Exxon Valdez Oil Spill
Long-Term Herring Research and Monitoring Program Final Report

Annual Herring Migration Cycle: Expanding Acoustic Array Infrastructure

Exxon Valdez Oil Spill Trustee Council Project 16160111-S
Final Report

Mary Anne Bishop
Prince William Sound Science Center
P.O. Box 705
Cordova, AK 99574

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Study History: This project is a continuation of project 14120111-B, "Tracking Seasonal Movements of Adult Pacific Herring in Prince William Sound." Methodology and the results from this previous project were used to develop this FY16, one-year project to purchase supplies and equipment for a FY17-FY20 study that will investigate herring movements in Prince William Sound. The current project is a component of the Herring Research & Monitoring Program. A detailed description of this project was approved for funding by the *Exxon Valdez* Oil Spill Trustee Council in November 2015. Supplies and equipment for the project were purchased during FY16, and the deployment of the equipment occurred in February 2017. This is the final report on activities conducted by this project.

Abstract: One of the important knowledge gaps for the Pacific herring (*Clupea pallasii*) population in Prince William Sound is understanding adult herring annual migration movements between spawning, summer feeding, and overwintering areas. In 2013 we documented post-spawn migration of herring from Port Gravina to the entrances of Prince William Sound by acoustic tagging adult herring and collecting data from the Ocean Tracking Network acoustic arrays. The 2013 study, however, could not verify if herring were migrating out into the Gulf of Alaska and then returning to Prince William Sound because of the layout of the Ocean Tracking Network arrays. The objectives of this FY16 project were to 1) purchase and deploy additional acoustic receivers at the Ocean Tracking Network arrays so that the direction of herring movements (into or out of the Sound) can be determined and 2) purchase acoustic tags. Acoustic tags and tagging supplies were purchased in FY16. Additional acoustic receivers were deployed across the Ocean Tracking Network arrays in February 2017. The achievement of these objectives allows us to begin a new *Exxon Valdez* Oil Spill Trustee Council-funded project in spring 2017 to begin to address objectives aimed at 1) documenting adult herring migration movements out of and into the Sound; and 2) understanding factors that influence migration patterns including age, condition, spawning location, and residency in the Sound.

Key Words: acoustic array, acoustic transmitters, *Clupea pallasii*, migration, Ocean Tracking Network, Pacific herring, Prince William Sound

Project Data:
Description of data – Location of acoustic receivers deployed in February 2017.

Format –Location (latitude and longitude) for each acoustic receiver deployed and date of deployment is available as a csv.file.

Data archive and custodians –
Carol Janzen
AOOS, 1007 W. 3rd Ave. #100,
Anchorage, AK 99501
907-644-6703
janzen@aoos.org
https://workspace.aoos.org/file/2965624/AcousticArrayDeployment_February%202017.csv

Mary Anne Bishop, Ph.D.
Prince William Sound Science Center
P.O. Box 705
Cordova, AK 99574.

There are no limitations on the use of the data, however, it is requested that the authors be cited for any subsequent publications that reference this dataset. It is strongly recommended that careful attention be paid to the contents of the metadata file associated with these data to evaluate data set limitations or intended use.

Citation:

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EXECUTIVE SUMMARY

One of the important knowledge gaps for the Pacific herring (*Clupea pallasii*) population in Prince William Sound (PWS) is understanding adult herring annual migration movements between spawning, summer feeding, and overwintering areas. In 2013 we documented post-spawn migration of herring from Port Gravina to the Prince William Sound entrances by acoustic tagging adult herring and collecting data from the Ocean Tracking Network acoustic arrays. The 2013 study, however, could not verify if herring were migrating out into the Gulf of Alaska (GOA) and then returning to Prince William Sound because of the single-line layout of the Ocean Tracking Network arrays.

The goal of this herring study is to clarify the annual migration cycle of PWS adult herring. The objectives of this proposed project are to:

1) purchase and deploy additional acoustic receivers at the Ocean Tracking Network arrays so that the direction of herring movements (into or out of PWS) can be determined in future studies and,

2) purchase acoustic tags.

Achieving these objectives in FY16 allows us to begin in spring 2017 to address objectives aimed at 1) documenting adult herring migration movements out from and into PWS; and 2) understanding factors that influence migration patterns including age, condition, spawning location, and residency in PWS.

During FY16 we purchased 128 acoustic tags, tag supplies, 15 acoustic receivers and mooring supplies. The 15 new receivers were deployed at Ocean Tracking Network arrays in February 2017. Completing these activities allows us to initiate acoustic tagging of herring in spring 2017 when herring are aggregated on their spring spawning grounds.

INTRODUCTION

Conservation concerns about the recovering Pacific herring (*Clupea pallasii*) population in Prince William Sound (PWS) make it increasingly important to document migration patterns to inform our understanding of PWS adult herring survival. In 2013 we documented post-spawn migration of herring from Port Gravina to the PWS entrances by acoustic tagging adult herring and collecting data from the Ocean Tracking Network acoustic arrays (Eiler and Bishop, 2016; Bishop and Eiler, 2018). The 2013 study, however, could not verify if herring were migrating out into the Gulf of Alaska (GOA) and then returning to PWS because of the single-line layout of the Ocean Tracking Network arrays.

Our project objectives were to: 1) purchase and deploy additional acoustic receivers at the Ocean Tracking Network arrays so that the direction of herring movements (into or out of PWS) can be determined and 2) purchase acoustic tags. Because it takes several months from the start of funding to get tags and equipment purchased, prepared, and deployed, achieving our objectives in FY16 will allow us in spring 2017 to begin a new, acoustic tagging study when herring are aggregated on their spring spawning ground. Our new FY17 study will address objectives aimed at 1) documenting adult herring migration movements out from and into PWS; and 2) understanding factors that influence migration patterns including age, condition, spawning location, and residency in PWS.

METHODS

The Ocean Tracking Network is a series of underwater, moored acoustic receivers located at Hinchinbrook Entrance, Montague Strait, and the four southwest Passages. This acoustic telemetry system is manufactured by Vemco (Bedford, Nova Scotia), and is a proprietary system that consists of Vemco transmitters and Vemco receivers working together, using proprietary coding techniques and custom batteries that provide unique tag IDS to allow the interoperability of Vemco receiver arrays world. In 2009, Vemco developed a new coding technology that is encrypted which can only be detected and decoded by Vemco equipment. Since only Vemco sources the unique and proprietary tag coding that works with the Vemco acoustic telemetry system, this receiver purchase and tracking system can only be sourced from Vemco.

RESULTS & DISCUSSION

We purchased 7 VR2-AR receivers (Vemco) for the four southwest passages and 8 VR4 receivers (Vemco) for Hinchinbrook Entrance (n = 4) and Montague Strait (n = 4). Fifteen hardball floats (750 m rated; Deepwater Buoy, Biddeford, Maine) were also purchased for attachment to the receivers. All receivers were deployed during February 2017 (Table 1, Fig. 1). We also purchased 125 acoustic transmitters (Model V9-2L, 69 kHz, Vemco) and 3 reference tags as well as tagging supplies. Transmitters will be deployed in April 2017 during herring spawning.

Table 1. Acoustic receiver name (first column), location (latitude and longitude) and depth (feet) for receivers deployed at the Ocean Tracking Network arrays in Prince William Sound. February 2017.

Hinchinbrook Entrance							
HA	60.3379°N	146.7205°W	at a depth of	361	feet with a top float depth of	306	ft
HB	60.3350°N	146.7328°W	at a depth of	607	feet with a top float depth of	533	ft
HC	60.3020°N	146.8928°W	at a depth of	410	feet with a top float depth of	353	ft
HD	60.2997°N	146.9055°W	at a depth of	82	feet with a top float depth of	29	ft
Montague Strait							
MA	59.9192°N	147.8183°W	at a depth of	230	feet with a top float depth of	193	ft
MB	59.9252°N	147.8253°W	at a depth of	410	feet with a top float depth of	353	ft
MC	59.9697°N	147.8813°W	at a depth of	705	feet with a top float depth of	623	ft
MD	59.9753°N	147.8892°W	at a depth of	558	feet with a top float depth of	486	ft
Latouche Passage							
LPA	59.9750°N	148.0382°W	at a depth of	98	feet with a top float depth of	66	ft
LPB	59.9792°N	148.0445°W	at a depth of	131	feet with a top float depth of	100	ft
Elrington Passage							
EPA	59.9844°N	148.0992W	at a depth of	328	feet with a top float depth of	300	ft
EPB	59.9894°N	148.1081°W	at a depth of	262	feet with a top float depth of	233	ft
Prince of Wales Passage							
PWA	60.0399°N	148.1283°W	at a depth of	266	feet with a top float depth of	233	ft
PWB	60.0402°N	148.1367°W	at a depth of	230	feet with a top float depth of	200	ft
Bainbridge Passage							
BPA	60.1188°N	148.2244°W	at a depth of	115	feet with a top float depth of	83	ft

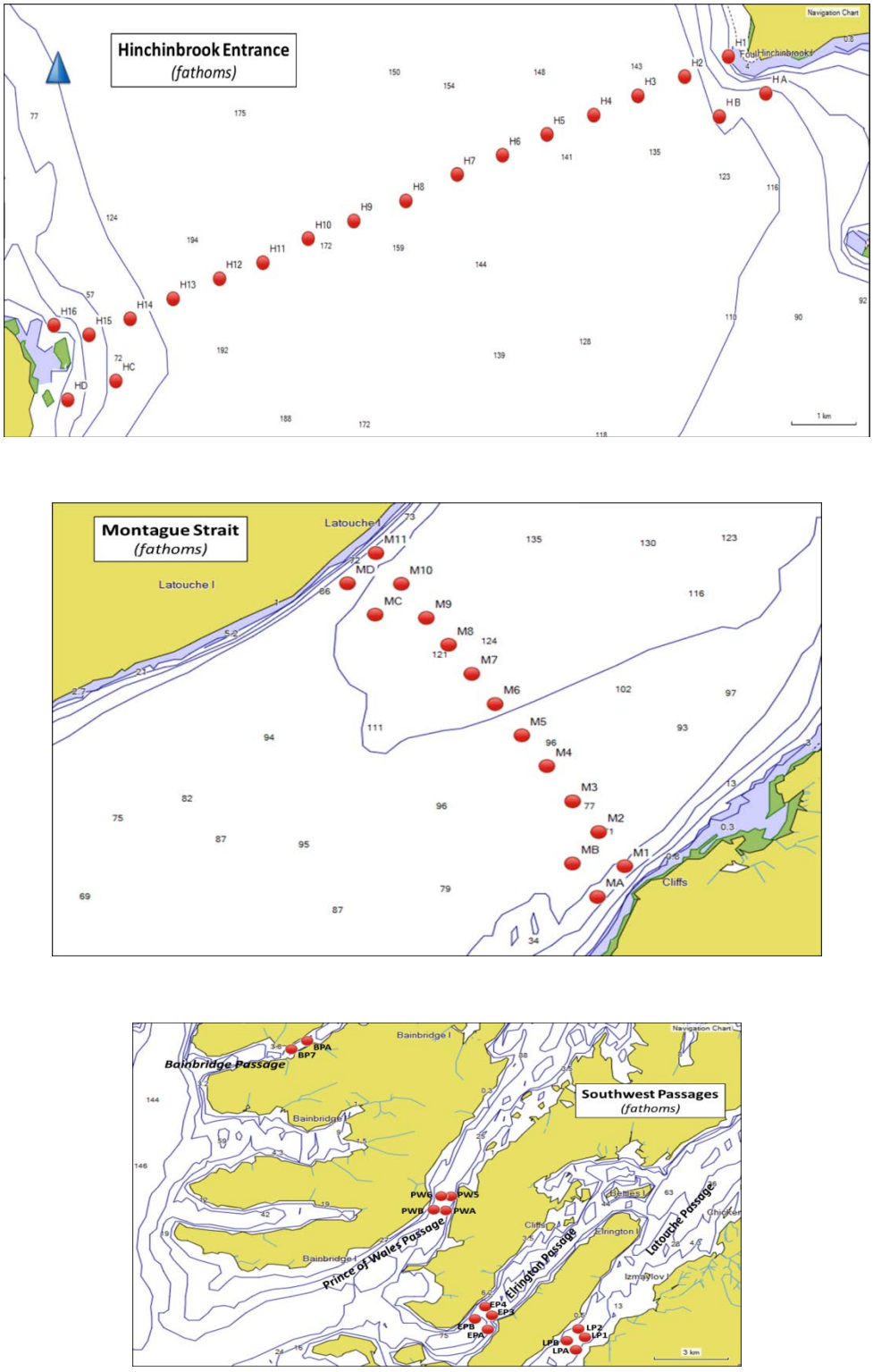

Figure 1. Location of Ocean Tracking network in Prince William Sound. Top: Hinchinbrook Entrance, middle: Montague Strait; bottom: southwest passages. At each site, new receivers are more southerly than the original network.

ACKNOWLEDGEMENTS

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