Annual Progress Report Form - Oil Spill Recovery Institute

This report may be submitted by mail, fax or e-mail
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Deadline for this report: This report is due within 45 days of the anniversary of the effective date of the grant.

Today's date: 7-3-06

Name of awardee/grantee: Seanbob Kelly

OSRI Contract Number: 05-10-16

Project title: Identifying past habitat use and essential habitat of Pacific herring

Dates this progress report covers: July 1, 2005-June 30, 2006

PART I - Progress Report on Activities

The progress report must include the following elements.

1. **Non-technical Abstract or summary of project work to date that does not exceed two pages and includes an overview of the project. The abstract should describe the nature and significance of the project and progress made toward realizing project goals. It may be provided to the Advisory Board and could be used by OSRI staff to answer inquiries as to the nature and significance of the project.**

My research focus fits within OSRI research focus area (#1), the observation and modeling of the quantitative ecology of marine and estuarine habitats. Following the *Exxon Valdez* oil spill in March 1989 and the decline of herring stocks in the 1990´s, the need for quantitative analysis of essential fish habitat has become more critical to the conservation of this important fisheries stock. Identification of essential fish habitats (EFH) for various life stages of herring in PWS is necessary to examine the status and recovery potential of the stock, which is a priority of fisheries managers. Identification of habitat change since 1995, the oldest available samples, through 2006, the latest samples, would be an indicator of the recovery of the herring populations in PWS. Herring spawning on documented oil-damaged habitat and surviving to recruitment is an indication that those habitats have recovered. Otolith chemical analysis of regional signatures enables my research to quantify ecological recovery status through shifts in

herring habitat usage over time.

Since July 1, 2005, I have worked to identify the habitat use and essential habitats for Pacific herring (*Clupea pallasii*) in PWS. Using otolith microchemistry as a tool, I have collected and analyzed data on the habitat use of herring. Initial lab work consisted of the physical extraction and processing of archived Pacific herring samples collected during the Sound Ecosystem Assessment project (SEA) from 1995-1998. Otoliths from individual samples (n=632) were laterally thin-sliced, mounted on slide, and polished.

Identification of regional elemental signature within the otolith requires a trace element analysis. To get the raw trace elemental count, otolith samples were analyzed by an Inductively Coupled Mass Spectrometer with Laser Ablation (LA-ICP-MS). Using GeoPro software I have normalized and standardized the trace element counts of Sr^{88}, Mg^{24}, and Ba^{137} to Ca^{48}. Using SPSS 11 + 14 these processed data have been tested for normality using Shapiro-Wilks and for constant variance using Brown-Forsythe. Residuals were also plotted on a time series and several periods of equipment malfunction were identified. These samples (n=25) were then reexamined by the LA-ICP-MS. Several transformations of the data were attempted, but the normality assumption for ANOVA and PCA were not met. I have identified the outliers in the data and I will reexamine these samples with the LA-ICP-MS. Data exploration was conducted with ANOVA analysis of all factors, to determine the sources of variance.

2. Brief review of the objectives as described in original proposal and progress report related to these objectives.

The overall objective of this study is to identify past habitat use and essential habitat of Pacific herring (*Clupea pallasii*) from Prince William Sound (PWS). My specific objectives are to (1) use trace element signatures of core portions of herring otoliths to identify individual spawning bays within PWS, (2) use trace element signatures of edge portions of juvenile herring otoliths to identify individual rearing bays within PWS, (3) use adult otoliths to identify bays that contribute a greater portion to the herring population, and (4) use adult otoliths to identify past habitat use and temporal changes.

1)

Analysis of the core portions of the juvenile otoliths has not been completed.

Identification of spawning areas from core signatures will depend on the initial edge analysis.

2)

Edge signatures have been statistically analyzed by management area and capture bay. Identification of regional signatures will depend on the statistical resolution spatially and temporally. Class membership of samples will be determined by a discriminate function analysis.

3)

Adult otoliths (n=61) from 2005 have been prepped and raw data has been collected from the LA-ICP-MS.

4)

Analysis of habitat change over time has not been completed and will be the final step in the analysis

3. Describe problems or roadblocks encountered in project implementation.

During the first quarter I experienced delays due to LA-ICP-MS technical problems. This slowed my data collection efforts and was resolved, as all samples received have been analyzed on LA-ICP-MS.

During the second quarter, I had anticipated receiving otoliths from adults caught in 2004. We have discovered that no otoliths from fish captured in 2004 were retained by ADF&G. This problem requires a change of scope in the project, as 2004 adults cannot be included in the project. Also during the second quarter, the computer software (Glitter) I was planning to use to process the mass spectrometer data for statistical analysis did not functioning properly. Initially, this software was identified as tool for taking the raw elemental counts derived from the ICP-MS and processing this scattered data into a uniform computer language, which could then be utilized in the statistical analysis of the otoliths. The software was replaced with an equivalent program, GeoPro. This potential problem constitutes a change in scope of work: It required more time for computer analysis of the raw elemental data. I had to adjust my timeline up one month. I completed the computer processing of juvenile otoliths during the 3rd quarter.

Currently I am anticipating the arrival of PWS adult herring otoliths from 2006. The PWS herring-spawning event was significantly smaller this year than in the 2005 sampling year.

Communications with ADF&G have revealed that herring collection efforts were hindered by earlier than normal spawning. I am awaiting confirmation from ADF&G that samples were collected for my project.

4. Highlight accomplishments, whether or not they were part of the original proposal.

My initial year has seen many accomplishments made possible by the generous support I have received from the OSRI Advisory Board. In the two semesters I have attended the UAF GPMSL Fisheries Oceanography program I have completed several required classes: Physical Oceanography (grade B), Fisheries Oceanography (grade A), Chemical Oceanography (grade A), and Geological Oceanography (grade A). During Fall 2006 semester I will complete my required coursework by completing Biological Oceanography.

On June 7th, 2006 I presented preliminary data at the North American Benthological Society (NABS) 54th Annual Meeting in Anchorage. This was my first presentation outside of scholastic endeavors. My presentation was received well.

5. Conclusions to date.

My preliminary conclusions are as follows:

1)

Sources of variance in my data are Capture year, Capture Month, Capture Region, and Year Class.

2)

Otolith chemistry can be used to identify and quantify habitat use of PWS Pacific herring.

6. Appendix including copies of all written reports or publications completed or in progress, resulting from the project work. This also includes abstracts of papers presented at conferences. Please note the acknowledgment of OSRI support stated in Section 10.3.4 of the Grant Policy Manual.

North American Benthological Society 54th Annual Meeting Anchorage, AK
June 4-9, 2006

Abstract

Otolith chemical tags identify past habitat use of larval and juvenile Prince William Sound Pacific herring

Investigation into the larval migrations of Prince William Sound Pacific herring (*Clupea pallasii*) has lead to the identification of regional elemental signatures. Preliminary results of otolith analysis have revealed differences in the core (spawning) and edge (capture) regions. These natural tags identify the spatial region an individual herring inhabited as well as temporally through accumulation of rings within the otolith. Using archived juvenile herring collected on the Sound Ecosystem Assessment (SEA) from 1995-98 we extracted and processed the otoliths. We have begun to isolate regional elemental signature in the otolith using and Inductively Coupled Mass Spectrometer with Laser Ablation, ICPMS-LA. The objective of this research is to (1) identify the natural tags with in the core and edge of the juvenile herring, (2) recreate this migration for each management region, Northeast, Southeast, Naked Island, and Montague Island and (3) compare these larval migrations to a model for larval drift in PWS (3D-PWS). The model has not been ground-truthed and the present research can validate or help refine the model.

American Fisheries Society 136th Annual Meeting

September 10-14, 2006

Abstract

Identifying habitat use of juvenile Pacific herring in Prince William Sound, Alaska

Pacific herring (*Clupea pallasii*) have historically been a lucrative fishery in Prince William Sound (PWS), Alaska. However, the stock collapsed in 1993 and shows no sign of recovery. Investigations into regional variations in recruitment success of herring can help identify recovery behavior. Spawning and nursery areas of individual fish can be identified through analysis of trace elements in otoliths. Otolith chemical chronology is similar to dendrochronology in that rings in an otolith are accumulated much like the rings of a tree. Otolith chemical analysis allows identification of regional elemental signatures in the juvenile herring from individual bays in PWS. Analysis of juvenile herring otoliths from 1995 through 1998 revealed regional natal and nursery habitat use. Identifying past habitat use of recruits could help managers understand regional variations in herring success both within PWS and through time.

This material is based on work supported by the Oil Spill Recovery Institute under Grant No. (05-10-16). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect those of the Oil
Spill Recovery Institute

Part II - Annual Financial Statement

Budget Category	Budget	Year-to-date Expenses	Balance Remaining
Direct Costs			
Personnel	$18,683	$18,220.11	$462.89
Travel			
Contractual	$4,396	$1732.00	$2,664.00
Commodities	$20.00	$20.00	<$20.00>
Equipment			
Subtotal Direct Costs			
Indirect	$1,868	$1,824.03	$43.97
Project Total	**$24,947.00**	**$21,796.14**	**$3,150.86**