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL PROGRAM BUDGET PROPOSAL AND REPORTING FORM								
Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5-YR TOTAL PROPOSED	ACTUAL CUMULATIVE	
Personnel	\$80,157	\$81,515	\$78,040	\$79,866	\$81,739	\$401,317	\$115,073	
Travel	\$15,394	\$14,320	\$14,488	\$18,083	\$14,852	\$77,137	\$12,636	
Contractual	\$50,000	\$50,000	\$50,000	\$52,000	\$52,000	\$254,000	\$100,262	
Commodities	\$4,000	\$7,000	\$7,000	\$2,300	\$2,300	\$22,600	\$6,536	
Equipment & F&A Exempt	\$24,000	\$18,900	\$19,845	\$20,837	\$21,879	\$105,461	\$29,400	
Indirect Costs (varies by proposer)	\$14,255	\$14,897	\$13,887	\$14,379	\$13,846	\$71,265	\$14,673	
SUBTOTAL	\$187,806	\$186,633	\$183,260	\$187,465	\$186,616	\$931,779	\$278,579	
General Administration (9% of subtotal)	\$16,903	\$16,797	\$16,493	\$16,872	\$16,795	\$83,860	N/A	
PROJECT TOTAL	\$204,709	\$203,430	\$199,754	\$204,337	\$203,411	\$1,015,640		
Other Resources (In-Kind Funds)	\$140,000	\$140,000	\$140,000	\$140,000	\$140,000	\$700,000		
<p>COMMENTS:</p> <p>This is the combined budget for the individual Moran and Straley budgets that follow. Moran is affiliated with NOAA, a Trustee Agency, and Straley is affiliated with the University of Alaska Southeast, a Non-Trustee Agency. The budgets have been combined by using a Non-Trustee Agency budget reporting form. This form contains the summary information only. Detail by year for each PI can be found in the following two worksheets.</p> <p>UAS spending for FY22 & FY23 is behind schedule because of the delay in the release of funds by EVOSTC and the issuance of the NOAA grant.</p>								
FY22-26	Project Number: 22120114-O Project Title: Humpback Whale Monitoring PI(s): Moran (NOAA) & Wild (UAS)				SUMMARY TABLE			

The cumulative spending shown above combines NOAA and UAS spending through FY23. NOAA spending is on track, but UAF spending is behind because of the delay in the NOAA grant.