Exxon Valdez **Oil Spill Trustee Council**

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

Annual Project Reporting Form

Project Number: 22220203

Project Title: Assessment of Prince William Sound walleye pollock with investigations into walleye pollock-Pacific herring interactions

Principal Investigator(s):

Wyatt Rhea-Fournier, Alaska Department of Fish and Game

Pete Rand, Prince William Sound Science Center

Mike Byerly, Alaska Department of Fish and Game

Paul Hershberger, United States Geological Survey

David Beauchamp, United States Geological Survey

Andrew Whitehead, University of California - Davis

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

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

Project Website: https://gulfwatchalaska.org/

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

☐ **Project progress is on schedule.**

☒ **Project progress is delayed.**

All field work, lab analysis, and reporting delayed one fiscal year. Project will continue as outlined in the proposal beginning in EVOSTC fiscal year 2023.

☒ **Budget reallocation request.**

See section 5.

☐**Personnel changes.**

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1. Summary of Work Performed:

Due to the delay in the release of funds for FY22 and the resulting no-cost extension request, no field work was performed in 2022 and the summer bottom trawl survey and associated data collections will begin in June 2023. However, in the current fiscal year data collection methods were refined and equipment was purchased. Examination of stomach contents from piscivorous groundfish target species on an Alaska Department of Fish and Game (ADF&G) funded bottom trawl survey in Prince William Sound (PWS) resulted in the observation of Pacific herring in the stomachs of walleye pollock, arrowtooth flounder, and longnose skates. Net mensuration equipment, acoustic equipment, and electronic data collection equipment were purchased in preparation for surveys in 2023. ADF&G personnel also collaborated with Prince William Sound Science Center (PWSSC) staff to ensure standardized collection of oceanographic data.

2. Products:

No publications or additional reports were produced in the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) FY22 as no EVOSTC funded survey took place. Wyatt Rhea-Fournier presented the project proposal and results of stomach content observations from an ADF&G funded bottom trawl for the Gulf Watch Alaska-Long-Term Research and Monitoring (GWA-LTRM) principal investigator (PI) meeting. Martin Schuster, an ADF&G biologist funded through this project, attended the GWA-LTRM PI meeting held at the Alaska Marine Science Symposium.

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

The PWSSC is a partner for this project and ADF&G staff has had consistent communications with their staff. Communications included the collaboration with Scott Pegau and Rob Campbell to assess oceanographic equipment and to standardize collection protocols and coordination with Pete Rand for the purchasing of acoustic equipment and logistics for vessel installation.

EVOSTC Long-Term Research and Monitoring Projects

Project staff continue to collaborate with Dr. Paul Hershberger regarding project logistics. Dr. Hershberger is a PI on this project as well as the companion Herring Disease Program (project 22120111-E). Communications have continued with Andrew Whitehead of UC Davis to evaluate proposed sample collections considering funding limitations.

EVOSTC Mariculture Projects

None

EVOSTC Education and Outreach Projects

None

Individual EVOSTC Projects

None

Trustee or Management Agencies

ADF&G is a Trustee Agency.

Native and Local Communities

None

4. Response to EVOSTC Review, Recommendations and Comments:

May 2021 EVOSTC Science Panel Comment: The Science Panel was supportive of the surveys described under objectives 1 and 2, noting that groundfish interact with and may influence herring via known or suspected links via competition, predation and disease transmission. Regarding objective 1, see suggestions by external peer reviewers and the SP. Regarding objective 2, we note that there are 25 to 30 years of data in hand and the PIs should describe better what has already been learned from these data and why it should continue in the context of this proposal. We recognized the value of pollock data for fisheries models, but the section of the proposal concerning "monitoring groundfish and correlations with local climate indices" could be done with data in hand already. The external reviewers expressed some additional concerns that should be addressed for these objectives.

PI response: The ADF&G historical summer bottom trawl survey data in Objective 2 has not been analyzed for correlations with groundfish (pollock) abundances and climate indices in the past. This trawl survey historically had a primary objective of assessing Tanner crab populations and thus ADF&G's analysis and reports have focused on Tanner crab fishery management goals.

May 2021 EVOSTC Science Panel Comment: Objective 3 is largely redundant of the separate proposal led by Hershberger on herring disease (22120111-E): these activities belonged clearly within the Hershberger proposal. We advise to remove this objective here or more clearly distinguish both here and in the Hershberger proposal how the two are distinct from each other. Activities here should be limited to collecting samples required by Hershberger. Regarding this

collection, the proposal should clarify whether eggs will be collected from female adult pollock or embryos from the water column. This would seem to depend on whether the hypothesis is that disease is obtained from adult females or as free-floating embryos from the environment.

PI response: Objective 3 offers a new collection platform for tissue samples to test for the presence and transmission of Ichthyophonus that is not available in the Hershberger proposal. Objective 3 proposes to evaluate whether Ichthyophonus is transmitted to Pacific herring through ovivory (page 3) and laboratory analysis will confirm that pollock eggs are infected by the disease prior to parturition. Tissue collection activities are specific to the requirements of Hershberger's work (page 11 and 12). The collection of eggs from gravid females caught on the winter A-T survey has been clarified in page 12 revisions.

There is some apparent redundancy between this study and the herring disease study (22120111-E), reflecting the collaborative nature of the two studies and the administrative structure of the EVOS programs. The herring disease study is part of the larger, integrated Gulf Watch Alaska (GWA) Program, but this pollock study is not. The GWA Program was limited to a finite funding request for the entire program, and this finite amount was apportioned among the team members. The scope of work and budget for the herring disease project were developed within these funding parameters. The serendipitous request to develop this pollock proposal (and include the Ichthyophonus ovivory studies) came after the budget for the Herring Disease Project was already maxed out within GWA. Therefore, the budget request for the pollock project includes a small amount of funding for a part time laboratory technician to process the pollock egg samples and run the egg exposure studies in the laboratory.

Eggs will be collected from the ovaries of adult females. We hypothesize that transmission occurs after eggs (with associated parasite) are released from the female and consumed by susceptible herring. At the current time, we have no indication that true vertical transmission occurs (i.e. penetration of the parasite to the inside of the egg); rather, it is more likely that the parasite is somehow associated with the outside of the chorion. For this reason, it is not completely necessary to obtain fertilized embryos from the water column. Additionally, plankton tows (where fertilized eggs might be encountered) are not a part of this study. However, the reviewer makes a good point. If we are not able to demonstrate transmission using ovary-sourced eggs, then we will make every effort to obtain naturally-spawned and fertilized eggs from the water column.

May 2021 EVOSTC Science Panel Comment: We had many concerns about objective 4. Based on the literature cited, predation / interactions between herring and pollock have been thoroughly investigated; thus, we are not convinced of the value of more limited surveys. The description of the calculations and extrapolations made regarding predation rates using the bioenergetic models was disturbingly vague, leaving the SP skeptical that they would actually be useful. The proposal

mentions the Wisconsin model, but then suggests some parameters may be derived from parameters in the von Bertallanffy growth function (VBGF). A study by Essington et al. (Ca. J. Fish Aquat. Sci, 2001), with Kitchell as a co-author, noted high risk of bias in such estimates, and proposed that "biases and precision of these estimates must be made on a case by case basis". Any such estimates must have uncertainty estimates reported alongside, and we felt that the confidence intervals on such estimates could be very wide. We agreed with external peer reviewer comments about spatial and temporal variation in diet, and sampling scheme for quantification of diet in a quantitative way; these would add further uncertainty to the consumption rate estimates. Overall, we felt that the PIs needed considerably more information and justification to consider this component further.

PI response: This project proposes to quantify consumption of herring by pollock from diet information collected during the winter and summer surveys which have considerable spatial overlap. Stomach contents will be collected from pollock during the first half of the winter acoustic-trawl survey in the eastern part of PWS where the summer bottom trawl survey occurs. Other groundfish consumption estimates will be limited to the summer season in the spatial extent of the bottom trawl survey. Text has been edited on page 12 and 15 of the proposal.

May 2021 EVOSTC Science Panel Comment: We also noted that it was not clearly stated which personnel are responsible for which deliverable.

PI response: PIs have been assigned reports in the revised Deliverables section of the proposal.

May 2021 EVOSTC Science Panel Comment: On balance we were supportive of objectives 1 and 2, but viewed the other two less favorably.

September 2021 EVOSTC Science Panel Comment: Our concerns stated in our March review were largely unanswered by the PI responses. Rather than address why existing pollock data were insufficient to address the questions, the PIs merely stated that the data had been used for something else to date. We expected preliminary analysis of existing data to justify objectives 1 and 2. Objective 3 should be merged into proposal 22120111-E as its primary function is to collect eggs for that proposal; the PI responses indicated that it was placed here largely to circumvent a funding cap on the LTRM proposal, which we did not view as a sufficient justification. Our concerns about the Bioenergetic model approach in objective 4 were also largely unaddressed. In general, we were disappointed with the very limited responses, which mostly just reiterated their planned objectives, and thus we are unable to recommend funding.

PI response: After reviewing the Science Panel's comments on Project 22220203, the PIs would like to provide some additional responses to concerns. This project proposes two surveys to assess walleye pollock in Prince William Sound and their interactions with Pacific herring that may be responsible for herring mortality through pathogens and predation. ADF&G's historical summer bottom trawl survey, which catches predatory groundfish (including pollock), was discontinued after 2019 due to budget constraints. Although this summer survey provided valuable information on pollock and other dominant groundfish in PWS, survey objectives did not include a pollock assessment. The bottom trawl survey cannot provide a total biomass estimate of pollock, which is traditionally conducted through winter acoustic-trawl surveys on pre-spawn aggregations. To address Objective 1, the winter acoustic-trawl survey proposed in this project will deliver new information that was previously unavailable by providing a pollock biomass estimate for PWS. This information will be valuable to pollock and ecosystem research in PWS and will provide new data for the Gulf of Alaska pollock stock assessment as supported by the Stock Assessment and Fishery Evaluation report author (M. Dorn letter of recommendation).

The primary objective of the historical ADF&G summer bottom trawl survey was to assess the Tanner crab population in PWS. Although data from this survey has been analyzed to produce groundfish species-specific indices of abundance, correlations with herring abundance or climate time-series have not yet been investigated as it was outside the scope of work of ADF&G. This proposal includes funding to continue the ADF&G summer bottom trawl survey and for an additional ADF&G biologist to increase capacity and facilitate additional research that includes investigating correlations of survey results with herring abundance and/or climate time-series to address Objective 2. The 25-year time series of groundfish catches from the historical ADF&G PWS bottom trawl survey have been analyzed to produce a summer index of abundance for multiple piscivorous groundfish species including pollock (Byerly et al 2022). This historical bottom trawl catch data has weights and lengths for pollock and some piscivorous groundfish that may prey on herring, although age determination was discontinued in 2009. This project will provide additional information as all groundfish identified as herring predators will be aged so growth models can be developed for species specific bioenergetic models. The groundfish age structure data and growth models will be available to ecosystem modeling efforts in other EVOSTC projects.

The continuation of the ADF&G summer bottom trawl survey and the introduction of the proposed winter acoustic-trawl survey will provide new platforms to study the consumption of herring by pollock and other groundfish through the UC Davis DNA barcoding lab and by the USGS bioenergetic lab. The index of abundance for pollock (and other PWS groundfish) from the summer bottom trawl survey and consumption estimates from the bioenergetic modeling will provide new information for assessing the summer predation on herring by a large community of piscivorous fish. The bioenergetic model will provide estimations of daily consumption of

herring by an individual fish and thus can be scaled to any population estimate to be included as population removals within stock assessment modeling. Pollock stomach contents will also be analyzed from the winter survey and thus it will be possible to construct annual consumption rates and investigate seasonal variable of herring predation by pollock. This information was previously unavailable to fulfill Objective 4. This project proposal has been amended to address the concerns of the Science Panel on spatial and temporal variability of groundfish consumption estimates while recognizing the opportunity to provide new information on herring mortality through predation that was previously unavailable.

Inclusion of this pollock proposal into the portfolio of EVOSTC projects provides value to proposal 22120111-E (Herring Disease Program) by providing access to pollock eggs on the winter acoustic-trawl survey that were previously unavailable. The budget for project 22120111-E was already at the maximum Alaska Gulf Watch allocation for the other identified objectives when the opportunity for pollock samples arose in project 22220203. Therefore, this proposed project provides value to 22120111-E with a minimal cost. If project 22220203 were not funded, and the pollock ovivory objective remained in #22120111-E, then the Herring Disease Program would have needed an alternative pollock sampling platform to fulfill project objectives.

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	$83,901	$192,328	$246,203	$201,522	$283,057	$1,007,011	$30,622
Travel	$4,000	$11,210	$8,323	$4,245	$8,660	$36,438	$0
Contractual	$78,000	$148,725	$58,725	$27,000	$68,725	$381,175	$32
Commodities	$19,500	$11,670	$9,833	$8,949	$10,179	$60,131	$18,069
Equipment	$116,310	$0	$0	$0	$0	$116,310	$50,752
Indirect Costs (varies by proposer)	$31,674	$39,231	$41,563	$28,396	$43,696	$175,810	$0
SUBTOTAL	$333,385	$403,164	$364,647	$270,111	$414,317	$1,785,624	$99,475
General Administration (9% of subtotal)	$30,005	$36,285	$32,818	$24,310	$37,289	$160,706	N/A
PROJECT TOTAL	$363,390	$439,448	$397,465	$294,421	$451,606	$1,946,331	
Other Resources (In-Kind Funds)	$59,000	$60,200	$61,400	$62,600	$63,900	$307,100	

COMMENTS:
This is the summary spreadsheet for PIs associated with ADF&G (Rhea-Fournier), PWSSC (Rand), and USGS (Hershberger and Beauchamp). See subsequent spreadsheets for details.

The delayed release in FY22 funding resulted in this project delaying field work for one year and expenses are lower than anticipated. The PIs requested a no-cost extension to use FY22 funds in following years.

FY22-26	Project Number: 22220203 Project Title: Pollock-Herring Interactions PI(s): Rhea-Fournier (ADF&G), et. al	SUMMARY TABLE

When funds for this project were released, ADF&G had not yet received spending authority as a Capital Project during the State of Alaska's 2022 fiscal year (July 2021-June 2022), and thus the proposed June 2022 survey could not be completed. Furthermore, due to an ADF&G research vessel being decommissioned and limited availability on the remaining vessel, it was not possible to complete the survey during the remaining summer months of 2022. Subsequently, Wyatt Rhea-Fournier requested a no-cost extension to delay all survey work and associated laboratory analysis costs for one year. Work will continue as proposed in the EVOSTC 2023 fiscal year. Items such as net mensuration and hydroacoustic equipment were purchased after funds were released in March 2022 to prepare for a June 2023 bottom trawl survey. Line 100

funding was allocated to the salary for an ADF&G biologist in 2022 to prepare for the 2023 survey, coordinate with co-PIs, and assist in report writing.

In addition, adjustments will need to be made to the PWSSC budget for co-PI Rand. This project was originally proposed as an individual project and was added to the GWA-LTRM program after it was funded by EVOSTC. As an individual project, PWSSC included its customary 35% indirect rate, but as a project within the GWA-LTRM program, the indirect rate is waived and personnel costs typically included in the indirect rate are billed.