

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: PWS Herring Research and Monitoring: Intensive surveys of juvenile herring

Project Period: February 1, 2014 – January 31, 2015

Primary Investigator(s): Michele Buckhorn, PhD (Lead PI)
Richard Thorne, PhD (co-PI); Prince William Sound Science Center, Cordova, AK

Abstract: Hydroacoustic surveys of juvenile herring nursery areas in Prince William Sound have been conducted during fall and late-winter for the last several years. The number of locations surveyed have varied from 5-9, including the 4 Sound Ecosystem Assessment (SEA) bays. However, each seasonal effort has conducted only a single night survey in each of these locations. Thorne (2010) examined seasonal changes from fall 2006 to spring 2009. He showed that apparent overwinter mortality of age 0 herring appeared to be greatest in Simpson Bay and least in Whale Bay. However, the differences in seasonal abundance could be attributed to mortality, emigration, or changes in ambient light. We propose to address these uncertainties with an intensive fall and late winter/spring intensive survey. The fall series will start mid-October 2014 and extend to the first week of December. The late winter/spring series will begin the 3rd week of February 2015, and extend into the 2nd week of April. We propose to conduct the surveys in two bays sufficiently adjacent to cover each bay each night, such as Simpson Bay, Port Gravina, Windy Bay or St. Mathews Bay. In addition to the hydroacoustic surveys, we propose a single night of direct capture effort in each location for each of the survey weeks (See Bishop, this proposal). The survey design will follow the historic zig zag transects run by Thorne since 1993 in order to remain consistent with that sampling design and to put the long term fall and spring surveys into context.

Estimated Budget:

EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
50,100	29,757	46,543	6,800	0	133,200

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
		0			

Date: 30 August 2013

I. NEED FOR THE PROJECT

A. Statement of Problem

Hydroacoustic surveys of juvenile herring nursery areas in Prince William Sound have been conducted during fall and late-winter for the last several years. The objectives of this effort have been to improve understanding of habitat utilization by juvenile herring, especially age 0, and to help identify candidate sites that could be potentially used for supplementation efforts. The surveys have also been a focus for other studies on juvenile herring energetics, disease and predation. The number of locations surveyed have varied from 5-9, including the 4 Sound Ecosystem Assessment (SEA) bays. However, each seasonal effort has conducted only a single night survey in each of these locations. Thorne (2010) examined seasonal changes from fall 2006 to spring 2009. He showed that apparent overwinter mortality of age 0 herring appeared to be greatest in Simpson Bay and least in Whale Bay. However, he also pointed out that the differences over winter could also be the result of emigration. Not only might age 0 herring move among bays during the winter, but movement into and out of bays may be progressive during a season. It is possible the overwintering component of age 0 may not be fully recruited into a bay at the time a single fall survey, or may have begun spring movement out of bays prior to any given late-winter survey. Another potential source of variability could be the stage of the moon. Ambient light is known to affect fish distributions. On many occasions, age 0 concentrations were readily identified by their distinct distribution: a diffuse layer near surface, near shore and near the heads of bay. On other occasions, this distinctive distribution was absent even though age 0 herring were present. The change might have been the result of different ambient light regimes.

B. Summary of Project to Date (if applicable)

This project is not slated to begin until October 2013.

II. PROJECT DESIGN

A. Objectives

The objectives of this study are:

1. to improve the accuracy of both annual and seasonal comparisons from single-night surveys by intensively sampling throughout a fall and spring season
2. estimate the level of immigration and emigration of age 0 herring between bays

B. Procedural and Scientific Methods

We propose to address these uncertainties with an intensive fall and late winter/spring intensive survey. The fall series will start mid-October 2014 and extend to the first week of December. The late winter/spring series will begin the 3rd week of February 2015, and extend into the 2nd week of April. We propose to conduct the surveys in two bays sufficiently adjacent to cover each bay each night, such as Simpson Bay, Port Gravina, Windy Bay or St. Mathews Bay. We will conduct four surveys per season spaced at 2 week intervals. Each of the two bays will be surveyed in three consecutive nights. Such a design will address daily, weekly and monthly variability, including moon phase. In addition to the hydroacoustic surveys, we propose a single night of direct capture effort in each location for each of the survey weeks (See Bishop, this proposal). The survey design will follow the historic zig zag transects run by Thorne since 1993 in order to remain consistent with that sampling design and to put the long term fall and spring surveys into context. Such information is especially critical if hydroacoustic surveys are needed to provide an index of future age 0 herring abundance.

C. Data Analysis and Statistical Methods

There are well-developed protocols for hydroacoustic data analysis. Basic analysis is done using echo integration techniques (Thorne 1983a,b; McLennon and Simmonds 1992). We will be using to ECHOVIEW post processing software for the echo integration and analysis. Specific analysis of schools or layers requires a bounding process to limit analysis to a specific school or layer (Fig 8). Target strength characteristics of herring as well as several other common fishes are well documented (Thorne 1983b; Traynor 1998; Thomas et al. 2002). The acoustic analysis determines the biomass density of the fish. The biomass estimates use scaling factors that are size and species specific, but are relatively insensitive to these variables (Thorne 1983b). These densities are extrapolated to the appropriate area based on the GPS information that is automatically written to the acoustic data files. Conversion of biomass to numerical values is more sensitive to species/size information. For adults and age 0 herring this information is typically available. Some assumptions are required for other species and these assumptions are dependent on the direct capture information.

D. Description of Study Area

This project will take place in the northeastern region of Prince William Sound (60.841056, -146.128239, 60.864482, -147.345965, 60.622618, -147.382919, 60.609086, -146.018257).

E. Coordination and Collaboration with Other Efforts

This proposal is part of the integrated “PWS Herring Research and Monitoring” proposal submitted by the Prince William Sound Science Center to the Exxon Valdez Oil Spill Trustee Council. It includes the collaboration and coordination described there for work within the herring research group and with the Long-Term Monitoring proposal submitted by the Alaska Ocean Observing System.

III. CV's/RESUMES

Curriculum Vitae: Michele Leigh Buckhorn

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Education:

Ph.D. 2009 University of California, Davis, Ecology (AOE Marine Ecology)
Advisors: Marcel Holyoak, PhD and Peter B. Moyle, PhD
B.A. 1999 University of California, Santa Cruz, Biology
A.S. 1993 American River College, Math and Physical Sciences

Related Employment:

Principal Investigator. Fish Ecologist, Prince William Sound Science Center. November 2011 – present

Postdoctoral Researcher Fish Ecologist, Prince William Sound Science Center. June 2010 – November 2011

Postdoctoral Researcher. U.C. Davis. Department of Wildlife, Fish and Conservation Biology. 2008-2009.

Publications

Journal Articles:

Thorne, R and M. L. Buckhorn. "Assessment of Adult Herring Abundance in Prince William Sound, Alaska, 1993-2012." In prep.
Buckhorn, M.L. and R. Thorne. "Use of acoustic surveys to examine juvenile herring habitat and abundance in Prince William Sound, Alaska." In prep

Selected Presentations

2011 Buckhorn, M.L. and Richard Thorne. Juvenile Herring Assessment In Prince William Sound. American Fisheries Society 141st Annual Meeting. Seattle, WA.
2011 Buckhorn, M.L., Richard Thorne, James Thorne. Evaluation of a Floating, Two-Vessel Towed Transducer System for Detection of Near-Surface Fishes. Poster. American Fisheries Society 141st Annual Meeting. Seattle, WA.

Recent Collaborators

Scott Pegau, PhD., Prince William Sound Science Center
Richard Thorne, PhD., Prince William Sound Science Center
A. Pete Klimley, PhD., UC Davis

CURRICULUM VITAE

Richard E. Thorne, Ph.D.
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Employment History

Prince William Sound Science Center	Senior Scientist	2000-present
BioSonics, Inc. 4027 Leary Way NW Seattle, WA 98107	Vice President Manager Technical Services Senior Scientist	1996-1999 1991-1999 1988-1999
University of Washington School of Fisheries Fisheries Research Institute Seattle, WA	Affiliate Research Professor Research Professor Research Associate Professor Senior Research Associate	1991-2001 1981-1990 (LOA 1988-1990) 1976-1981 1970-1976
Commercial Fisher (salmon and albacore)		1957-1968

Academic Background

Ph.D., Fisheries-1970, University of Washington, School of Fisheries
MS Degree-1968, University of Washington, Department of Oceanography
B.S. Degree-1965, University of Washington, Department of Oceanography

Selected Publications

- Thorne, R.E. and G.L. Thomas (in press). The Exxon Valdez Oil Spill and the Collapse of the Prince William Sound Herring Stock: A Reexamination of Critical Biomass Estimates, In: Alfred, J.B. and Peterson, M (eds), *Impacts of Oil Spill Disasters on Marine Fisheries in North America*, CRC Press/Taylor & Francis, Boca Raton, FL
- Thorne, R.E. and G.L. Thomas 2011. The Role of Fishery Independent Data, Chapter 12, In: Janice S. Intilli (ed) *Fisheries Management*. Nova Science Publishers, ISBN 978-1-61209-682-7.
- Frid, A., J. Burns, G.G. Baker and R.E. Thorne 2008. Predicting synergistic effects of resources and predators on foraging decisions by juvenile Steller sea lions. *Oecologia* 10.1007/s00442-008-1189-5, 12 p.
- Thorne, R.E. 2008. Walleye pollock as predator and prey in the Prince William Sound ecosystem. Pp: 289-304, In: G.H. Kruse, K. Drinkwater, J.N. Ianelli, J.S. Link, D.L. Stram, V. Wespestad and D. Woodby (eds), *Resiliency of gadid stocks to fishing and climate change*. Alaska Sea Grant, University of Alaska, Fairbanks
- Thorne, R.E. and G.L. Thomas 2008. Herring and the “Exxon Valdez” oil spill: an investigation into historical data conflicts. *ICES Journal of Marine Science* 65(1):44-50.
- Frid, A., Dill, L.M., Thorne, R. E., Blundell, G. M. 2007. Inferring prey perception of relative danger in large-scale marine systems. *Evolutionary Ecology Research*, Vol. 4.

- Churnside, J.H. and R.E. Thorne 2005. Comparison of airborne lidar measurements with 420 kHz echos-sounder measurements of zooplankton. *Applied Optics* **44**(26):5504-5511
- Thomas, G.L. and R.E. Thorne 2003. Acoustical-optical assessment of Pacific herring and their predator assemblage in Prince William Sound, Alaska. *Aquatic Living Resources* **16**:247-253.
- Thomas, G.L., J. Kirsch and R.E. Thorne 2002. Ex situ target strength measurements of Pacific herring and Pacific sand lance, *North American Journal of Fisheries Management* **22**:1136-1145.
- Thomas, G.L. and R.E. Thorne 2001. Night-time Predation by Steller Sea Lions. *Nature* **411**:1013.

Collaborations:

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IV. SCHEDULE

A. Project Milestones

Objective 1. to improve the accuracy of both annual and seasonal comparisons from single-night surveys by intensively sampling throughout a fall and spring season.

To be met by March 2014

Objective 2. estimate the level of immigration and emigration of age 0 herring between bays

To be met by September 2014

B. Measurable Project Tasks

Specify, by each quarter of each fiscal year, when critical project tasks (for example, sample collection, data analysis, manuscript submittal, etc.) will be completed. This information will be the basis for the quarterly project progress reports that are submitted to the Trustee Council Office. Please format your schedule like the following example.

FY13 4th Quarter (October 1, 13 to December 31, 13)

October Begin acoustic intensive study

FY14 1st Quarter

January Annual Marine Science Symposium

February Continue with intensive study

FY14 2nd Quarter

May Attend annual PI meeting

FY14 3rd Quarter

Summer Complete intensive study

V. BUDGET

Budget Form (Attached)

Please complete the budget form for each proposed year of the project.