

ATTACHMENT B. Annual Project Report Form (Revised 11.21.19)

1. Project Number:

20160111-F

2. Project Title:

Herring Program – ASL Study and Aerial Milt Surveys

3. Principal Investigator(s) Names:

Stormy Haught – Alaska Department of Fish and Game

4. Time Period Covered by the Report:

February 1, 2020-January 31, 2021

5. Date of Report:

March 2021

6. Project Website (if applicable):

<https://pwssc.org/herring/>

7. 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 every project within the HRM program.

We conducted 57 hours of spring aerial surveys of Prince William Sound during 20 flights from March 19 to May 10, 2020. The number of survey flights and total flight hours in 2020 were above 2000-2019 averages (Table 1). Herring data collected included location and linear extent of herring milt by flight, classification of herring milt (intensity), and herring school biomass. Data collected on other species included observations on the distribution and abundance of birds, sealions, and other marine mammals. We observed 23.7 mile-days of spawn in 2020, the most since 2015 (Fig. 1). In addition, we integrated all current and past aerial survey data (flight tracks, spawn extents, bird/mammal observations) into a Geodatabase in ArcGIS.

We conducted no R/V Solstice-based herring sampling surveys in 2020 due to the pandemic. Community members and staff collected herring samples with cast net near Hells Hole and Red Head (April 3, April 4), Double Bay (April 10, April 17), and Canoe Pass (April 8, April 23-25). We processed and summarized ASL data (Fig. 2) from ~ 1,700 herring collected during opportunistic sampling in 2020. These samples included herring sampled for this project as well as HRM disease studies. Herring age compositions in 2020 were dominated by the 4-year-old age class, which composed 79% of fish sampled. Average size at age of age-3, -4, -5, and -6 fish increased in 2020 after a trend of declining size at age in recent years (Fig. 3).

This work is performed by ADF&G 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 acoustic biomass and 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.

Table 1. Prince William Sound herring aerial survey effort, 1997-2020.

Year	Number of Flights	Average Hours Per Flight	Total Hours of Flight Time
2000	8	2.9	20.4
2001	11	2.4	26.4
2002	8	2.3	11.3
2003	10	2.3	15.8
2004	6	2.8	14
2005	10	3.2	16.1
2006	12	3.3	40
2007	15	2.6	36.3
2008	15	3.4	50.9
2009	17	2.6	39

Year	Number of Flights	Average Hours Per Flight	Total Hours of Flight Time
2010	21	2.6	55.1
2011	13	2.7	35.7
2012	17	2.2	38.2
2013	19	1.8	35
2014	16	2.0	31.4
2015	19	2.0	38.4
2016	14	2.1	29.3
2017	22	2.7	58.6
2018	12	3.2	38.9
2019	19	3.1	58.2
2020	20	2.9	57.2
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2000-2019 Average	14	2.6	34.5

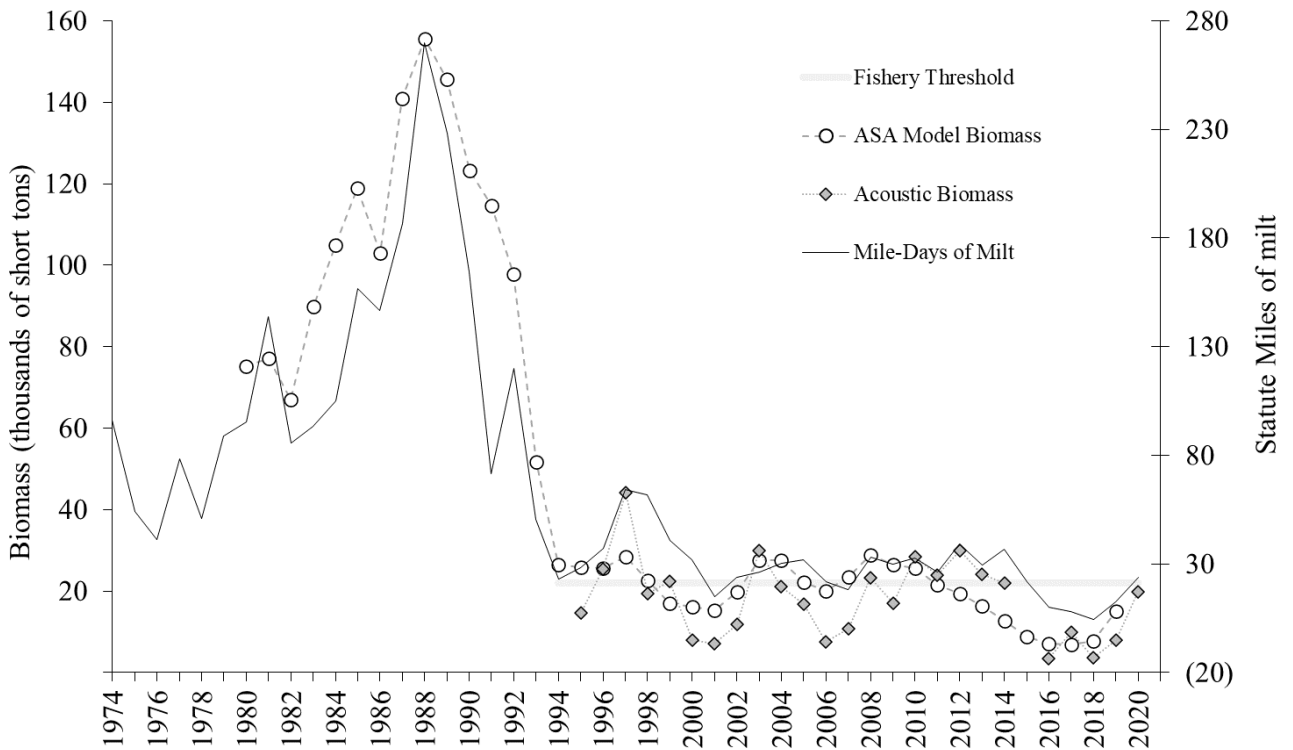


Figure 1. Prince William Sound mile-days of herring milt, acoustic biomass, age-structure-assessment (ASA) modeled biomass, and fishery threshold (5 AAC 27.365), 1974-2020.

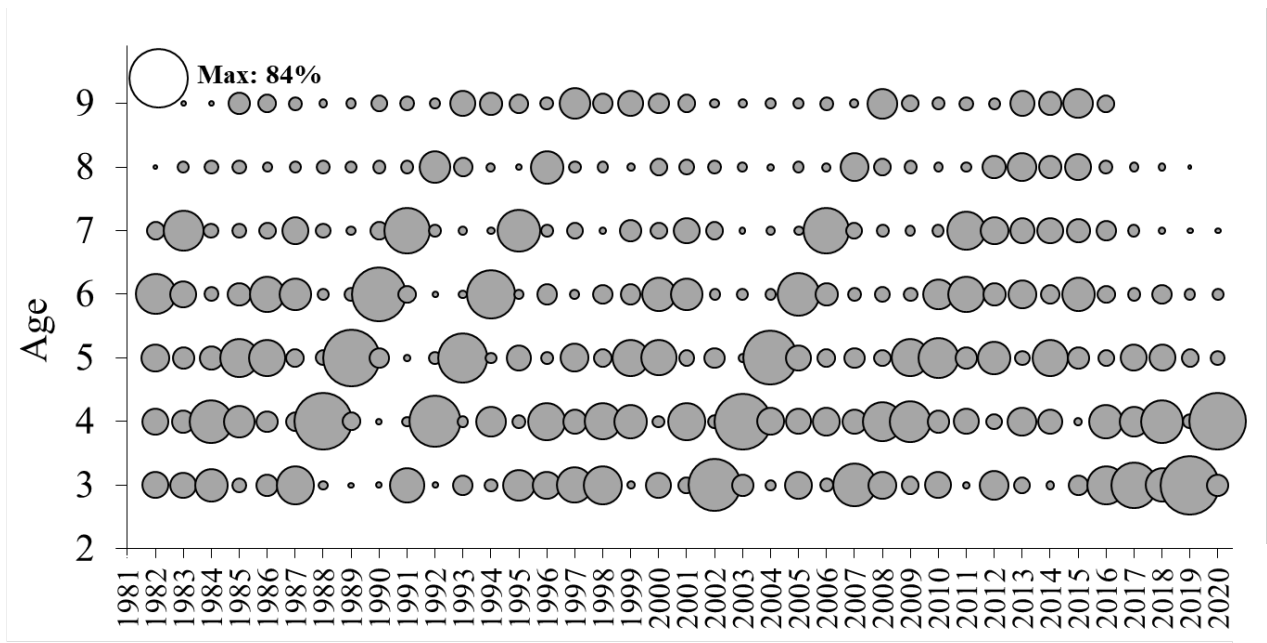


Figure 2. Spring Prince William Sound herring age composition by year 1982-2020.

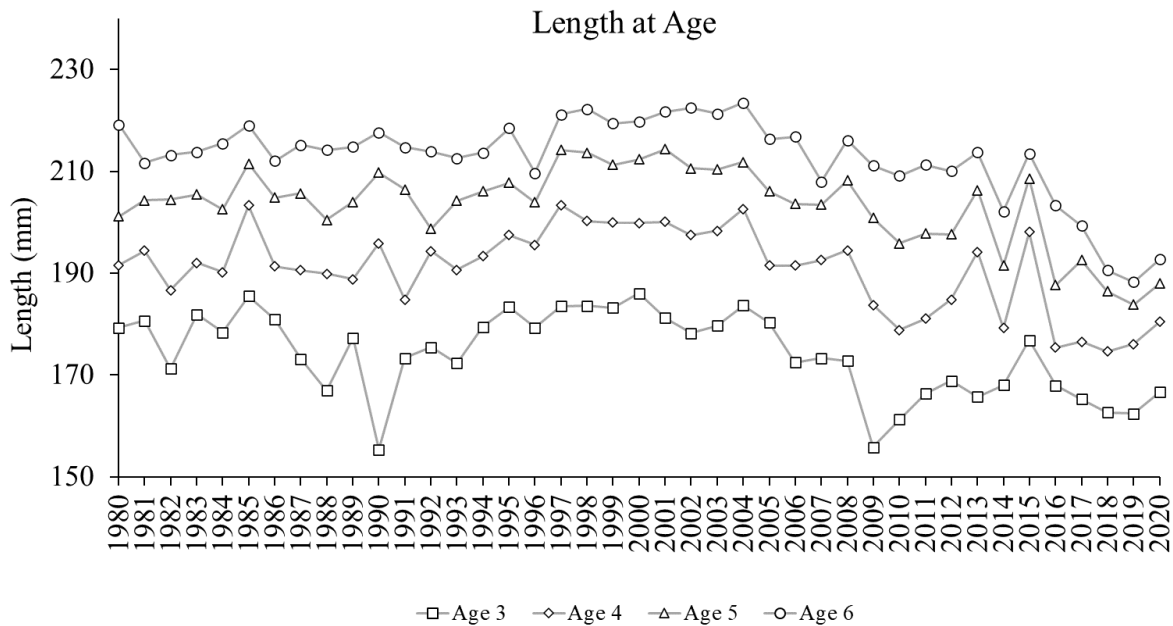


Figure 3. Spring Prince William Sound herring length at age 1980-2020.

8. Coordination/Collaboration:

A. Long-term Monitoring and Research Program Projects

1. Within the Program

This project coordinated and collaborated with all HRM projects. We provided daily aerial survey results and boat-based observations to all field programs. We provided ADF&G personnel, equipment, and facilities for disease sampling (project 20120111-E), and reproductive maturity sampling (20170111-D). We aged ~300 herring, collected gonad samples, and provided transport logistics for the disease project (project 20120111-E). We provided 2020 herring ASL results to the adult acoustics survey (project 20120111-G) and provided aerial survey and ASL results to the modeling and stock assessment project (project 20120111-C).

2. Across Programs

a. Gulf Watch Alaska

We provided aerial mile-days of milt and biomass datasets to Gulf Watch Alaska project 20120114-O, PIs Moran and Straley, in order to explore relationships with humpback whale abundance.

b. Data Management

We provided updates for all aerial survey and ASL datasets including spatial data (ArcGIS files) to data management project for dissemination to other researchers.

B. Individual Projects

N/A

C. With Trustee or Management Agencies

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9. Information and Data Transfer:

A. Publications Produced During the Reporting Period

1. Peer-reviewed Publications

McGowan, D.W., T.A. Branch, S. Haught, and M. Scheuerell. In Prep. Multi-decadal shifts in the distribution and timing of Pacific herring (*Clupea pallasii*) spawning in Prince William Sound, Alaska.

2. Reports

Haught, S., 2020. Herring Research and Monitoring ASL Study and Aerial Milt Surveys. Annual Report, (Exxon Valdez Oil Spill Trustee Council Program 19160111-F). *Exxon Valdez Oil Spill Trustee Council*, Anchorage, Alaska.

Pegau, W. S, and D. R. Aderhold, editors. 2020. Herring Research and Monitoring Science Synthesis. Herring Research and Monitoring Synthesis Report, (Exxon Valdez Oil Spill Trustee Council Program 20120111). *Exxon Valdez Oil Spill Trustee Council*, Anchorage, Alaska.

Pegau, W.S., J. Trochta, and S. Haught. 2020. Prince William Sound Herring. Pages 82-84 [In] B. Ferriss and S. Zador, editors. Ecosystem Status Report 2020, Gulf of Alaska. North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation Report 2020, Anchorage.

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.

3. Popular articles

N/A

B. Dates and Locations of any Conference or Workshop Presentations where EVOSTC-funded Work was Presented

1. Conferences and Workshops

Haught, S. 2020. Prince William Sound herring spawn and ASL, 2020. Oral presentation, Herring Research and Monitoring 2020 PI meeting, online, November 19.

2. Public presentations

N/A

C. Data and/or Information Products Developed During the Reporting Period, if Applicable

Data and information products developed during the reporting period include: 2020 individual aerial survey maps (distributed to HRM participants, other herring researchers, and a variety of stakeholders within 24hrs of survey), 2008-2020 aerial herring biomass observations shapefiles, 1973-2020 aerial herring spawn observations shapefiles, 1997-2020 herring aerial survey routes shapefiles, 2008-2020 aerial survey marine bird observations shapefiles, 2008-2020 aerial survey marine mammal observations shapefiles, 2008-2020 aerial survey sea lion observations shapefiles, ASL database updated through 2020, and age structure and size at age summaries by sample and overall (pooled).

D. Data Sets and Associated Metadata that have been Uploaded to the Program's Data Portal

Data sets and associated metadata that have been uploaded to the Data Portal include: 2020 aerial survey maps, 2008-2020 aerial herring biomass observations shapefiles, 1973-2020 aerial herring spawn observations shapefiles, 1997-2020 herring aerial survey routes shapefiles, 2008-2020 aerial survey marine bird observations shapefiles, 2008-2020 aerial survey marine mammal observations shapefiles, 2008-2020 aerial survey sea lion observations, 2014-2020 herring ASL data.

10. Response to EVOSTC Review, Recommendations and Comments:

Sept 2020: Science Panel Comment – FY21: This project continues to execute good field work and the PIs are to be commended for finding creative ways to get samples during the pandemic. Deliverables are being achieved on time. The SP appreciates the comment that care needs to be exercised in the interpretation of age, sex and length composition as cast nets are selective for males. The SP seems to recall studies that demonstrated this with larger fish (more likely to be females) at greater depths than males. Are there comparative gear studies that would allow for correction of the bias associated with cast nets? Perhaps there is a gear study that compared paired sample collections by purse seine and cast nets? If so, this would be useful to document and incorporate.

Haught response to Science Panel:

I am not aware of any existing comparative gear studies that would allow for correction of historical PWS cast net data. Paired purse seine/cast net sampling would not be feasible. We target actively spawning herring (in the milt cloud, usually in depths <2m) with cast nets and pre-spawn/staging

schools (offshore, usually in depths > 12 fathoms) with a 150 x 17 fathom purse seine. However, pairing cast net samples with other gear deployable in shallow water, such as beach seine or variable mesh gillnet would likely provide insights into any potential cast net male bias. It is possible that males bias in cast net samples is reflective of a truly male biased sex ratio within the milt cloud. Deploying additional gear types while sampling actively spawning herring could help elucidate the observed bias.

Sept 2020: Science Panel Comment – FY21: From a bigger picture perspective, the SP noted that a 33-year old study (Brady 1987) is still being cited as the authority on the behavior of herring in PWS. Given the addition of so much more herring research and observations since the 1980s, the SP encourages the PIs, perhaps in collaboration with other scientists, to develop a new synthesis on PWS herring that would become the new authoritative reference.

Haught response to Science Panel:

This comment has been shared with the program coordinator for discussion in the development of future work.

Sept 2020: Science Panel Comment – FY21: What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

Haught response to Science Panel:

We operated somewhat normally during 2020 but did cancel our purse-seine surveys. ADF&G vessel surveys have since resumed and there are not expected to be cancellations for the coming spring. Some vessel crew substitution may be needed if out of state crew (USGS disease studies) are unable to participate due to travel restrictions.

Sept 2020: Science Panel Comment – FY21: Will any unused funds for FY21 be repurposed for additional lab and/or data analyses?

Haught response to Science Panel:

Our aerial survey gear is badly in need of upgrade. We currently use Panasonic Toughbooks and a custom ArcPad application. ArcPad will no longer supported by ESRI in the next year. In 2020, we had regular issues with our older Toughbooks failing to pair with newer Bluetooth GPS units. Statewide, other herring survey programs have moved on to using modern tablets (iPads), paired with tablet-specific external GPS unit (Garmin Glo), and the new ESRI Collector application (ArcPad replacement). We are hoping to use any funds we saved through lack of 2020 vessel surveys on the purchase of new aerial survey data collection kits. We have worked with ADF&G programmers to ensure an easy transition to the new machines with little change in data fields.

Sept 2019: Science Panel Comment – FY20: The Science Panel recognizes this is a monitoring project that provides important information and data to nearly all EVOSTC herring work, including the BASA model. Project goals are being completed on time. Although this project provides routine monitoring data, it nonetheless raises questions that may be worthy of investigation, perhaps as part

of a program synthesis. For example, as pointed out in the Branch proposal, the PWS herring population now seems unique among many in the world for the long-term duration of low biomass or, stated differently, an apparent lack of recovery. Could this perspective be influenced a paucity of information related to spawning and distribution of herring in other areas of PWS or areas immediately adjacent – such as Kayak Island? Could there be other instances of herring spawning, perhaps in substantial quantities, that go undetected? If this were the case, could other survey methods be used? For example, synoptic larval surveys are frequently used by other agencies, especially in Atlantic waters, to monitor distribution and abundance.

Haught response to Science Panel:

It is unlikely that substantial herring spawning events go undetected. The PWS area (including Kayak Island) is heavily trafficked by boat and airplane. Our first indication of spawn is often through pilot or vessel report. In addition to the herring aerial survey program, ADF&G receives regular reports from air taxis, private pilots, fishers, and subsistence users during PWS herring spawn timing. Also, Other PWS HRM program activities including acoustics, tagging, disease, and ASL surveys are running concurrent to the aerial survey program and making vessel-based observations of herring concentrations.

Many PWS commercial herring permit holders live in Cordova and the general interest in, and subsistence value of PWS herring among residents is high. Considering the amount air and vessel traffic in the sound, it is unlikely that significant spawning events, similar in magnitude to those observed in the Port Gravina and Hawkins Island areas in recent years, would go unobserved and unreported. However, we undoubtedly miss small, short-timed “spot spawning” events.

Although we do survey Kayak Island, survey coverage is less frequent than PWS proper (1-3 Kayak Island surveys per year, usually prompted by a report of spawn activity beginning). This is primarily because of its location and the fact that we have not historically included this area in the index. If there is strong interest for increasing the frequency of Kayak Island surveys this could be accommodated with an increase in survey budget.

The estimates generated by the aerial surveys were designed to be an index of relative abundance, comparable across the historical time series. As such, it is important to keep survey methods as consistent and repeatable as possible to retain comparability among years (also the reason we do not include Kayak Island in the current mile days of milt total...it is not included in the historical index). Although we acknowledge that other methods exist and may even produce more refined estimates of biomass, they would lack historical comparability. Unless a clear benefit was apparent, we would not support discontinuing the current program in favor of other methods

11. Budget:

Budget Category:	Proposed FY 17	Proposed FY 18	Proposed FY 19	Proposed FY 20	Proposed FY 21	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	\$54.5	\$54.5	\$54.5	\$54.5	\$54.5	\$272.5	\$351.9
Travel	\$1.4	\$1.4	\$1.4	\$1.4	\$1.4	\$6.8	\$4.9
Contractual	\$94.6	\$94.6	\$94.6	\$94.6	\$94.6	\$473.0	\$128.9
Commodities	\$2.1	\$2.1	\$2.1	\$2.1	\$2.1	\$10.5	\$42.0
Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$4.9	\$4.9	
SUBTOTAL	\$152.6	\$152.6	\$152.6	\$152.6	\$157.5	\$767.7	\$527.7
General Administration (9% of subtotal)	\$13.7	\$13.7	\$13.7	\$13.7	\$14.2	\$69.1	N/A
PROJECT TOTAL	\$166.3	\$166.3	\$166.3	\$166.3	\$171.6	\$836.8	
Other Resources (Cost Share Funds)	\$54.5	\$54.5	\$54.5	\$54.5	\$54.5	\$272.5	