Exxon Valdez **Oil Spill Trustee Council**

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

Annual Project Reporting Form

Project Number: 22160111-F

Project Title: Herring surveys and age, sex, and size collection and processing

Principal Investigator(s): Jennifer Morella, Alaska Department of Fish and Game

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

Submission Date (Due March 1 immediately following the reporting period): March 1, 2023, modified June 6, 2023 and June 30, 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.**

A budget reallocation is not requested, but differences between categories are explained in the Budget section below.

☐ **Personnel changes.**

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1. Summary of Work Performed:

The Alaska Department of Fish and Game (ADF&G) was funded for this project to conduct herring aerial surveys and to sample herring for age, sex, size, and sexual maturity (ASL). In addition to these two over-arching objectives, this project plays a central role in coordinating and collaborating survey and sampling efforts with all Herring Research and Monitoring (HRM) projects. We provide the R/V Solstice as a research platform, collect herring samples for multiple projects, provide logistical support for field work, travel, and sample shipment, and disseminate aerial and vessel survey observations in a timely manner. Spring aerial herring surveys and ASL sampling have been conducted by ADF&G in Prince William Sound since the early 1970s. These two datasets are the longest continuous time-series records of herring in Prince William Sound and as such are critical inputs to age structured modeling and stock assessment efforts, and provide a basis for understanding the population dynamics, changing biomass, and biological processes that are happening in the population. Funding provided by the *Exxon Valdez* Oil Spill

Trustee Council (EVOSTC) allows ADF&G to continue to conduct these surveys and collections and provides continuity for these two long-term datasets. Overall, this critical project serves as a foundation to the HRM program and directly assists, coordinates, or provides data and/or samples to other projects within the HRM program.

During 2022, we conducted 69 hours of aerial surveys during 22 flights of Prince William Sound. The 2022 Prince William Sound aerial spawn estimate is 32.7 statute mile-days-of-milt (Fig. 1). This is the highest level of spawn recorded since 2014 and 56.5 % above the 10-year average (2012-2021) of 20.9 mile-days-of-milt. The first aerial survey was flown on March 21 and the first observed spawn occurred on April 2, two days earlier than the 10-year average date of first spawn (Fig. 2). Surveys continued through April 28 and the last spawn was observed on April 27, one day later than the 10-year average date of last spawn. The department was unable to fly surveys due to inclement weather from April 4 - 6 during a portion of the spawning activity at Hell's Hole therefore the mile-days of milt estimate is biased low. Spawn was documented in two areas that have no historical documentation of spawn, Mummy Islands and Boswell Bay (Fig. 2). In 2022, we monitored satellite imagery to look for spawn in areas or on days we did not fly, although satellite imagery is limited by cloud cover and satellite view, it is becoming a helpful tool to identify spawning events that may otherwise go undetected. We did not detect any spawn events from satellite imagery in 2022 there were not documented by aerial surveys.

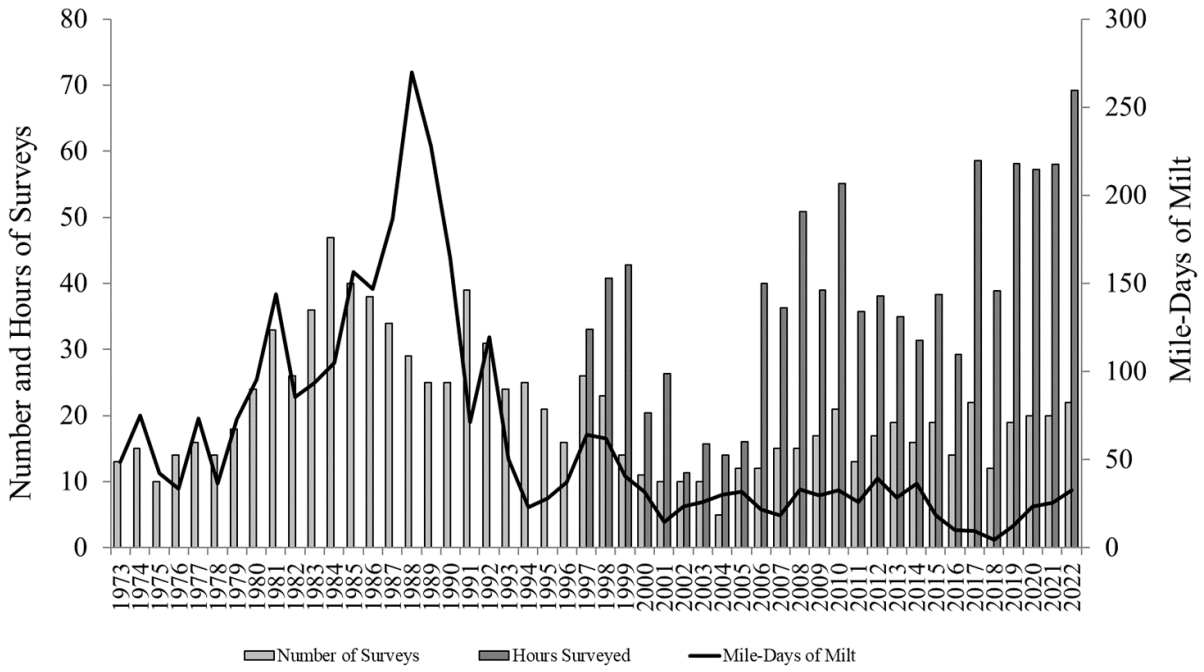

Figure 1. Prince William Sound herring aerial survey effort and mile-days of milt, 1973-2002.

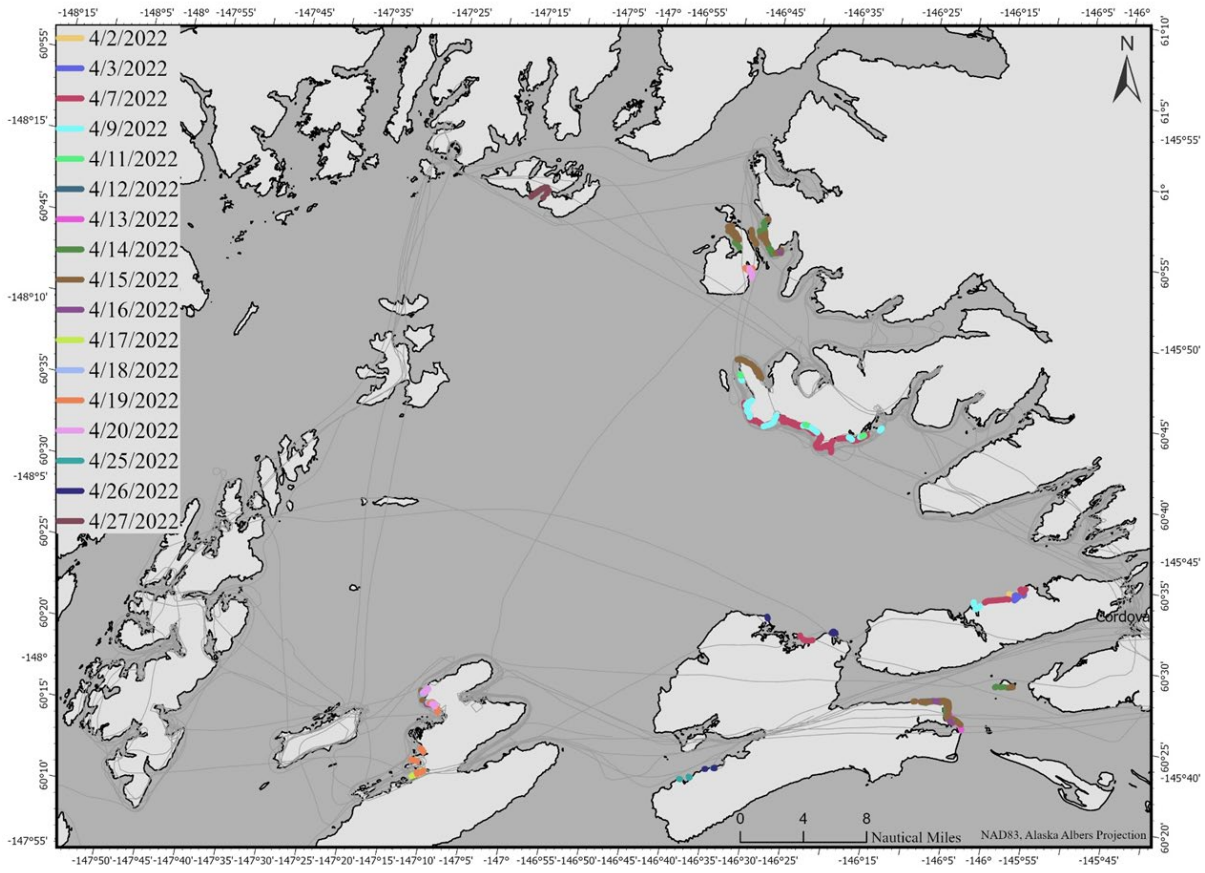

Figure 2. 2022 timing and distribution of Prince William Sound herring spawn.

ASL sampling of 2022 spring herring was conducted in six locations within Prince William Sound: Red Head, Cedar Bay, Rocky Bay, Port Chalmers, Port Etches and Boswell Bay. Overall, Prince William Sound age composition was 19.5% age 3, 10.7% age 4, 15.8% age 5, 51.3% age 6 and 2.8% age 7 or older (Fig. 3). Overall weight at age increased in all major age classes (Fig. 4) while length at age decreased (Fig. 5).

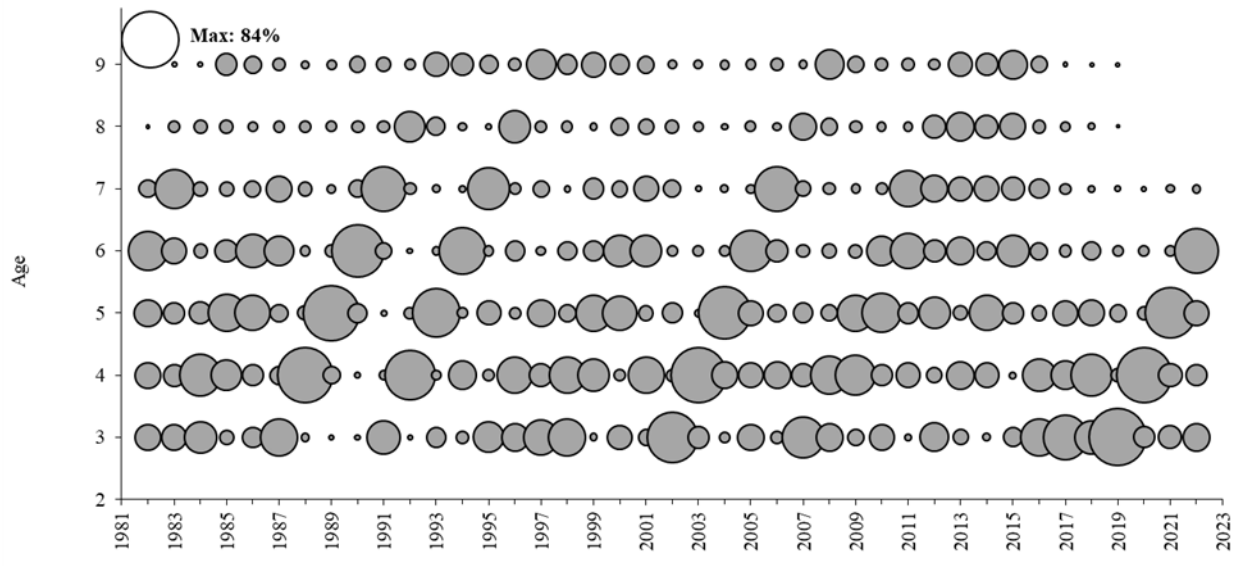

Figure 3. Spring Prince William Sound herring age composition by year, 1982-2022

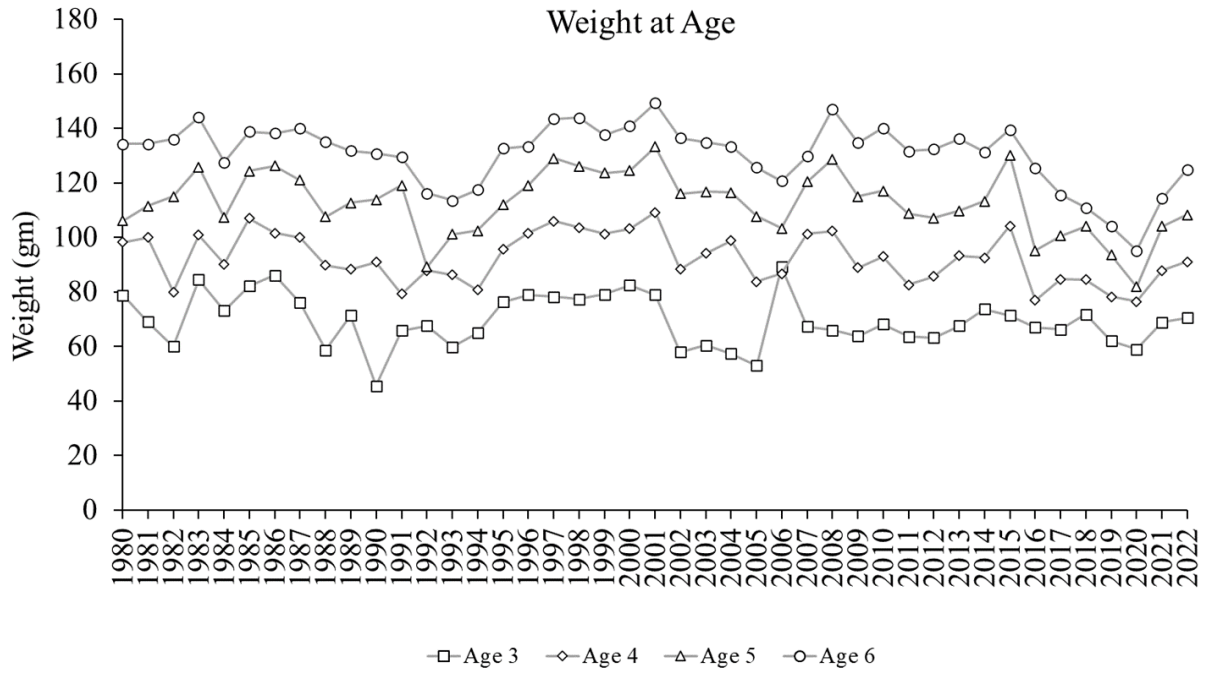

Figure 4. Spring Prince William Sound herring weight at age, 1980-2022.

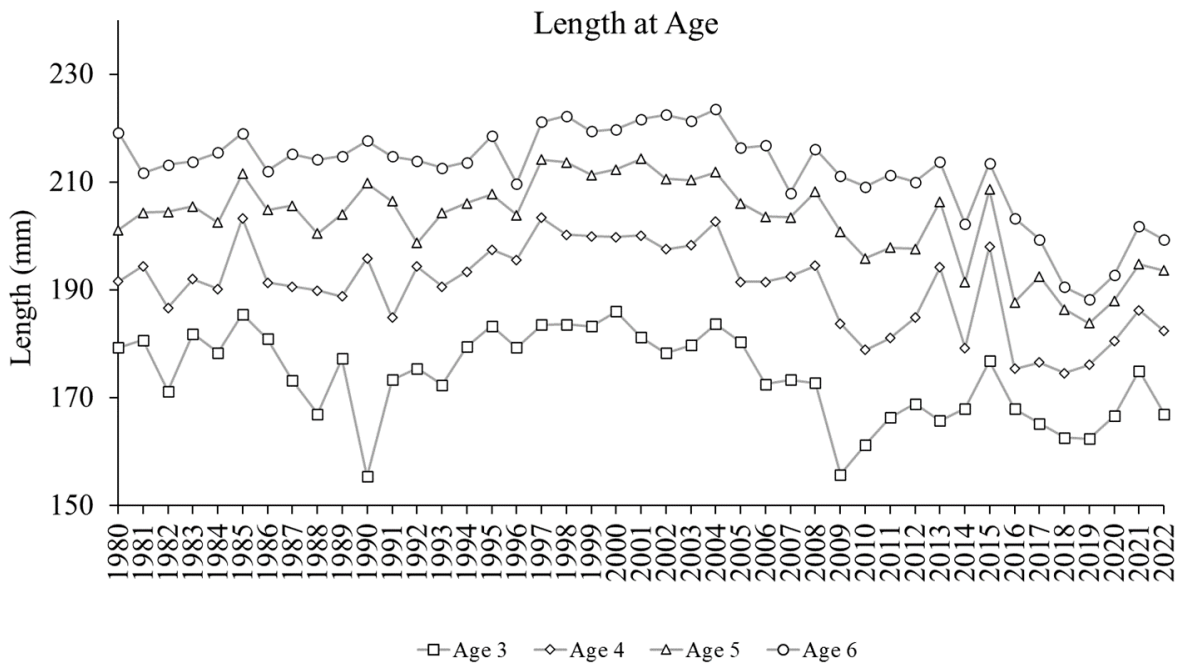

Figure 5. Spring Prince William Sound herring length at age, 1980-2022.

We conducted 10.25 hours of aerial surveys during 5 surveys of Kayak and Wingham Islands. The 2022 Kayak Island area aerial spawn estimate is 41.1 statute mile-days-of-milt. Historically, Kayak Island has not had regular aerial survey coverage or sampling, and therefore was not included in the development of the age structured assessment (ASA) model and the minimum spawning biomass threshold for consideration of a commercial fishery. Additionally, Kayak Island herring stocks historically have not been commercially fished. Large spawning events have occurred at Kayak Island in 2021 and 2022, with total mile-days of milt at Kayak Island exceeding Prince William Sound. Historic estimates of Kayak Island spawn should be considered a minimum due to limited survey efforts and therefore are not comparable to recent data. However, we believe spawn at Kayak Island has markedly increased in the past two years. It is unlikely that spawning events of the magnitude of 2021 and 2022 would have gone unnoticed and unreported with local air and boat traffic (boats and planes often transit from Sitka to Cordova, travelling past Kayak Island, during this spawn timing). We collected an ASL sample from Kayak Island using a variable mesh gillnet aboard the F/V Redline. We also collected live herring for disease analysis and transported them back to Cordova where we processed them with US Geological Survey staff. Age composition of the Kayak Island sampling event was 6.2% age 3, 6.2% age 4, 21.6% age 5, 63.2% age 6 and 2.7% age 7 or older fish.

2. Products:

Peer-reviewed publications:

None

Reports:

Scannell, H., J. Botz, K. Gatt, J. Morella, J. Buza, and R. Ertz. 2022. 2021 Prince William Sound area finfish management report. Alaska Department of Fish and Game, Fishery Management Report No. 22-XX, Anchorage.

Popular articles:

None

Conferences and workshops:

None

Public presentations:

Oral presentation, Herring Research and Monitoring PI meeting, Recorded Presentation, November 8, 2022

Oral presentation, Salmon Harvest Task Force Spring Meeting, Cordova, AK, April 20, 2022

Oral presentation, Salmon Harvest Task Force Fall Meeting, Cordova, AK, November 1, 2022

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

2018 individual aerial survey maps (distributed to herring list serve within 24hrs of survey),
2008-2022 aerial herring biomass observations shapefiles
1973-2022 aerial herring spawn observations shapefiles
1997-2022 herring aerial survey routes shapefiles
2008-2022 aerial survey marine bird observations shapefiles
2008-2022 aerial survey marine mammal observations shapefiles
2008-2022 aerial survey sea lion observations
1973-2022 PWS herring age, sex size

Data sets and associated metadata:

2008-2022 aerial herring biomass observations shapefiles
1973-2022 aerial herring spawn observations shapefiles
1997-2022 herring aerial survey routes shapefiles
2008-2022 aerial survey marine bird observations shapefiles
2008-2022 aerial survey marine mammal observations shapefiles
2008-2022 aerial survey sea lion observations
1973-2022 PWS herring age, sex size

Additional Products not listed above:

ADF&G advisory announcements- 2022 PWS Herring Announcement #1 May 26, 2022
ADF&G advisory announcements- 2022 PWS Herring Announcement #1 October 12, 2022
https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareapws.herring

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

There were no collaborative projects with the Alaska SeaLife Center. The herring surveys and ASL project collaborates with Prince William Sound Science Center at a programmatic level because members of the Gulf Watch Alaska-Long-Term Research and Monitoring (GWA-LTRM) program management teamwork for PWSSC.

EVOSTC Long-Term Research and Monitoring Projects

This project coordinates and collaborates with all Herring Research and Monitoring (HRM) component projects of the GWA-LTRM program. We provided daily aerial survey results and boat-based observations to all HRM field programs. We provided the R/V Solstice (as well as ADF&G personnel) as a research platform for disease sampling (project 22120111-E). We aged ~400 herring, collected organ samples, and provided transport logistics for the disease project (project 22120111-E). Additionally, we collected a Kayak Island herring sample for disease analysis. Finally, we provided 2022 herring ASL results and aerial survey and ASL results to the modeling and stock assessment project (project 22120111-C). We participated in management strategy evaluation workshop meetings as part of Joshua Zahner's thesis work associated with the modeling and stock assessment project and provided ASL data for this work.

EVOSTC Mariculture Projects

This project has not collaborated with mariculture projects to date.

EVOSTC Education and Outreach Projects

This project has not collaborated with education and outreach projects to date. However, this project contributes content to the Herring Watch Facebook page. Contributions include maps from each survey, photos, and descriptions of ASL sampling efforts and updates such as mile-days of milt season totals etc.

Individual EVOSTC Projects

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

Trustee or Management Agencies

This work is performed by ADF&G (a Trustee Agency) commercial fisheries research and management personnel. The results of both the aerial surveys and age/size structure are critical to the management of herring commercial fisheries in Prince William Sound. The estimates of aerial biomass as well as age structured assessment model outputs are central in evaluating the population in relation to regulatory thresholds set in the Prince William Sound Herring Management Plan (5 AAC 27.365). Results of these surveys are disseminated to all relevant ADF&G commercial fisheries management and research staff.

Native and Local Communities

This project regularly engages with native and local communities. The Native Village of Tatitlek receives herring survey maps after each survey and much of the community accesses survey maps through the herring watch Facebook page. Herring are an important subsistence resource and our aerial observations are utilized by native and local communities to guide timing and location of subsistence harvest efforts. The Native Village of Tatitlek regularly shares their herring observations with us. Additionally, many Prince William Sound commercial herring permit holders live in Cordova and have interest in Prince William Sound herring. The PI regularly meets with the local fisherman's organization to discuss herring and provides informational presentations at fishermen's meetings. In 2022, several community members aided in sample collection in collaboration with ADF&G staff.

4. Response to EVOSTC Review, Recommendations and Comments:

May 2021 EVOSTC Science Panel Comment: The work described in this proposal is designed to collect data in support of other projects, especially the biomass assessment project (22120111-C Branch). Additionally, this project also provides a platform for collection opportunities in support of other projects. In recent years we have discussed whether the project should be evaluated similarly to others where we consider the importance and clarity of the hypotheses and the likelihood of relevant scientific output, especially in the form of peer-reviewed papers, are taken as indicators of the significance and probability of success of the project. Given the role of this project is primarily data collection in service of other projects, different metrics of success may need to be applied.

PI Response: Thank you for recognizing the role of this project.

May 2021 EVOSTC Science Panel Comment: With reference to the vitally important tasks of conducting aerial surveys of spawn and collection of specimens in support of biological assessment, the PI has a sterling record: both for data collection and cooperation and collaboration with the PIs in many projects. We acknowledge this significant contribution and suggest that the many collaborators who use data from this project might consider additional acknowledgement of this project's contributions, perhaps in the form of inclusion of the PI as a manuscript co-author and at the very minimum recognition in the acknowledgements.

PI Response: This is the current practice regarding use of data within the program.

May 2021 EVOSTC Science Panel Comment: The information collected from this work is essential for all herring-related project work as well as other work funded by EVOSTC. The PI has done an excellent job of reporting the results in a form useful to other researchers. During the proposal review, however, we were advised of a change in the PI for this project. We suggest that this is an opportune time to consider a different kind of reporting for this essential work. For instance, it might be beneficial to see some form of a longer, more detailed technical report that would describe the methods and results, with special attention given to both the limitations and merits of the approach. A specific task might be some documentation about the nature of interannual variation in the estimates of spawn miles and commenting on the potential both for missed spawns related to unusual spawning dates (early and later than the surveys) or survey interruptions related to weather or equipment malfunction.

PI Response: We agree with the need for an error analysis associated with the methods and the topic is expected to be further addressed in the workshop proposal.

May 2021 EVOSTC Science Panel Comment: There is a specific question that requires clarification. On page 11 of the proposal there is a comment about 'reader drift'. What is this and is it important? Also, we expect to see the qualifications (including CV) for the new project PI included in the revised proposal.

PI Response: Reader drift is the divergence of age estimates by different readers over time. It is essential for their use in stock assessment that age estimates do not differ by readers over time. Current protocols include independently interpreting age by two or three readers followed by discussion of any discrepancies to reach a consensus on age estimation and further spot checking by the crew leader. These protocols are established to prevent reader drift in age estimates. I have updated the sentence on page 11 (Section 4, Project Design, B. Procedural and Scientific Methods) to better define reader drift. Qualifications have been updated in Section 10, Project Personnel, to reflect the change in PI.

September 2021 EVOSTC Science Panel Comment: This project is essential both for annual herring assessments as conducted by ADFG and for other research projects supported with EVOSTC funds. While we appreciate the positive responses of the PI to most of our recommendations, the response to the specific recommendations about documentation of methodologies and sources of error etc. was unclear. The PI advises that this recommendation will be addressed through a workshop. However, if the proposed workshop does not proceed as planned, then this important task will not be addressed. To reiterate, we advise that it is in the interest of all researchers who access any output from herring assessments and related work to have an accessible document that explains the methods and sources of error associated with all aspects of this project for all years that work has been conducted. Such a document would be comprehensive and explain strengths and weaknesses of aerial and shipborne surveys, including the implications of related topics, such as 'reader drift' during annual analyses of age through herring scales. The PI advises that such a document will be produced from a future workshop. We will leave the specific choice of reporting venue to the PI. However, we suggest that a workshop might not be a suitable venue to compile and describe all aspects of the methodology and sources of error. We expect the report to be thorough and probably too long for typical workshop reports. However, if the workshop cannot proceed then another report format should be used. We consider this requirement for this report as 'expected' and not optional and will consider this in future reviews of this project.

PI Response: An operational plan containing detailed methodology since the early 1970s with limitations and merits of prior and current approaches was published in 2019 (Shepherd and Haught, 2019). We will work towards expanding this into a more detailed technical report.

Shepherd, C. S., and S. Haught. 2019. Pacific herring aerial surveys and age, sex, and size processing in the Prince William Sound Area, 2018–2021. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.2A.2019.05, Cordova.

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	$72,526	$80,489	$76,197	$78,102	$80,055	$387,368	$81,607
Travel	$1,560	$1,599	$1,639	$1,680	$1,722	$8,200	$0
Contractual	$67,000	$85,063	$72,493	$75,421	$78,479	$378,456	$39,991
Commodities	$2,600	$2,665	$2,732	$2,800	$2,870	$13,666	$22,088
Equipment	$0	$38,775	$25,000	$0	$0	$63,775	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
SUBTOTAL	$143,686	$208,590	$178,060	$158,003	$163,125	$851,465	$143,686
General Administration (9% of subtotal)	$12,932	$18,773	$16,025	$14,220	$14,681	$76,632	N/A
PROJECT TOTAL	$156,617	$227,363	$194,086	$172,224	$177,807	$928,097	
Other Resources (In-Kind Funds)	$55,030	$56,405	$57,815	$59,261	$60,742	$289,253	

COMMENTS:
Spending for FY22 is estimated based on the spenddown of funds from the FY17-21 funding cycle no cost extension and delay in release of EVOSTC FY22 funds.

In-Kinds funds are from general fund payroll for permanent ADF&G staff associated with this project. This project leverages considerable existing ADF&G resources including R/V Solstice and other field and lab equiment as well as ADF&G long-term datasets.

FY22-26	Project Number: 22170111-F Project Title: Spawning Surveys & ASL Primary Investigator: Morella (ADF&G)	TRUSTEE AGENCY SUMMARY PAGE

Spending for FY22 is estimated based on the spenddown of funds from the FY17-21 funding cycle no cost extension and delay in release of EVOSTC FY22 funds.

The differences between proposed and actual cumulative spending for FY22 for personnel, contractual and commodities categories are explained below:

Personnel: The personnel category was overspent because the recent increases in herring biomass in Prince William Sound allowed ADF&G to collect more ASL samples which resulted in more processing time, and increases in levels of herring spawn required more aerial surveyor staff time (and associated premium pay) to adequately document the spawn.

Contractual and Commodities: When ADF&G budgets for use of the R/V Solstice as a platform for this work ($2,200 per day) we budget it into contractual. However, because the Solstice is an in-house vessel, the division using it is not billed a daily rate, instead the division responsible for the vessel charges purchases or services to the ADFG&G EVOSTC budget equal to an amount for the total days of use. Due to the uncertain nature of vessel work it is difficult to forecast vessel needs annually by budget category, we overspent commodities and underspent contractual. This was for vessel purchases primarily related to marine diesel and reconditioning a winch and associated hydraulics.