11.24.03

Exxon Valdez Oil Spill Trustee Council

Monday, October 28, 2013

9:30 a.m. to 4:30 p.m.

800-315-6338 – code 8205

Agenda

DRAFT 10/21/2013

Exxon Valdez Oil Spill Trustee Council

4210 University Drive • Anchorage, AK 99508-4626 • 907 278 8012 • fax 907 276 7178

AGENDA

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

Oct. 28, 2013, 9:30 a.m. - 4:30 p.m.

Anchorage, Alaska

Trustee Council Members:

JEN SCHORR
Alternate for Attorney General
Michael C. Geraghty
Alaska Department of Law

LARRY HARTIG
Commissioner
Alaska Department of
Environmental Conservation

THOMAS BROOKOVER
Alternate for Commissioner Cora Campbell
Alaska Department of Fish and Game

JIM BALSIGER
Administrator, Alaska Region
National Marine Fisheries Service
U.S. Department of Commerce

PAT POURCHOT
Special Assistant to the Secretary for
Alaska Affairs
Office of the Secretary
U.S. Department of the Interior

TERRI MARCERON
Forest Supervisor
Chugach National Forest
U.S. Department of Agriculture

Meeting in Anchorage: USGS Alaska Pacific University Campus, Glenn Olds Hall Conference Room, 4210 University Drive

Teleconference number: 800.315.6338. Code: 8205

State Chair: ___________

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1	Call to Order – 9 30 a m	
2	Consent Agenda - Approval of Agenda* - Approval of Meeting Notes* February 21, 2013	
3.	Public Comment (3 minutes per person)	
4	Executive Director's Report (20 min) - Reporting and Financial Policy Revisions*	 Elise Hsieh, EVOSTC Exec. Dir.
5	Investment Fund Asset Allocation* (15 min)	Mike O'Leary, Callan Assoc Bob Mitchell, ADOR
6	Annual Admin Budget (APDI)* (10 min)	Elise Hsieh Linda Kilbourne, EVOSTC Admin Mgr
7	Habitat Program (30 min) - Updated appraisal instructions* - EVOSTC GLT Habitat Project* - Stewart Parcel* - Beeson Parcel*	Elise Hsieh Samantha Carroll, ADNR Phil Shephard, Exec. Dir , Great Land Trust Chris Little, The Conservation Fund Jack Blackwell, ADNR
8.	Long-Term Programs (20 min) Long-Term Herring* (15 min) Long-Term Monitoring* (GulfWatch Alaska) (15 min)	Catherine Boerner, EVOSTC Science Coordinator Scott Pegau, PWSSC Katrina Hoffman, PWSSC Molly McCammon, AOOS Kris Holdereid, NOAA
9	GOAK Marine Debris Project* (10 min.)	Catherine Boerner
10	USFWS Pigeon Guillemot Project* (15 min)	Catherine Boerner
11	NOAA Clean Harbor Projects (25 min) Project 14120112-A Eyak -Cordova Clean Harbor* Project 14120112-C Cordova Snow Mgmt* Project 14120112 NOAA Clean Harbor (Admin)*	Catherine Boerner
12	Koniag Master Agreement and Easements Update* (10 min)	Joe Darnell, DOI, Regional Solicitor
13	Executive Session (10 min) - Personnel	

Lunch will be ready for service at noon Adjourn by 4 30 p m

*Indicates potential action items
Times provided are tentative estimates for planning purposes only.

TC Meeting Notes
Feb 21, 2013

10/2/13

Exxon Valdez Oil Spill Trustee Council

4210 University Drive • Anchorage, AK 99508-4626 • 907 278 8012 • fax 907 276 7178

TRUSTEE COUNCIL MEETING NOTES

Anchorage, Alaska
February 21, 2013

Chaired by: Pat Pourchot
Trustee Council Member

Trustee Council Members Present

Terri Marceron, USFS	Jennifer Schorr, ADOL ***
◦ Pat Pourchot, USDOI	Tom Brookover, ADF&G **
Peter Hagen, NMFS *	Larry Hartig, ADEC

◦ Chair
* Peter Hagen alternate for Jim Balsiger
** Tom Brookover alternate for Cora Campbell
*** Jennifer Schorr alternate for Michael Geraghty

The meeting convened by at 9 35 a m , February 21, 2013 in Anchorage at the Dr Glenn Olds Hall Conference Room, 4210 University Drive

1. Approval of the Agenda

APPROVED MOTION.	Motion to approve the February 21, 2013 agenda as presented
	Motion by Hartig, second by Marceron

2 Approval of September 14, 2012 meeting notes

APPROVED MOTION·	Motion to approve the September 14, 2012 meeting notes
	Motion by Hartig, second by Marceron

Public Comment none offered

3 Reporting Policy

APPROVED MOTION: Motion to adopt the revised Reporting Policies dated February 20, 2013

Motion by Marceron, second by Hartig

4 Document Digitizing Project

APPROVED MOTION: Motion to approve funding $14,388, which includes 9% GA, for FY 2013 to the Alaska Resources Library and Information Services for Phase I of the EVOSTC Document Digitizing Project The budget does not include indirect costs, as the ARLIS Management Team would receive the funds through ADF&G.

Motion by Hartig, second by Marceron

5 Great Land Trust Proposal

APPROVED MOTION: Motion to approve funding for FY 2013 of $284,866, which includes 9% GA, for the Great Land Trust Proposal to work with willing landowners in the Kodiak, Afognak and surrounding islands and other EVOS-affected areas to facilitate the Council's habitat program

Motion by Hartig, second by Schorr

6 Torsen Small Parcel (KAP 3000)

APPROVED MOTION: Motion to approve funding of up to $107,600 to US Fish and Wildlife Service for due diligence costs associated with the Torsen parcel (KAP 3000) and to fund the purchase of this parcel, conditioned upon 1) if the fair market value established by an appraisal falls within the range of $60,000 - $100,000, 2) due diligence reports are acceptable to ADNR and ADOL, and 3.) provided that the EVOSTC Executive Director, ADNR and ADOL find that it is in the best interest of the Council to move forward with acquisition of the parcel.

Authorization for funding the purchase of this parcel shall terminate if a purchase agreement is not executed by February 21, 2015

Motion by Marceron, second by Hartig

Executive Session

Motion to go into Executive Session for discussion with state and federal attorneys regarding potential legal concerns around the proposed NOAA Clean Harbor Projects for the purpose of getting legal advice on the concerns on the projects and how the Council might address those concerns

Motion by Hartig, second by Schorr

Off the record 10:45 a m
Executive Session
On the record 11 25 a.m

7 NOAA Clean Harbor Projects

Cordova Clean Harbor Program, project 13120112-A – defer
Cordova Snow Management Analysis, project 13120112-C – defer

APPROVED MOTION

Motion to defer further consideration and action on Project 13120112-A Cordova Clean Harbor Program and Project 13120112-C Cordova Snow Management Analysis until the Council's next meeting to provide an opportunity for additional effort by the agencies to clarify a process to evaluate the project in light of legal concerns and provide further dialogue with the proponents to resolve the concerns raised by the Science Panel and Science Coordinator

Motion by Hartig, second by Marceron

Clean Boating Activities and Improved Waste Management Using Smartphones and Outreach, project 13120112-B

APPROVED MOTION

Motion to not fund Clean Boating Activities and Improved Waste Management Using Smartphones and Outreach, project 13120112-B

Motion by Marceron, second by Hartig

Landfill Restoration, project 13120112-D

APPROVED MOTION	Motion to not fund the Landfill Restoration project1312112-D Motion by Marceron, second by Hartig

Oil Water Separation by Superhydrophilic and Superhydrophobic Surfaces, project 13120112-E

APPROVED MOTION	Motion to not fund Oil Water Separation by Superhydrophilic and Superhydrophobic Surface Project 13120112-E although it may have some interest as a proof and concept type project it doesn't fit well with the projects the Council can legally fund Motion by Hartig, second by Schorr

Prince William Sound Harbor Cleanup Program, project 13120112

APPROVED MOTION.	Motion to defer consideration of Prince William Sound Harbor Cleanup Program, project 13120112 pending resubmission at the Council's next meeting Motion by Hagen, second by Hartig

8 <u>GoAK Marine Debris Amendment, project 13120116-Am2 21 13</u>

APPROVED MOTION	Motion to approve funding $483,088 which includes 9 percent General Administration for project 13120116-AM2.21 13, Marine Debris Removal Program for fiscal year 2013 Motion by Hartig, second by Marceron

Executive Session

APPROVED MOTION	Motion to go into Executive Session for purposes of conferring with legal counsel regarding legal issues raised in the proposed Koniag stewardship agreement that's been proposed Motion by Hartig, second by Marceron

Off the record 1 00 p.m
Executive Session
On the record 1 30 p m.

9 Koniag Conservation Easement

APPROVED MOTION	Motion to direct the Council staff and legal counsel to take necessary actions to amend the Koniag conservation easement and related agreements, an amendment to provide Koniag the ability to unilaterally terminate the conservation easement and related agreements Notice must be given by Koniag within 30 days after the next regularly scheduled Council meeting with the termination effective 30 days after notification of the termination If Koniag terminates the conservation easement and related agreements, the annual payment for 2013 would be reduced on a pro rata basis (transcript pgs 63-64) Motion by Hartig, second by Marceron

10. Cordova Center

APPROVED MOTION	Motion to authorize funding of 1.3 million additional funds for the Cordova Center on the terms of our original authorization of funding with the following contingencies 1.) That our overall funding of the project doesn't exceed more than one-third of the construction costs 2) That there would not have been a change in the allocation of space such that there would be less space to be used for EVOS purposes than in the original funding resolution 3) That none of the additional funds being authorized in this motion be disbursed unless and until Department of Law and Department of Justice have confirmed to their satisfaction that the City of Cordova has firm commitments for the remaining two-thirds of funding needed to complete the project beyond our one-third 4) That the City of Cordova agree not to approach the Trustee Council for additional funding Motion by Hartig, second by Marceron

Off the record 2 10 p m

PAC Meeting
Summary Oct 3, 2013

The Oct 3, 2013 Public Advisory Committee meeting cancelled due to the Government's Oct 1 shutdown.

Reporting Policy
Revisions

Exxon Valdez Oil Spill Trustee Council

Procedures for the Preparation and Distribution of Reports

Adopted: __________, 2013 *Draft August 29, 2013*

Table of Contents

Exxon Valdez Oil Spill Trustee Council
Procedures for the Preparation and Distribution of Reports

I. INTRODUCTION

These *Procedures for the Preparation and Distribution of Reports* provide instructions regarding the preparation, peer review, printing and distribution of reports for projects funded by the *Exxon Valdez* Oil Spill Trustee Council.

A. Additional Guidelines

These *Procedures for the Preparation and Distribution of Reports* update and supersede earlier versions of this document and should be read together with the report writing guidelines published by the *Journal of Wildlife Management:*

> Block, W.M., F.R. Thompson, D. Hanseder, A. Cox, and A. Knipps. 2011. Journal of Wildlife Management Guidelines. http://joomla.wildlife.org/documents/JWMguidelines2011.pdf

To the extent that there are any inconsistencies between these *Procedures for the Preparation and Distribution of Reports* and the guidance provided by Block, et al. (2011), the instructions provided in these *Procedures* shall be followed.

B. Project Numbers

For purposes of identification each project is assigned a unique number.

1. **Final Report Number –** The project number that appears on the final report will be the number of the final year of funding.
2. **Projects Funded from FY 2010 to Present –** These projects have eight-digit project numbers:
   - **a)** the first two digits designate the current funding year,
   - **b)** the second two digits represent the year the initial funding was authorized by the Trustee Council, and
   - **c)** the last four digits are the unique project identifier.
3. **Trustee Council-Funded Programs –** Programs are given an eight-digit number that follows the same numbering scheme as described above. Each project within a program receives the program's eight-digit number with the addition of a letter designation beginning at "A".
4. **Amendments –** Projects that submit amendments receive a designation of "Am" followed by the date of the amendment.
5. **Examples –**
   - **a) Projects –**

10071234 indicates the project received funding in 2010.

10071234 indicates the project was initially funded by the Council in 2007.

10071234 can be cross-referenced with projects from other funding years such as 071234, 081234, etc.

10071234-Am12.12.10 indicates an amendment to project 10071234, adoption date December 12, 2010.

b) **Programs –**

12120114 indicates the Long-Term Monitoring Program.

12120114-A indicates a project within the Long-Term Monitoring Program.

12120114-A-Am12.12.12 indicates an amendment adoption date December 12, 2012 to a project within the Long-Term Monitoring Program.

6. **Previous Numbering Conventions –** Over time the Trustee Council's project numbering system has evolved to meet the changing needs of the Restoration Program. For information on previous project numbering conventions, see Attachment A, *How to Find EVOSTC Reports.*

II. FINAL REPORTS

A. Preparation of Final Reports

1. **Content Format –** Authors shall follow the format set out below to prepare final reports. Reports shall meet normal scientific standards of completeness and detail that permit an independent scientific reader to evaluate the reliability and validity of the methods, data and analyses.

a) **Report Cover –** The report shall have a front and back cover of quality cover stock. To ensure consistent appearance, the preferred color is goldenrod, but yellow is acceptable. An example of a final report cover is provided. *See*, Attachment B. A final report cover shall:

(1) identify the report, using the appropriate series title, for example:

(a) *Exxon Valdez* Oil Spill Restoration Project Final Report,

(b) *Exxon Valdez* Long-Term Monitoring Program ("GulfWatch Alaska"),

(c) *Exxon Valdez* Long-Term Herring Research and Monitoring Program,

(d) *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report, (Funding for these projects has been completed.),

(e) *Exxon Valdez* Oil Spill Gulf Ecosystem Monitoring and Research Project Final Report, (Funding for these projects has been completed.) or

(f) other series that may be designated by the Trustee Council.

(2) provide report title;

(3) include the project identification number;

(4) identify the author(s) with appropriate affiliation(s);

(5) include the date (month and year) of publication; and

(6) include the following non-discrimination statement toward the bottom of the page on the inside front cover:

"The *Exxon Valdez* Oil Spill Trustee Council administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The Council administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972. If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information, please write to: EVOS Trustee Council, 4210 University Drive, Anchorage, Alaska 99508-4626, or dfg.evos.restoration@alaska.gov; or O.E.O. U.S. Department of the Interior, Washington D.C. 20240."

b) **Title Page –** The Title Page of the report shall immediately follow the report cover page on white bond paper and be identical in content and format to the front of the report cover page. *See*, Attachment B.

c) **Study History, Abstract, Key Words, Project Data and Citation –** Following the Title Page, the report shall include, on not more than two pages: a study history; an abstract; key words; summary of data gathered during the project; and a recommended citation for the final report. *See*, Attachment B.

(1) *Study History* – A brief study history shall include reference to any prior project numbers; changes in the title of the project or report over time; annual project reports or other reports which contributed to the final report; and citation of publications that have preceded publication of the final reports. If the final report includes information regarding related projects or synthesis, the study history should reference this information.

(2) *Abstract* – An abstract, with a maximum length of 200 works, shall enable readers to quickly identify the basic content of the report, determine its relevance to their interests and thus decide whether to read the document in its entirety. If the final consists of several chapters or manuscripts, the abstract shall summarize the entire reports. *See*, Use of Manuscripts for Final Report Writing, II (A) (3). Do not use abbreviations or acronyms in the abstract. This abstract is submitted by the Alaska Resources Library and Information Services (ARLIS) to the National Technical Information Service.

(3) *Key Words* – A short list of key words (up to 12 in alphabetical order) shall be provided. Include words from the title and others that identify:

(a) common and scientific names of principal organisms, if any;

(b) geographic area or region;

(c) phenomena and entities studied (e.g., behavior, reproduction);

(d) methods (only if the report describes a new or improved method); and

(e) other words not covered above but useful for indexing.

(4) *Project Data* – A summary of the data collected during the project shall be provided in order to preserve the opportunity for other researchers and the public to access this data in the future. The summary shall:

(a) describe the data;

(b) indicate the format of the available data collections;

(c) identify the archive in which the data have been stored or the custodian of the data (including contact name, organization, address, phone/fax, e-mail, and web address where data may be acquired); and

(d) indicate any access limitations placed on the data. Limiting access requires written pre-approval by the Trustee Council Office.

(5) *Citation* – A recommended citation for the final report shall be provided. *See*, Attachment A for the correct citation format.

d) **Table of Contents**, including Lists of Tables, Figures and Appendices.

e) **Executive Summary** – The executive summary shall:

(1) consolidate principal points of the report in one place and provide enough detail for the reader to understand the significance of the report without having to read it in full;

(2) be written to that it can be understood independently of the report (i.e., it must not refer to figures, tables or references contained elsewhere and all acronyms, uncommon symbols, and abbreviations must be spelled out;

(3) not exceed four singled-spaced pages;

(4) concisely state the objectives, methods, results and conclusions of the report and reference any related projects or synthesis; and

(5) be organized in the same manner as the report it summarizes.

f) **Introduction** – The introduction shall reference any related projects or synthesis, where appropriate, and:

(1) clearly present the nature and scope of the problem investigated, including the general area in which field activities were conducted; and

(2) review pertinent literature, state the methods(s) of investigation and briefly state principal results.

g) Objectives – The statement of objectives shall be the same as the objectives identified in the approved proposal. If the objectives have changed, describe what has changed and why.

h) Methods – The discussion of methods shall include a clear description of the study area. To the extent the methodology differs from that described in the proposal, explain the reason for the deviation.

i) Results – The presentation of results shall provide an objective and clear presentation of the data collected.

j) Discussion – The discussion section shall:

(1) interpret the study results and explore the meaning and significance of the findings, including alternative interpretations of the results;

(2) discuss whether the study hypotheses are upheld or disproven;

(3) note where there are unanswered questions; and

(4) where appropriate, cite relevant findings from other *Exxon Valdez* oil spill restoration studies, including published literature.

k) Conclusions – This shall be a brief, clear statement of the conclusions that are apparent from the discussion. Major unanswered questions shall be identified.

l) Acknowledgments

m) Literature Cited

n) Other References – If there is a need to list references other than the literature cited (e.g., personal communications), these references shall be identified in this section.

2. Technical Format – The following guidelines shall help provide consistent formatting:

a) Word Processing Conventions

(1) *Standard Settings*

Line
Line spacing: single

Hyphenation: off (i.e., do not hyphenate at right margin)

Justification: left (i.e., do not right-justify margins)

Margins: 1 inch at top, bottom
1 inch at left, right

Tabs: every 0.5 inch

Widow Protection: yes

Page
Page numbers:

Position: bottom center

No numbers: cover, OEO/ADA page (inside of front cover), title page

Roman numerals: lower case (i, ii, iii, iv, v, vi, etc.); front matter, includes Study History, Table of Contents, List of Tables, List of Figures, and List of Appendices.

Arabic numbers: (1, 2, 3, etc.); narrative, beginning with the Executive Summary.

Header: none

Font
Times: 12 point
Note: If Times is not available, some other serif font shall be used (e.g., Palatino, Bookman or New Century Schoolbook).

(2) *Literature Citations* – In the Literature Cited section, start each citation with a hanging indent as shown below:

Byrd, G.V., D. Gibson, and D.L. Johnson. 1974. The birds of Adak Island, Alaska. Condor 76:288-300.

b) Other Conventions

(1) *Italics* – Use italics, rather than underlining, for Latin names and for *Exxon Valdez*.

(2) *Paper* – Use good quality white paper 8.5 x 11" (215 x 280mm) or metric size A4.

(3) *Terms for oil spill* – When referring to the oil spill that occurred because the *Exxon Valdez* ran aground, use *Exxon Valdez* oil spill. After the first mention of the *Exxon Valdez* oil spill, refer to it simply as the spill.

(4) *Acronyns* – Clearly define any acronyms. Avoid the use of acronyms completely in the Abstract and Executive Summary.

(5) *Terms* – Use the terms "damages" and "injury" as defined by CERCLA regulations (*See*, 43 CFR 11.14):

(a) *"Damages"* means the amount of money sought by the natural resource trustee as compensation for injury, destruction or loss of natural resources.

(b) *"Injury"* means a measurable adverse change, either long or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil. Injury encompasses the phrases "destruction" and "loss".

(c) *"Destruction"* means the total and irreversible loss of a natural resource.

(d) *"Loss"* means a measurable adverse reduction of a chemical or physical quality or viability of a natural resource.

3. Use of Manuscripts for Final Report Writing – The Trustee Council encourages principal investigators to publish the results of their work in peer-reviewed journals. With the written approval of the Trustee Council's Science Coordinator, and on a project-by-project basis, manuscripts or journal articles may be used to satisfy project final report writing requirements. When a manuscript is used to fulfill the report requirements, it is strongly preferred that the manuscript be in draft form before it has been submitted to a journal to allow duplication without violation of copyright or publication rights. *See*, Copyright and Publication Rights, II (A) (3) (d).

a) Authority to Use Manuscripts – Principal investigators shall contact the Science Coordinator to request written approval to use a manuscript(s) as the body of a final report.

b) **Objectives –** Because final reports are the primary and permanent record of how Trustee Council funds have been spent and what has been accomplished with those funds, it is necessary that these reports address all of the objectives for which the Trustee Council has provided funds.

(1) If all of the project's objectives are completely described within one or more manuscripts being prepared for publication, a copy of the manuscript(s) may be submitted as the entire body of the report. *See*, Standard Format requirements, II (A) (3) (c).

(2) If a project's objectives are not all described completely within one or more manuscripts, the manuscript(s) may serve as a portion of the report. For example, if only two of five objectives are addressed in a manuscript, the report shall include – in addition to the manuscript – information on the three objectives not covered in the manuscript. The two objectives covered by the manuscript shall be referenced in the report as appropriate (e.g., in the Methods and Results sections) and substantially integrated into the Discussion section, where there shall be an overall discussion of the project. In such cases, the combination of the manuscript and additional report material shall present an organized, integrated and complete account of the project activities and results.

c) **Standard Format –** Every report, regardless of whether it is in the standard format or includes manuscripts, shall adhere to the formatting prescribed for the Report Cover, Title Page, Study History, Abstract, Key Words, Project Data and Citation. *See*, Content Format, II (A) (1).

d) **Copyright and Publication Rights –** When a manuscript is used to fulfill report writing requirements, it must be in a form that can be duplicated freely and posted on the Trustee Council website. This may require obtaining permission from the publisher. When appropriate:

(1) The author shall provide the Trustee Council Office with a copy of the publisher's written permission to duplicate and post the article as part of the report.

(2) The statement "This article is reprinted with permission from the publisher." shall precede the journal article(s) in the report.

e) **Disclaimer Statement –** Investigators seeking to publish the results of Trustee Council-sponsored projects shall include the following statement with all manuscripts:

> "The research described in this paper was supported by the *Exxon Valdez* Oil Spill Trustee Council. However, the findings and conclusions presented by the author(s) are their own and do not necessarily reflect the views or position of the Trustee Council."

f) **Reprints –** Investigators who publish the results of Trustee Council-sponsored projects shall provide the Trustee Council Office (attention: Science Coordinator) three (3) reprints of any published manuscript. The Trustee Council Office shall provide one (1) of the reprints to ARLIS.

4. Due Date

a) **Due Dates –** Unless a different date is specified in the approved proposal or contract, draft final reports shall be submitted for peer review in the year following the fiscal year in which project work was completed:

(1) For an October 1-September 30 fiscal year, the report is due by April 15.

(2) For a February 1-January 31 fiscal year, the report is due by March 1.

b) **Request for Extension –** If the due date cannot be met, the principal investigator shall file an extension request with the Science Coordinator at least 15 days prior to the due date. The request must be in writing and state a reason the report will be late. With approval of the Executive Director, an alternative final report due date may be identified.

Comment [CH1]: EMH: Former Section II (A) (5), Withholding of Funding Pending Deliverables, was redundant with requirement in Financial Procedures and has been removed.

B. Review Process: Final Reports

1. **Submission of Draft Final Reports for Peer Review –** Draft final reports are required to undergo the peer review process outlined below. For projects which are not in a Trustee Council-funded Program, the principal investigator shall submit one (1) electronic copy of the draft final report to the Science Coordinator for peer review. The electronic copy shall be submitted as a word processing document (most recent version of Microsoft Word for Windows) with any figures and tables embedded.

Science Coordinator phone: (907) 278-8012
EVOS Trustee Council Office fax: (907) 276-7178

4210 University Dr.
Anchorage, AK 99508-4626
E-mail: dfg.evos.projects@alaska.gov

2. **Draft Final Report Peer Review –** Draft final reports shall be scientifically or technically peer reviewed under the direction of the Science Coordinator or, for Trustee Council-funded Programs, the Team Leads.

   a) **Peer Review –** The Science Coordinator or Team Leads, where applicable, may secure the services of a minimum of two qualified reviewers who will provide comments, identify questions, and suggest revisions as appropriate for the report.

      (1) Reviewers will be selected based upon experience, expertise, availability, and objectivity.

      (2) Reviewers will be screened to avoid conflicts of interest and shall sign a conflict of interest disclosure form before being selected for a peer review.

      (3) Peer reviews will be confidential. Comments may be submitted in writing to the Science Coordinator or Team Leads.

      (4) Peer reviewers will be anonymous to the authors of the report and the general public.

   b) **Peer Review Comments –** The Science Coordinator or Team Leads, where applicable, shall consolidate the peer review comments and provide the consolidated comments and any recommendations in writing to the principal investigator(s); Team Leads will also forward the peer review comments and any recommendations to the Science Coordinator.

3. **Revision of Final Report and Re-Submission for Approval**

   a) **Revision –** Within 30 days of receiving peer review comments, principal investigators will revise their draft final reports to address peer review comments, as appropriate.

   b) **Re-Submission –** After revision, principal investigators will submit one (1) electronic copy of the revised final report to the Science Coordinator for acceptance.

   c) **Approval –** Final reports will not be distributed from the Trustee Council Office until peer review is complete. Once the final report is accepted,

(1) the Science Coordinator shall notify the principal investigator in writing and send a copy of the letter of acceptance to the project manager, ARLIS, and Team Leads, where applicable;

(2) the Science Coordinator will also forward the report to ARLIS for format review.

4. **Final Report Review of Format** – Once the content of the report is accepted by the Science Coordinator, the Science Coordinator shall forward the final report to ARLIS for review of format.

a) **Format Review** – After approving the final report, the Science Coordinator will send an electronic copy of the final report as a Word file to ARLIS (attention: Carrie Holba at reference@arlis.org) for format review.

b) **Revisions** – Within 15 days of receipt of the final report, ARLIS staff shall review it for compliance with the report format standards, remove all references to "draft", and make any revision needed for format compliance.

c) **Approval** – After revising and approval the format, ARLIS staff will e-mail a copy of the report to the principal investigator with written confirmation that the format has been approved and the report is ready to be printed. The principal investigator shall not reproduce the report until format approval is confirmed in writing by ARLIS. ARLIS staff will also e-mail final copies of the report and format approval letter to the Science Coordinator, project manager and Team Leads, where applicable.

C. Printing and Distribution Process

1. **Reproduction and Number of Copies** – Within 60 days of the date of the written confirmation from ARLIS indicating approval of the final report format, the principal investigator shall produce and send to ARLIS six (6) two-sided, bound copies of the report.

2. **Binding** – Copies of final reports shall be bound using Perfect binding. Smaller reports may be bound with black tape or comb binding. Very small reports may be bound with staples in three places along the spine, but only when other binding options are not available. Questions regarding binding shall be directed to ARLIS (attention: Carrie Holba at reference@arlis.org).

3. **Distribution of Final Reports** – ARLIS shall send two bound copies of final reports to the Trustee Council Office for the Science Coordinator and the Trustee Council's Official Record. Final reports, in locked PDF format, shall be posted on the Trustee Council website at

www.evostc.state.ak.us. ARLIS will provide URLs for final reports to the Alaska State Library and National Technical Information Service (NTIS) to fulfill state and federal depository requirements. *See*, Attachment A, *How to Find EVOSTC Reports*.

III. ANNUAL PROJECT REPORTS AND ANNUAL AND MID-YEAR PROGRAM STATUS SUMMARIES

A. Projects not in a Trustee Council-Funded Program: Annual Project Report Requirement

1. **Annual Project Report –** The principal investigator for a project is responsible for the submission to the Trustee Council of an annual project report.

2. **Multi-Year Projects –** An annual project report shall be submitted each year until the project is completed, at which time a final report shall be submitted.

3. **Due Date –** Unless a different date is specified in the approved proposal or contract, annual project reports shall be submitted for each fiscal year for which a project received funding:

   a) for an October 1-September 30 fiscal year, by September 1;

   b) for a February 1-January 31 fiscal year, by March 1.

B. Trustee Council-Funded Programs: Annual Project Reports and Annual and Mid-Year Program Status Summaries Requirements

1. **Annual Project Reports –** The principal investigator for a project within a Trustee Council-funded program is responsible for production of an annual project report for submission to the Trustee Council by the Team Leads, as required in III (B) (3) (b).

2. **Multi-Year Projects –** An annual project report shall be submitted each year until the project is completed, at which time a final report shall be submitted.

3. **Program Team Lead Submission –** Team Leads are responsible for:

   a) collecting, reviewing and collating the annual project reports from the individual projects within the program, including any agency projects;

   b) submission to the Trustee Council of:

      (1) the annual project reports from the individual projects within the program to be submitted with

Comment [CH2]: EMH: This section has been reorganized slightly to clarify requirements. Track changes were accepted for ease of review.

(2) an annual program status summary; and

c) submission of a mid-year program status summary.

4. **Due Date –** Unless a different due date is specified in the approved proposal or contract,~~For Trustee Council-funded Programs~~ for each fiscal year for which a project within a Trustee Council-funded program received funding:

a) the ~~individual projects'~~ annual project reports and annual program status summary are due by March 1; and

b) the mid-year program status summary is due by September 1.

C. Content of Annual Project Reports and Annual and Mid-Year Program Status Summaries

1. **Annual Project Reports –** Annual project reports shall include the information listed below and be submitted on the appropriate form. *See* Attachments C, D and E.

a) **Project Number**

b) **Project Title –** The annual and mid-year program status summaries shall include the program title.

c) **Principal Investigator's Name(s) –** The annual and mid-year program status summaries shall include the name(s) of the Team Leads submitting the report.

d) **Time Period Covered by the Report or Summary –**

(1) The annual project reports and annual program status summary will report on the prior fiscal year's work.

(2) The mid-year program status summary will report on the prior six-months' work.

e) **Date of Report or Program Status Summary –** specify month and year.

f) **Project or Program Website –** if applicable.

g) **Summary of Work Performed –** This section shall include a brief summary of work performed during the reporting period, including any results available to date and their relationship to the original project objectives. Any deviation from the original project objectives, procedures or statistical methods, study area, or schedule shall be included. Any known problems or unusual developments, and any other significant information pertinent to the project, shall also be described.

h) **Summary of Future Work to be Performed** – This brief summary shall describe work to be performed during the upcoming reporting period, if changed from the original proposal. A description of any proposed changes in project objectives, procedures or statistical methods, study area, or schedule shall be included.

i) **Coordination/Collaboration** – This section shall describe efforts undertaken during the reporting period to achieve the coordination and collaboration provisions of the proposal, if applicable.

j) **Community Involvement/TEK and Resource Management Applications** – This section shall describe efforts undertaken during the reporting period to achieve the community involvement/TEK and resource management application provisions of the proposal, if applicable.

k) **Information Transfer** – This section shall list

(1) publications produced during the reporting period;

(2) conference and workshop presentations and attendance during the reporting period; and

(3) data and/or information products developed during the reporting period.

l) **Budget** – This section shall provide:

(1) a detailed accounting of the project spending for the fiscal year, February 1-January 31, or October 1-September 30, as applicable;

(2) using the Reporting Summary Form, which is included in the Detailed Budget Form submitted with the original proposal and available on the EVOSTC website at http://www.evostc.state.ak.us/Publications/Invitations.cfm, please provide:

(a) a comparison of the actual funds spent versus those originally requested and approved by the Council; and

(b) in the Comments box,

Comment [CH3]: EMH: This section has been edited alongside a newly revised proposal budget form which provides a designated form for annual reporting.

(i) clearly note discrepancies and a brief reason provided for any changes; and

(ii) identify non-EVOSTC or in-kind contributions used as cost-share for project work, matching funds or other funds from non-Trustee Council sources. Please also note the purpose for which the funds will be used. Do not include funds that are not directly and specifically related to project work.

2. **Annual Program Status Summary –** The annual program status summary shall include the information required in III (C) (1). The requirements in III (C) (1) refer to "projects". However, the Team Leads should address the requirements in III (C) (1) as applicable to the program where appropriate, and also include the following:

   a) summarize the status and development of the program;

   b) progress towards milestones;

   c) detail or highlight any noteworthy issues or findings relating to the program and projects within the program; and

   d) include an overview of work performed during the prior year, including any results available to date, as well as discussion of how future work is anticipated to contribute to this overview of work. The overview of work should clearly demonstrate how the individual projects inform the overall program goals and may include

      (1) collaborations, both practical and scientific;

      (2) scientific synthesis;

      (3) program milestones reached;

      (4) emerging/developing hypotheses;

      (5) public and management agency use of program or project products or data;

      (6) any known problems or unusual developments; and

      (7) any other significant information pertinent to the program.

3. **Mid-Year Program Status Summary –** The mid-year program status summary shall be a brief document ~~(4-5 pages)~~ that includes items listed in III (C) (1) (a~~b~~-h).

~~4. Timely Submission – The information in the annual report and annual and mid-year program status summaries shall be a key component in the Trustee Council's annual decision to continue funding a project. Failure to submit an annual report or summery by the applicable due date, or unsatisfactory review of an annual report or summary, may result in withholding of additional project funds, and may result in cancellation of the project or denial of funding for future projects.~~

Comment [CH4]: EMH: This language was consolidated with an existing requirement in the Financial Procedures.

D. Submission and Review Process: Annual Project Reports and Annual and Mid-Year Program Status Summaries

1. **Submission for Review of Annual Project Reports and Annual and Mid-Year Program Status Summaries –** The principal investigator, or Team Lead, as applicable, shall electronically submit the report to the Science Coordinator, care of dfg.evos.projects@alaska.gov.

   a) **Subject Line –** The subject line of the e-mail transmitting the annual project report or summary must include the project number and the words "annual project report" (e.g., "035620 Annual Project Report), "annual program status summary" (e.g., "035620 Annual Program Status Summary"), or "mid-year program status summary" (e.g., "035620 Mid-Year Program Status Summary").

   b) **Electronic Format –** An electronic report or summary shall be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (using the most recent versions of Acrobat, Microsoft Word for Windows) with all figures and tables embedded. The preferred Acrobat file format is "formatted text with graphics" format. Minimally, "PDF searchable image" format may be used if pre-approved by the Trustee Council Office. In either case, the PDF file shall not be secured or locked from future editing, or contain a digital signature from the principal investigator.

2. **Review Process for Annual Project Reports and Annual and Mid-Year Program Status Summaries –** Annual project reports and annual and mid-year program status summaries shall be reviewed by the Science Coordinator. ~~Under the guidance of the Science Coordinator, t~~These reports and summaries may also be reviewed by qualified outside peer reviewers and the Trustee Council's Science Panel. The review process may~~shall~~ be used to determine whether continued funding of the project is warranted and to guide further work on the project. Any written comments on a report or summary shall be provided to the principal investigator or Team Leads, as applicable, and kept on file at the Trustee Council Office, available upon request.

E. Distribution of Annual Project Reports and Annual and Mid-Year Program Status Summaries – Annual project reports and annual and mid-year

program status summaries shall be kept on file as public documents at the Trustee Council Office, available upon request. These reports and summaries shall also be posted on the Trustee Council's website at www.evostc.state.ak.us.

IV. QUARTERLY REPORTS

A. Projects not in Trustee Council-Funded Programs

Projects not in a Trustee Council-funded Program shall~~must~~ submit a quarterly report.

B. Quarterly Project Status Reports

1. Within 30 days following the end of each quarter, the principal investigator for each Trustee Council-funded project shall submit a status report to the Executive Director.

2. Principal investigators shall work with their agency project managers to address measurable project tasks in their quarterly reporting obligations.

Comment [CH5]: EMH: Withholding of Funding Pending Deliverables language that followed this section was removed, as it was consolidated with an existing requirement in the Financial Procedures.

ATTACHMENT A *How to Find EVOSTC Project Reports*

A list of EVOS Trustee Council (EVOSTC) final reports and annual (prior to 2002) reports is maintained at the EVOSTC website at www.evostc.state.ak.us/Publications/bibliographies.cfm. EVOSTC reports are available as listed below. Reports are also submitted to the Alaska State Library and the National Technical Information Service in fulfillment of state and federal depository requirements.

Final project reports are available full-text at:

- EVOSTC website. The Trustee Council's database of restoration projects is searchable via Project Search by project number, researcher, or project title.

- ARLIS catalog. The catalog is searchable by title, project number, principal investigator, additional authors, series title, subject heading, and key words. A searchable notes field in the catalog record describes the report and provides additional access points. From the catalog record, a link takes the researcher to the full-text report. Paper copies of reports are available for check out at ARLIS and are loaned worldwide through interlibrary loan.

- National Technical Information Service (NTIS). Copies of most final reports can be purchased in electronic, paper or microfiche formats through NTIS at (703) 487-4650 or www.ntis.gov.

Annual project reports are available full-text at:

- EVOSTC website. The Trustee Council's database of restoration projects is searchable via Project Search by project number, researcher, or project title.

- ARLIS catalog. Annual reports for projects funded prior to 2002 are available full-text through the ARLIS catalog. Paper copies are available for check out and are loaned worldwide through interlibrary loan.

Program Status Summaries are available full-text at the EVOSTC website. The Trustee Council's database of restoration projects is searchable via Project Search by project number, researcher, or project title.

Report Numbers: When locating a report, it may be helpful to understand how the reports are numbered. For purposes of identification each project is assigned a unique number. The project number that appears on the final report is the number of the final year of funding. Over time the Trustee Council's project numbering system has evolved to meet the changing needs of the Restoration Program.

- Natural Resource Damage Assessment (NRDA) Studies: Funded in 1989 to 1992, these studies were designated by alpha-numeric study numbers (e.g., MM6 for "Marine Mammal Study 6" or FS2 for "Fish/Shellfish Study 2"). These reports were published in the series, *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Annual Report, or *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report.

- Restoration Projects: In 1993 the Trustee Council shifted the program emphasis from damage assessment to restoration, and projects were given five-digit numbers. The first two digits indicate the funding year and the last three digits identify the individual project. Initially, continuing projects received a new project number each year, but in 1995 the Trustee Council began using the unique project identifier, and the same last three digits were used to identify an individual project each year it was funded. Large projects were divided into several smaller subprojects, and numbers and/or letters were added to the project number to identify these subprojects (e.g., 95320S or 95139C1). Some NRDA studies focused on restoration activities were continued as restoration projects in 1993. From 1993 to 2001 restoration project annual reports were published in the series, *Exxon Valdez* Oil Spill Restoration Project Annual Report. Beginning in 2002, annual reports were no longer published, but are available in electronic format at the EVOSTC website. Restoration project final reports are published in the series, *Exxon Valdez* Oil Spill Restoration Project Final Report.
- *Exxon Valdez* Oil Spill Gulf Ecosystem Monitoring and Research Program (GEM): These projects were funded between FY 2002 and FY 2006. GEM projects funded in 2002 have five-digit numbers as described above. GEM projects funded after FY 2002 have six-digit project numbers (e.g., 030647). The first two digits identify the fiscal year in which the project was funded, and the last four digits are the unique project identifier. Some early GEM report numbers are preceded by a "G", but this practice was discontinued. These final reports were published in the series, *Exxon Valdez* Oil Spill Gulf Ecosystem Monitoring and Research Project Final Report.
- Restoration Projects funded in 2003 to 2009: These projects have six-digit project numbers. The first two digits represent the fiscal year of funding and the last four digits are the unique project identifier. These final reports were published in the series, *Exxon Valdez* Oil Spill Restoration Project Final Report.
- Projects funded from FY 2010 to present: The projects have eight-digit project numbers: the first two digits designate the current funding year, the second two digits represent the year the initial funding was authorized by the Trustee Council, and the last four digits are the unique project identifier. Trustee Council-funded programs are given an eight-digit number that follows the same numbering scheme. Each project within a program receives the program's eight-digit number with the addition of a letter designation beginning at "A". Projects that submit amendments receive a designation of "Am" followed by the date of the amendment. These project final reports are published in the series, *Exxon Valdez* Oil Spill Restoration Project Final Report. Reports from projects within a program are published in the series, *Exxon Valdez* Long-Term Monitoring Program ("GulfWatch Alaska") or *Exxon Valdez* Long-Term Herring Research and Monitoring Program.

For assistance in locating EVOSTC final and annual reports, contact ARLIS at:

Alaska Resources Library and Information Services (ARLIS)
Suite 111 Library Building
3211 Providence Drive
Anchorage, AK 99508
(907) 27-ARLIS (272-7547)
reference@arlis.org www.arlis.org

ATTACHMENT B ***EVOSTC Final Report Example***

Exxon Valdez Oil Spill
Restoration Project Final Report

Responses of River Otters to Oil Contamination:
A Controlled Study of Biological Markers

Restoration Project 99348
Final Report

NOTE: The Report Cover must be quality cover stock, goldenrod in color.

*This example cover page also shows how to indicate the authors' (Ben-David, Bowyer, Duffy) affiliation when the report was done at the direction of an agency (ADF&G) and the agency wants to be acknowledged.

Merav Ben-David
R. Terry Bowyer
Lawrence K. Duffy

Institute of Arctic Biology
311 Irving Building
University of Alaska Fairbanks
Fairbanks, Alaska 99775

for:

Alaska Department of Fish and Game
Habitat and Restoration Division
333 Raspberry Road
Anchorage, Alaska 99518

September 1999

NOTE: The statement below must be printed on the back of the goldenrod Report Cover.

Exxon Valdez Oil Spill
Restoration Project Final Report

Responses of River Otters to Oil Contamination. A Controlled Study of Biological Markers

Restoration Project 99348
Final Report

NOTE: The Title Page must be on white bond paper.

Merav Ben-David
R Terry Bowyer
Lawrence K. Duffy

Institute of Arctic Biology
311 Irving Building
University of Alaska Fairbanks
Fairbanks, Alaska 99775

for·

Alaska Department of Fish and Game
Habitat and Restoration Division
333 Raspberry Road
Anchorage, Alaska 99518

September 1999

Responses of River Otters to Oil Contamination·
A Controlled Study of Biological Stress Markers

Restoration Project 99348
Final Report

Study History: Project 99348 originated from the need to better understand the effects of contamination by crude oil on biomarkers in river otters (*Lontra canadensis*) Previous studies demonstrated elevated levels of biomarkers in river otters from oiled areas compared with those from non-oiled areas throughout Prince William Sound, Alaska, shortly following the *Exxon Valdez* oil spill (EVOS). Although the data collected to date strongly indicated a correlation between oil contamination and physiological stress in river otters, this evidence required verification through controlled experiments as identified by the EVOS Trustee Council review process (1997). This 2-year project was conducted at the Alaska SeaLife Center in Seward, Alaska, USA, between April 1998 and March 1999 Additional funding was provided by the Council for completion of 3 manuscripts in FY 2000 for publication in a peer-reviewed journal.

Abstract: In this study, we experimentally determined the effects of oil contamination on river otters. Fifteen wild-caught male river otters were exposed to 2 levels of weathered crude oil (i e , control, 5 ppm/day/kg body mass, and 50 ppm/day/kg body mass) under controlled conditions in captivity at the Alaska SeaLife Center in Seward, Alaska. Responses of captive river otters to oil ingestion provided mixed results in relation to biomarkers. Although hemoglobin, white blood cells, alkaline phosphates, and possibly interleukin–6 immunoreactive responded in the expected manner, other parameters did not. Aspartate Aminotransferase Alanine Aminotransferase haptoglobin did not increase in response to oiling or decrease during rehabilitation In addition, although expression of P450-1A increased in captive river otters during oiling, several inconsistencies in the data complicated data interpretation. Nonetheless, we were able to establish that reduction in hemoglobin led to increase in energetic costs of terrestrial locomotion, decrease in aerobic dive limit, and potential increase in foraging time due to a decrease in total length of submergence during each foraging bout. We offer a theoretical physiological model to describe interactions between the different biomarkers and advocate the exploration and development of other biomarkers that will be independent of the heme cycle.

Key Words: Aerobic dive limit, Alaska, captivity, CYP1A, crude oil, hemoglobin, immuno-histochemistry, liver enzymes, *Lontra canadensis*, lymphocytes, oxygen consumption, quantitative RT-PCR.

Project Data: *Description of data* – data was collected from live animals held in captivity at the Alaska SeaLife Center. Blood and other tissues were sampled and processed in different laboratories Additional samples are archived at the Institute of Arctic Biology, UAF *Format* – All data were entered as Excel spreadsheets *Custodian* – contact Merav Ben-David, Institute of Arctic Biology, 311 Irving Building, University of Alaska Fairbanks, Fairbanks, Alaska 99775.

Citation:

Ben-David, M , R.T Bowyer, and L.K. Duffy. 1999. Responses of river otters to oil contamination A controlled study of biological stress markers, *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 99348), Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage, Alaska.

ATTACHMENT C ***EVOSTC Annual Project Report Form***

Due Dates for projects not in a Trustee Council-funded program:

As per Reporting Policy III (A)(1)-(3), the principal investigator for a project not in a Trustee Council-funded program is responsible for the submission to the Trustee Council of an annual report. Unless a different date is specified in the approved proposal or contract, annual reports shall be submitted for each fiscal year for which a project received funding:

1) for an October 1-September 30 fiscal year, by September 1;
2) for a February 1-January 31 fiscal year, by March 1.

Due Date for projects within a Trustee Council-funded program:

As per Reporting Policy III(B)(1)-(4), the principal investigator for a project within a Trustee Council-funded program is responsible for the production of an annual report for submission to the Trustee Council by the Team Leads. Unless a different date is specified in the approved proposal or contract, annual reports are due by March 1. *Note*: These due dates are for program submissions to the Trustee Council. PIs should consult with their program Team Leads with regard to any internal program due dates.

*Please refer to the Reporting Policy for all reporting due dates and requirements.

1. **Program Title and Number:** *See,* Reporting Policy at III (C) (1) (a), (b).

   Text

2. **PI Submitting the Report:** *See,* Reporting Policy at III (C) (1) (c).

   Text

3. **Time period covered by the Report:** *See,* Reporting Policy at III (C) (1) (d).

   Text

4. **Date of Report:** *See,* Reporting Policy at III (C) (1) (e).

   Text

5. **Project website (if applicable):** *See,* Reporting Policy at III (C) (1) (f).

   Text

6. **Summary of Work Performed:** *See,* Reporting Policy at III (C) (1) (g).

   Text

7. **Summary of Future Work to be Performed:** *See,* Reporting Policy at III (C) (1) (h).

   Text

8. **Coordination/Collaboration:** *See,* Reporting Policy at III (C) (1) (i).

   Text

9. Community Involvement/TEK and Resource Management Applications: *See*, Reporting Policy at III (C) (1) (j)

Text

10. Information Transfer: *See*, Reporting Policy at III (C) (1) (k)

Text

11. Budget: *See*, Reporting Policy at III (C) (1) (l)

Text

- All citations herein refer to the EVOSTC Procedures for the Preparation and Distribution of Reports ("Reporting Policy")
- For technical submission format information, please see Reporting Policy at III (D) (1)
- Form rev 7 2 13

We appreciate your prompt submission
and thank you for your participation.

ATTACHMENT D ***EVOSTC Annual Program Status Summary Form***

Due Date for Annual Program Status Summary:

As per Reporting Policy III (B) (3)-(4), Team Leads are responsible for submission to the Trustee Council of the annual reports from the individual projects within the program to be submitted with an annual program status summary. Unless a different date is specified in the approved proposal or contract, annual program status summaries are due by March 1.

*Please refer to the Reporting Policy for all reporting due dates and requirements.

1. **Program Title and Number:** *See*, Reporting Policy at III (C) (1) (a), (b).

   Text

2. **Team Lead Submitting the Report:** *See*, Reporting Policy at III (C) (1) (c).

   Text

3. **Time period covered by the Report:** *See*, Reporting Policy at III (C) (1) (d).

   Text

4. **Date of Report:** *See*, Reporting Policy at III (C) (1) (e).

   Text

5. **Project website (if applicable):** *See*, Reporting Policy at III (C) (1) (f).

   Text

6. **Summary of Work Performed:** *See*, Reporting Policy at III (C) (1) (g).

   Text

7. **Summary of Future Work to be Performed:** *See*, Reporting Policy at III (C) (1) (h).

   Text

8. **Coordination/Collaboration:** *See*, Reporting Policy at III (C) (1) (i).

   Text

9. **Community Involvement/TEK and Resource Management Applications:** *See*, Reporting Policy at III (C) (1) (j).

   Text

10. **Information Transfer:** *See*, Reporting Policy at III (C) (1) (k).

    Text

11. **Budget:** *See*, Reporting Policy at III (C) (1) (l).

    Text

12. Summarize the status and development of the programs: *See,* Reporting Policy at III (C) (2) (a)

Text

13. Progress towards milestones: *See,* Reporting Policy at III (C) (2) (b)

Text

14. Detail or highlight any noteworthy issues or findings relating to the program and projects within the program: *See,* Reporting Policy at III (C) (2) (c)

Text

15. Overview of Work: *See,* Reporting Policy at III (C) (2) (d)

Text

- All citations herein refer to the EVOSTC Procedures for the Preparation and Distribution of Reports ("Reporting Policy")
- For technical submission format information, please see Reporting Policy at III (D) (1)
- Form rev 7 2 13

We appreciate your prompt submission and thank you for your participation.

ATTACHMENT E ***EVOSTC Mid-Year Program Status Summary Form***

Due Date for Mid-Year Program Status Summary:

As per Reporting Policy III (B) (3)-(4), Team Leads are responsible for submission to the Trustee Council of a mid-year program status summary. Unless a different date is specified in the approved proposal or contract, mid-year program status summaries are due by September 1.

*Please refer to the Reporting Policy for all reporting due dates and requirements.

1. **Program Title and Number:** *See,* Reporting Policy at III (C) (1) (a), (b).

   Text

2. **Team Lead Submitting the Report:** *See,* Reporting Policy at III (C) (1) (c).

   Text

3. **Time period covered by the Report:** *See,* Reporting Policy at III (C) (1) (d).

   Text

4. **Date of Report:** *See,* Reporting Policy at III (C) (1) (e).

   Text

5. **Project website (if applicable):** *See,* Reporting Policy at III (C) (1) (f).

   Text

6. **Summary of Work Performed** –*See,* Reporting Policy at III (C) (1) (g).

   Text

7. **Summary of Future Work to be Performed** –*See,* Reporting Policy at III (C) (1) (h).

   Text

- All citations herein refer to the EVOSTC Procedures for the Preparation and Distribution of Reports ("Reporting Policy.")
- For technical submission format information, please see Reporting Policy at III (D) (1).
- Form rev. 7.2.13

We appreciate your prompt submission and thank you for your participation.

Financial Policy
Revisions

Exxon Valdez **Oil Spill Trustee Council**

Financial Procedures

Adopted: ________, 2013

Draft Oct 25, 2013

Table of Contents

Exxon Valdez Oil Spill Trustee Council

Financial Procedures

I. SETTLEMENT FUNDS

A. Joint Trust Funds

The Joint Trust Funds consist of all payments received or to be received by the United States and the State of Alaska pursuant to the Agreement and Consent Decree issued in United States v. Exxon Corporation, et al. (No. A91-082 CIV) and State of Alaska v. Exxon Corporation, et al. (No. A91-083 CIV)~~)~~, including any interest accrued thereon.

B. Investment Fund(s)

Pursuant to Court Order and in accordance with the Terms of the Memorandum of Agreement and Consent Decree, from December 1991 through October 5, 2000, the Joint Trust Funds were placed in an interest-bearing account in the Court Registry Investment System (CRIS) administered through the United States District Court. The Governments sought and obtained Congressional approval to expand options for investment of the settlement proceeds.

1. **Public Law 106-113 –** the Consolidated Appropriations Act, 2000, was enacted November 29, 1999.

2. **Section 350 of H.R. 3423 –** authorizes deposit of all or a portion of the Joint Trust Funds previously received, or to be received, by the Governments in the Natural Resource Damage Assessment and Restoration Fund or accounts outside the United States Treasury or both.

C. Investment Fund(s) Disbursement

Upon unanimous approval of the Trustee Council, the Alaska Department of Law and the United States Department of Justice shall be requested to notify the United States District Court for the District of Alaska.

1. **Notification –** shall consist of legal documents required by the Court and documentation demonstrating the unanimous agreement of the Trustee Council.

2. **Payment instructions –** Concurrently, the Alaska Department of Law and the United States Department of Justice shall be requested to provide

the custodian(s) of the Investment Fund(s) with payment instructions.

3. **Interest** – When appropriate, interest earned on the federal and state accounts and/or unobligated balances from prior years' authorizations shall be subtracted from the disbursement.

D. Authority to Spend

No obligations shall be incurred until such time as

1. a Court Order is entered by the United States District Court for the District of Alaska, or

2. a notification is filed with the United States District Court for the District of Alaska, and

3. any terms and conditions placed on the funding by the Trustee Council have been met.

E. Federal Account

In accordance with federal law, funds required for federal project implementation are deposited in the Natural Resource Damage Assessment and Restoration (NRDA&R) Fund managed by the Department of the Interior.

F. State Account

In accordance with state law, funds required for state project implementation are deposited in the *Exxon Valdez* Oil Spill Settlement Fund.

II. PROJECT AUTHORIZATION

A. General

Authorization to expend personal services, travel, contractual, commodities, equipment and general administration funds shall be consistent with the project budgets approved by the Trustee Council.

B. Fiscal Year

For Trustee Council approvals after September 2012, and unless otherwise approved by the Trustee Council, the fiscal year begins on February 1 and ends on January 31. In the event the Trustee Council approves

1. a project with a different fiscal year, the fiscal year must be clearly stated in the approval motion;

2. in a single approval motion, multiple fiscal years of funding for a project, the project must be designated as a "multiple-year project" in the approval motion and the fiscal year in which the funds will lapse must be specified in the approval motion; or

3. a capital project, the designation as a capital project must be clearly stated in the approval motion.

C. Adjustments between Projects

As long as an adjustment does not alter the underlying scope or objectives of the affected projects, agencies have the authority to move funds into or out of projects up to the cumulative amount of $10,000 or up to 10% of the authorized level of funding for each affected project, whichever is less.

1. Justification and supporting documentation as to the reason for all such adjustments shall be maintained by the agencies.

2. All such adjustments must be reported to the Executive Director in the Annual Financial Report. For further information regarding the Annual Financial Report, refer to the Accounting section IV of these procedures.

D. Adjustments between Line Items

As long as an adjustment does not alter the underlying scope or objectives of the project, agencies are authorized to move, within a single project, budgeted funds between line items and may change detailed items of expenditure to accommodate circumstances encountered during budget implementation.

1. Justification and supporting documentation as to the reason for all such adjustments must be maintained by the agencies.

2. All such adjustments must be reported to the Executive Director in the Annual Financial Report. For further information regarding the Annual Financial Report, refer to the Accounting section IV of these procedures.

E. Adjustments between Fiscal Years of a Multiple-Year Project

As long as an adjustment does not alter the underlying scope or objectives of the project, agencies are authorized to carry forward budgeted funds to the subsequent fiscal year of a multiple-year project.

1. Justification and supporting documentation as to the reason for all such adjustments must be maintained by the agencies.

2. All such adjustments must be reported to the Executive Director in the Annual Financial Report. For further information regarding the Annual Financial Report, refer to the Accounting section IV of these procedures.

F. Revisions

1. Trustee Council action is required to move amounts greater than that authorized in section II.C., above. Trustee Council action is also required if
   a) the adjustment changes the scope or objectives of a project,
   b) establishes a new project, or
   c) terminates an approved project before its scheduled completion.
2. In the event the proposed adjustment changes the scope or objectives of a project, establishes a new project, or terminates an approved project before its scheduled completion, the public shall be given a reasonable opportunity to review and comment on the proposed change prior to action of the Trustee Council.

G. Withholding of Funding Pending Deliverables

1. Ten percent (10%) of project funding will be withheld by project managers until the following have been completed:
   a) the final report has completed peer review and format review and has been accepted by the Science Coordinator;
   b) all print copies of the final report have been delivered to the Alaska Resources Library and Information Service (ARLIS);
   c) an electronic copy of the final report has been delivered to the Trustee Council office; and
   d) all project data and metadata have been submitted to approved archives, in accordance with the Trustee Council Data Policy.
2. The Executive Director has the discretion to alter the due date on deliverables, whether planned or for other grounds the Executive Director determines are reasonable.
3. The 10% withholding will apply to the final year of multi-year projects.
4. No further funding will be released or awarded to proposers with tardy

Comment [CH1]: EMH: Requirement was formerly in project resolution form.

Trustee Council deliverables or who receive an unsatisfactory review of a deliverable.

Comment [CH2]: EMH: Requirement was formerly in Reporting Policy.

III. PROJECT COSTS

A. Direct Project Costs

Direct costs are those costs that can be identified with or linked to a specific project.

B. Indirect Project Costs

Indirect costs are those costs that are incurred for common or joint projects and therefore cannot be identified readily and specifically with a specific project. In the case of governmental agencies, indirect costs are covered through a general administration formula. The appropriate indirect rate for contractors shall be approved on a case-by-case basis.

C. General Administration Formula

The general administration formula is used to reimburse governmental agencies for indirect project costs incurred in implementing the restoration program.

1. The general administration formula is nine percent (9%) of each project's direct costs.
2. General administration funds may be spent at the agency's discretion provided they are spent on indirect costs incurred in implementing activities funded by the Trustee Council.
3. Agencies are entitled to one hundred percent (100%) of their budgeted general administration funds regardless of how much of their budgeted direct project funds have been expended.

D. Unallowable Costs

Restoration funds shall be used only for costs that directly benefit Trustee Council approved projects with the exception of reimbursement of general administration (i.e., indirect) costs that are calculated in accordance with the general administration formula.

E. Bonuses

Bonuses for personnel working on Trustee Council-funded activities are allowable costs.

1. Agencies shall follow their standard operating procedures in determining bonus awards.

2. Bonuses shall be considered an indirect project cost and, if awarded, shall be paid with general administration funds.

IV. ACCOUNTING

A. General

It is the responsibility of agency personnel, Team Leads and certifying officers to make certain that all actions are based on sound accounting and budgetary practices.

B. Source Documentation

Adequate justification and supporting documentation shall be maintained for each project.

C. Appropriateness

Expenditures charged to a project shall be directly attributable to or allocated to the project benefiting from the activity. Salaries and benefits may be charged for the time an individual is working directly on a project, when supported by time sheets and when work performed by such individuals is necessary to the project.

D. Reasonableness

Costs attributable to a project shall be necessary and reasonable to achieve the objectives of the project and be consistent with the policies and procedures governing other activities of the agency.

E. Segregation

Accounts shall be properly designed and maintained to ensure that funds are expended in accordance with Trustee Council approval.

F. Expended (Outlays)

The term expended shall be defined as the actual outlay of funds through the issuance of checks or warrants, the disbursement of cash, or the electronic transfer of funds. The term expenditure shall be defined as the act of expending.

G. Obligation (Encumbrances)

1. The term obligation shall be defined as a commitment to acquire goods or services during the fiscal year or, for multiple-year projects, a commitment to acquire goods or services prior to the project's specified lapse date.

2. The term obligation shall also be used to accommodate contracts where the length of time for completion of the service extends into the following

fiscal year or, for a multiple-year project, beyond the project's specified lapse date.

3. An obligation is a commitment to pay and should not be considered an expenditure until the goods or services have been received and the invoice paid.

4. Funds approved for contracts in which the length of time for completion of the service extends into the following fiscal year may be obligated at year end or, for a multiple-year project, prior to the project's specified lapse date. As a general rule, agencies shall have one year from a project's specified lapse date to satisfy all obligations.

H. Reporting: Annual Financial Reports

By ~~January 31~~ March 31 of each year, agencies shall report to the Executive Director the total expended for each project, plus any valid obligations relating to the fiscal year just ended. For Trustee Council-Funded Programs, such as the Long-Term Monitoring or Herring Programs, ~~agencies shall report to the Executive Director the total expended for the Programs, plus any valid obligations relating to the fiscal year just ended, by March 1 of each year. T~~the report shall reflect the total amount authorized by line-item, any revisions approved by the Trustee Council, any adjustments between projects, any adjustments between line-items, and, for multiple-year projects, any adjustments between fiscal years for which the project was approved.

V. LAPSE

A. General

Subject to the exceptions noted in sections V.B.~~2~~ and V.C.~~3~~ below, the unexpended and unobligated balance of a project shall lapse on the last day of the month before the close of the fiscal year for which the project was approved. For example, for a project with an October 1 – September~~.~~ 30 period, the last day is September~~.~~ 30; for a project with a February 1 – January 31 period, January 31 is the close of the fiscal period. However, an undisclosed obligation may be established and/or paid during the Close-Out Period.

B. Multiple-Year Projects

1. The unexpended and unobligated balance of a multiple-year project shall be carried forward to the lapse date specified by the Trustee Council in the project's approval motion.

2. If no specific date is specified, the unexpended and unobligated balance shall lapse on the last day of the month before the close of the fiscal year specified by the Trustee Council. *See* General, V.A. above.

C. Capital Projects

The unexpended balance of a capital project shall be carried forward for two subsequent fiscal years. At the end of the three-year period, the unexpended and unobligated balance shall lapse. Trustee Council action is required to extend the project lapse date beyond the three year period.

D. Close-Out Period

1. For three months after the close of a fiscal year, agencies or Team Leads of Trustee Council-Funded Programs, such as the Long-Term Monitoring or Herring Programs, may pay from funds an expense that was undisclosed during that fiscal year. For example, for an October 1 fiscal year, expenses may be paid during the months of October, November and December (through December 31) from the funds from the fiscal year just ended on September 30. For a February 1 fiscal year, these may be paid during February, March and April.

2. In addition, agencies or Team Leads may establish obligations to accommodate an expense that was undisclosed during that fiscal year. Any such payments or obligations must be reported to the Executive Director in the Annual Financial Report. For further information regarding the Annual Financial Report, refer to the Accounting section IV of these procedures.

E. Expenses Discovered after the Close-Out Period

1. Expenses discovered after the Close-out Period (i.e., for an October 1 fiscal year, after December 31 and for a February 1 fiscal year, after April 30) may be charged to the subsequent year's project budget if the project has multiple years of funding and sufficient funds are available.

2. In the event there is no subsequent year's project budget, or in the event the agency or Team Lead determines that insufficient funds are available to charge the expense to the subsequent year's budget, authority to adjust a prior year Annual Financial Report is required.

3. During the six months after the Close-Out Period, authority to adjust a prior year Annual Financial Report may be provided by the Executive Director. For example, for an October 1 fiscal year: January through June;

for a February 1 fiscal year: May through October.

4. For expenses discovered after this six-month period, authority to adjust a prior year Annual Financial Report may be provided by the Trustee Council.

VI. EQUIPMENT

A. Definition

Equipment shall be defined as non-expendable items having an estimated life of more than one year and a unit value greater than $1,000.

B. Title and Use

This section shall apply to all equipment purchased under the restoration program, for projects already in progress or completed as well as for projects funded in the future.

Comment [EH3]: This lead-in language was moved up from its former position in the middle of this section's text.

1. Title –

   a) Items with an original per unit cost of under $5,000 shall belong to the acquiring agency. At the end of a project, if the equipment was purchased by a contractor, the agency may, at its discretion and if agency regulations allow, transfer the title to the contractor.

   b) Items with an original per unit cost of $5,000 and over shall belong to the acquiring agency on behalf of the Trustee Council. At the end of a project that has equipment with an original per unit cost of $5,000 or more, the Executive Director shall determine if the equipment item shall be used for another Trustee Council project or if the item shall remain with the acquiring agency. If the equipment shall be used for another Trustee Council project administered by an agency other than the acquiring agency, the title for the equipment shall be transferred to the agency administering the new project. If the equipment shall remain with the acquiring agency, and it was purchased by a contractor, the agency may, at its discretion and if agency regulations allow, transfer the title to the contractor.

2. Use – Equipment shall be used for the project for which it was acquired.

3. Surplus – Equipment that belongs to the acquiring agency shall be surplused in accordance with agency procedures.

4. Inventory – Property records shall be maintained in accordance with agency procedures.

5. Repair, Maintenance and Safeguarding – The repair, maintenance and safeguarding of equipment purchased with joint funds shall be accomplished in accordance with agency procedures.

6. Disposal – Equipment that ceases to function shall be disposed of in accordance with agency procedures.

7. Reporting – By December 31 of each year, agencies shall report all equipment with an original per unit cost of $5,000 or more to the Executive Director. The report shall include a description of the equipment (make and model), date the equipment was purchased, the purchase price, where the equipment is located and the condition of the equipment. The report shall also identify the project that is using the equipment.

VII. CONTRACTS

A. General

Agencies and Team Leads shall ensure that contracts for professional and non-professional services are accomplished in accordance with the terms, conditions, and specifications of the project approved by the Trustee Council and in accordance with applicable Trustee Council~~Program~~ policies, Federal and State laws.

B. Definitions

1. **Professional Services –** means contracts for professional, technical, or consultant services that result in the production of a report or the completion of a task, and includes analysis, evaluation, prediction, planning, or developing a recommendation.

2. **Non-professional Services –** means contracts for services that are primarily manual in nature, and includes boat charters, printing, and other. Non-professional services contracts usually provide a service rather than resulting in a product or report.

3. **Named Recipient –** In the event the Trustee Council determines that, in order to carry out its mandate under the Memorandum of Agreement and Consent Decree, a particular person or entity should implement all or a portion of a project through a state Trustee agency, the Trustee Council may, by unanimous vote, name a contract recipient.

   a) The approval motion shall include the reason for selecting the contract recipient.

b) If the contracting agency determines that an award to an entity different than that named by the Trustee Council would better serve the restoration program, the basis of that determination shall be stated in writing to the Executive Director and forwarded to the Trustee Council for approval.

4. **Indirect Rates –** The appropriate indirect rate for contractors shall be determined on a project-by-project basis or through a memorandum of understanding with a contractor that provides for a consistent rate and methodology.

5. **Equipment –** Equipment purchased by the contractor shall remain the property of the contracting agency unless other conditions prevail. *See* ~~section on~~ Equipment, Title and Use, VI.B. for specific details.

6. **Special Considerations –** All notes and other data developed by the contractor shall be subject to the Trustee Council's Data Policy.

VIII. GRANTS

A. General

Grants may be used as a procurement mechanism, but only to the extent they are permitted under existing state and federal laws. Federal Trustee agencies were given grant authority specific to the Trustee Council's restoration program under Public Law 106-113 (1999).

IX. AUDITS

A. General

The purpose of an audit is to ensure public trust and accountability regarding the use of settlement funds. An audit provides credibility to the information reported by or obtained from management by independently acquiring and evaluating the evidence.

B. Definition

The term audit includes both financial and performance audits.

C. Readiness

When an agency or Trustee Council-Ffunded Program receives funding from the Trustee Council, the agency or Team Leads, as appropriate, assumes certain responsibilities with respect to those funds. These include ensuring that source documentation is organized and available for review, internal controls are documented and individuals knowledgeable about the projects are available to answer questions.

D. Contracts

Contractors who receive funding for professional or non-professional services are not automatically subject to an annual audit. However, this does not preclude the Trustee Council or the agency or Trustee Council-Funded Program from making a determination that an audit is required in addition to an agency or Program's review of expenditure documentation and work produced by a contractor.

E. State and Federal Audits

Each Federal agency and the State of Alaska have audit functions. In the event an audit is performed on a Trustee Council-funded activity, a copy of the audit shall be provided to the Executive Director.

F. External Audits

All external audits shall be conducted in accordance with Governmental Auditing Standards. In addition, the firm and the staff assigned to conduct the audit shall be independent of the Trustee Council, the funding agencies, the Alaska Department of Revenue, the Court Registry Investment System, Exxon Corporation, Exxon Shipping Company and Exxon Pipeline Company.

APPENDIX A: FEDERAL INTERNAL PROCEDURES

I. NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION FUND

A. Segregation

All principal and interest shall be accounted for separately by the Department of the Interior, Office of the Secretary. Each disbursement shall be assigned an appropriate account, sub-activity and/or project number when deposited to the aggregate Natural Resource Damage Assessment and Restoration Fund within the Federal Reserve Bank. Confirmation of the deposit shall be provided to the Treasury Department, which reconciles the deposit with the Federal Reserve Bank.

B. Investments

By law, the funds may only be invested in Treasury Securities and all ownership is maintained in the name of the Natural Resource Damage Assessment and Restoration Fund. Based on an estimate of cash flow requirements, the Department of the Interior, Office of the Secretary generates instructions for investment and forwards the instructions to the National Business Center. The National Business Center develops and submits an Investment Confirmation Letter that indicates which account investments are being purchased, the scheduled maturity dates and the investment type(s) to the Department of Treasury, which purchases the securities. At maturity, interest income is paid directly to the account.

C. Reports

The Department of the Interior shall report interest income to the Executive Director annually, at a minimum. If requested by the Executive Director, disbursements to the federal agencies shall be reported to the Executive Director. By March 31 of each year, the Department of Interior shall report to the Executive Director all lapsed funds returned to the Natural Resource Damage Assessment and Restoration Fund by the federal agencies.

II. AUTHORIZATION

A. General

Congress permanently appropriated funding approved by the Trustee Council in Section 207 of Public Law 102-227. However, all authorization is subject to compliance with any terms and conditions imposed by the Trustee Council.

B. Budget and Reports

Under Section 207, agencies are required to comply with directions published by the Federal Office of Management and Budget. This includes submitting a budget for the upcoming fiscal year and documentation associated with the current and prior fiscal year.

C. Obligation Authority

Prior to the obligation of any funds, agencies must first complete the allocation process required by their respective budget offices to establish codes for each project. The allocation process provides the authority, amount of funding and the guidance with which to obligate funds.

D. Instructions for Transfer

Federal agencies are required to submit an annual cash flow plan to the United States Department of the Interior, Office of the Secretary, Natural Resource Damage Assessment and Restoration Office, and instructions regarding the transfer of settlement funds. The instructions shall specify the purpose of the transfer, which account the funds are to be transferred to, and an estimate of cash flow requirements. Unless the transfer represents a one-time payment, the cash flow estimate shall be structured on a quarterly basis. Any change in cash flow requirements that occurs during the fiscal year shall be communicated to the United States Department of the Interior, Office of the Secretary, Natural Resource Damage Assessment and Restoration Office, in writing. A change is defined as a decrease in the cash flow requirement due to an unanticipated delay in a project or an increase in the cash flow requirement due to an unanticipated change in the schedule, or subsequent Trustee Council action.

E. Fund Transfers

The vehicle used for transfers is a SF1151, a non-expenditure transfer. The SF1151 is initiated, prepared, and approved by the Natural Resource Damage Assessment & Restoration Office, Office of the Secretary and then sent to Treasury where the funds are transferred within the Treasury system.

F. Return of Unobligated Balances

By June 1~~On March 15~~ of each year, federal agencies must return to the Natural Resource Damage Assessment and Restoration Fund the unobligated balance for any projects which have terminated~~the fiscal year just ended~~. Concurrently, the agencies must return any de-obligated funds~~recovery of prior year obligations~~. Agencies are required to submit to the United States Department of the Interior, Office of the Secretary, Natural Resource Damage Assessment and Restoration

Office, a report reflecting the total unobligated balances of current projects as of June 1 ~~for the fiscal year just ended~~ and the amount of funding recovered from any prior year de-obligations. ~~The report submitted must also indicate the date the agency intends to return the funds.~~ The vehicle used for transfers is a SF1151, non-expenditure transfer. The Department of the Interior shall report the total unobligated balance ~~for the fiscal year just ended~~ and de-obligated balances~~the amount of funding recovered from prior year obligations~~ to the Executive Director by July 1~~March 31~~ of each year.

APPENDIX B: STATE INTERNAL PROCEDURES

I. *EXXON VALDEZ* OIL SPILL SETTLEMENT FUND

A. Segregation

All principal and interest shall be accounted for separately by the Alaska Department of Revenue, Division of Treasury. Each disbursement shall be deposited in a Department of Law sub-account, *Exxon Valdez* Oil Spill Settlement Fund. Confirmation of the deposit shall be provided by the bank to the Alaska Department of Revenue.

B. Investments

The Alaska Department of Revenue, Division of Treasury shall calculate the daily income amount and provide for daily compounding (including weekends and holidays). The income shall be credited to the fund and posted in the Alaska State Accounting System on a monthly basis.

C. Reports

The Alaska Department of Revenue, Division of Treasury shall report income earned to the Executive Director on a monthly basis.

II. AUTHORIZATION

A. General

Pursuant to Alaska Statute 37.14.405(a), a state agency may not expend money received from the trust unless the expenditure is in accordance with an appropriation made by law. However, prior to the expenditure of funds, Trustee Council approval must be obtained, the notice filed, any terms and conditions placed on the funding by the Trustee Council met, and the funds transferred from the Investment Fund to the *Exxon Valdez* Oil Spill Settlement Fund, if necessary.

B. Budget and Reports

To meet the requirements of Alaska Statute 37.14.415, agencies are required to comply with directions published by the State Office of Management and Budget, Division of Budget Review. Alaska Statute 37.14.415 states: The state trustees shall

1. submit to the governor and the legislature by December 15 of each year a report setting out, for each object or purpose of expenditure, the amounts approved for expenditure from the trust during the preceding state fiscal year and the amounts actually expended during the preceding state fiscal year;

2. prepare and submit, under AS 37.07, a budget for the next state fiscal year setting out, for each object or purpose of expenditure, the Trustees' estimate of the amounts that are, during the next state fiscal year, to be funded by the trust and expended by state agencies; and

3. prepare and submit to the legislature, at the same time the budget for state agency expenditures is submitted under (b) of this section, a proposal setting out, for each object or purpose of expenditure, the trustees' estimate of the amounts that are to be funded by the trust in the next state fiscal year and that are not included in the budget submitted under (2) of this section.

C. Legislative Budget and Audit Committee

Alaska Statute 37.14.405(b) allows agencies to meet the requirements of an appropriation conditioned on compliance with the ~~program~~ review provisions of AS 37.07.080(h). In accordance with the procedures of the Alaska Office of Management and Budget (OMB), agencies are required to submit a request to OMB for transmittal to the Legislative Budget and Audit Committee.

D. Expenditure Authority

Authorization to receive and expend shall be recorded in the Alaska State Accounting System within the *Exxon Valdez* Oil Spill Settlement Fund. Following legislative action, OMB will record the authorization by approving an Authorized Budget Transaction (AB).

Asset Allocation

Callan

Prepared August 14,, 2013

Exxon Valdez Oil Spill Trustee Council

Investment Presentation

October 2013

Michael O'Leary, CFA
Executive Vice President

Presentation Overview

"Now is always the most difficult time to invest!" was the sub-title used last year and is still appropriate in 2013

- Market Overview
  - Domestic Equities
  - Fixed Income
  - International Equity
- Historic Performance & Asset Values
  - Cumulative
  - Calendar Year Periods
  - Asset Class Performance
- Capital Market Background & Projections
  - Projection Process
  - Building Blocks
  - Changes in Projections from 2012
  - Existing Policy with 2013 Long-term Projections
- Other Issues

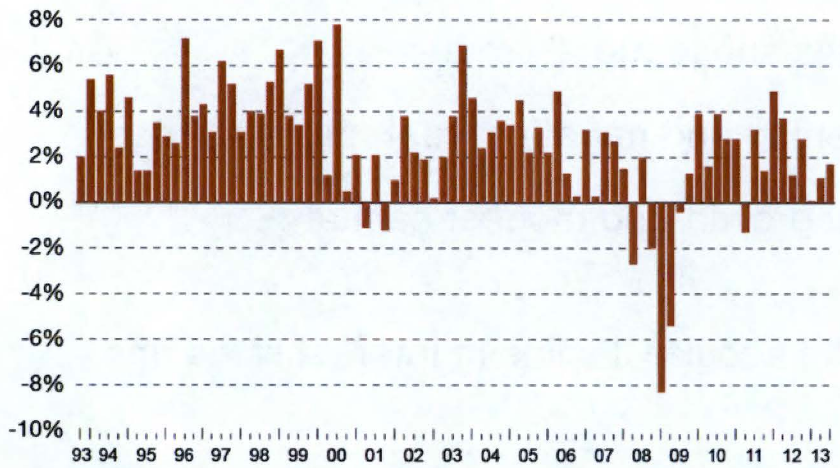
2012 and Early 2013 Overview

- Renewed concern regarding European credit and softness in emerging economies
- Continued real economic growth but initial estimates subsequently reduced
- Concern regarding potential monetary policy tightening and negative "real" interest rates
- Concerns regarding fiscal policy, slow employment growth and modest capital expenditures as fears of slower recovery grow
- Interest rates spike in Q2 2013 raising fears that the secular decline in interest rates has ended
- Mideast turmoil unsettling

Economic Indicators

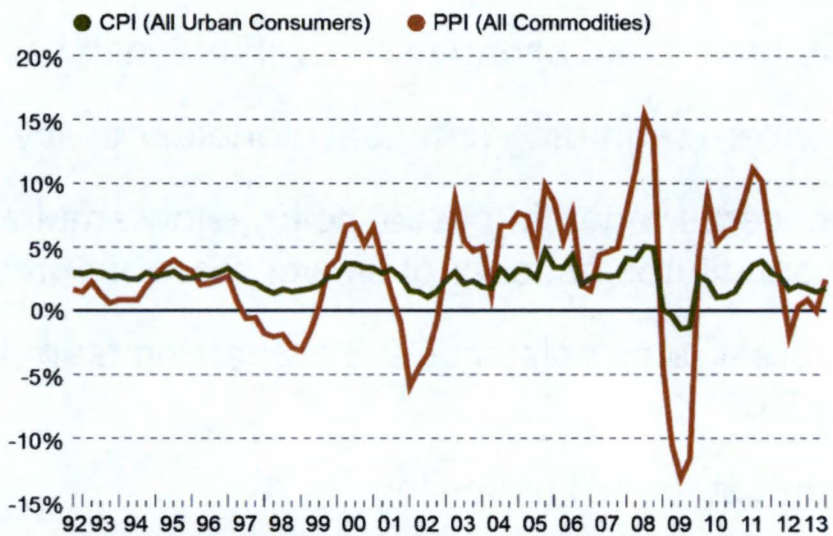
Through June 30, 2013

Quarterly Real GDP Growth* (20 Years)



Source: U.S. Department of Labor

Inflation Year-Over-Year



Source: Bureau of Labor Statistics

Recent Quarterly Indicators

Economic Indicators (seasonally adjusted)	2Q13	1Q13	4Q12	3Q12	2Q12	1Q12	4Q11	3Q11
Employment Cost–Total Compensation Growth	1.7%	1.7%	2.0%	1.7%	2.1%	1.7%	2.1%	1.4%
Nonfarm Business–Productivity Growth	1.5%	0.5%	-1.7%	3.1%	1.9%	-0.5%	1.2%	1.8%
GDP Growth*	1.7%	1.1%	0.1%	2.8%	1.2%	3.7%	4.9%	1.4%
Manufacturing Capacity Utilization	75.8%	76.3%	75.7%	75.5%	77.5%	77.6%	76.1%	75.2%
Consumer Sentiment Index (1966=100)	81.7	76.7	79.4	75.0	76.3	75.5	64.7	59.5

*The GDP estimates reflect the results of the comprehensive (or benchmark) revision of the national income and product accounts, according to the Bureau of Economic Analysis (BEA) website. More information on the revision is available at www.bea.gov/national/an1.htm.

Sources: Bureau of Economic Analysis, Bureau of Labor Statistics, Federal Reserve, Reuters/University of Michigan

Asset Class Performance

Periods Ending June 30, 2013

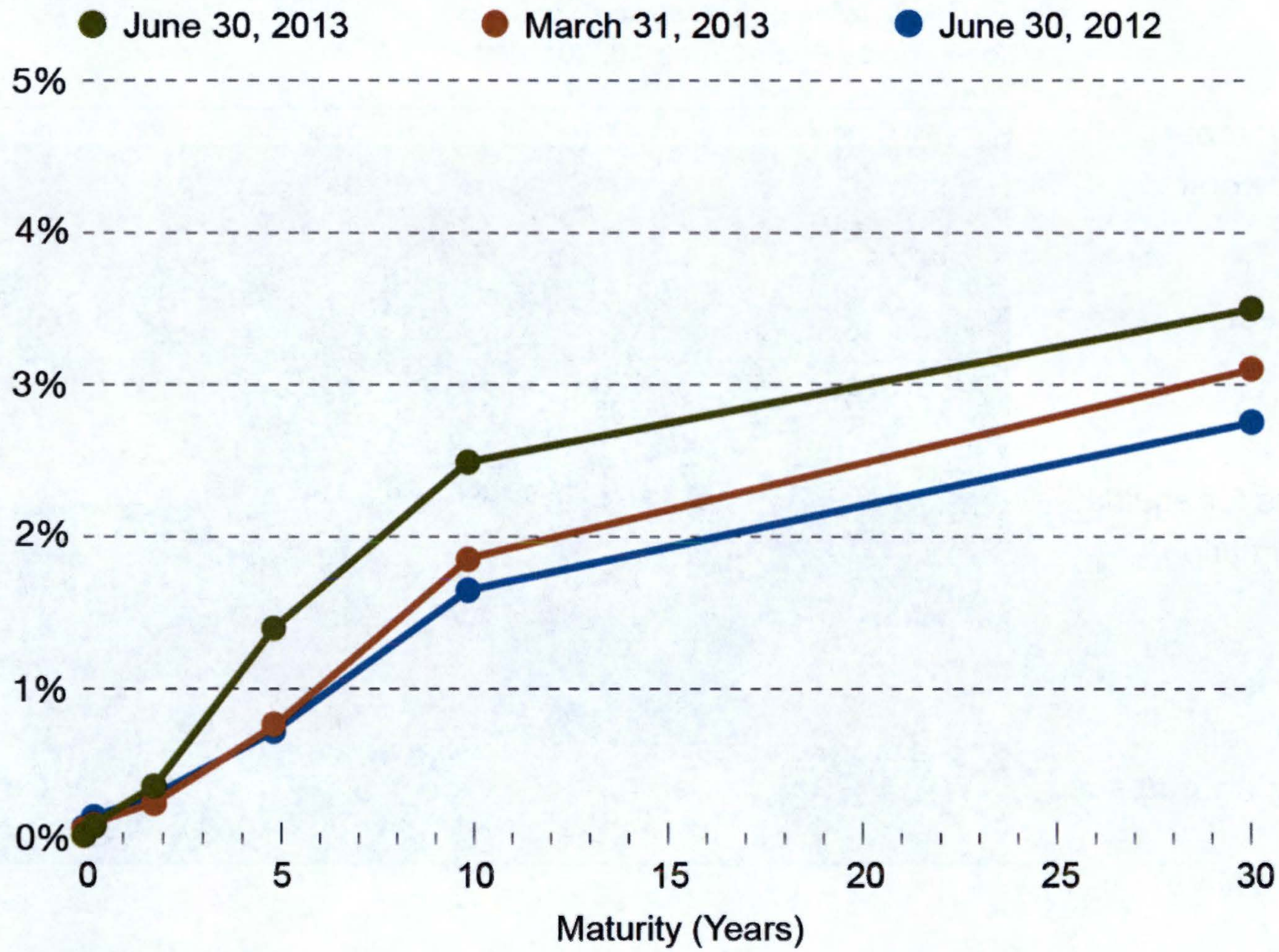
- For Quarter:
  - Domestic stocks on top
  - Emerging Markets worst
- For Year:
  - Domestic stocks best
  - Bonds negative
- Last 3 years:
  - Double digit returns for equities
  - T-bills well below inflation
- Last 10 years:
  - Emerging Markets led
  - Followed by Small Cap
  - Developed Int'l slightly outpaced U.S. Large Cap
  - All asset classes positive

Periodic Table of Investment Returns for Periods Ended June 30, 2013

Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 10 Years
Russell:2000 Index 3.1%	Russell:2000 Index 24.2%	Russell:2000 Index 18.7%	Russell:2000 Index 8.8%	MSCI:Emer Markets 14.0%
S&P:500 2.9%	S&P:500 20.6%	S&P:500 18.5%	S&P:500 7.0%	Russell:2000 Index 9.5%
3 Month T-Bill 0.0%	MSCI:EAFE US$ 18.6%	MSCI:EAFE US$ 10.0%	Barclays:Aggregate Index 5.2%	MSCI:EAFE US$ 7.7%
MSCI:EAFE US$ (1.0%)	MSCI:Emer Markets 3.2%	MSCI:Emer Markets 3.7%	3 Month T-Bill 0.3%	S&P:500 7.3%
Barclays:Aggregate Index (2.3%)	3 Month T-Bill 0.1%	Barclays:Aggregate Index 3.5%	MSCI:Emer Markets (0.1%)	Barclays:Aggregate Index 4.5%
MSCI:Emer Markets (8.0%)	Barclays:Aggregate Index (0.7%)	3 Month T-Bill 0.1%	MSCI:EAFE US$ (0.6%)	3 Month T-Bill 1.7%

Fixed Income – Treasury Yield Curve

U.S. Treasury Yield Curves



Source: Bloomberg

Recent Asset Values

Portfolio	AUM ($MM) 6/30/2013	AUM ($MM) 12/31/2012
AY02 - Research Fund	96,650,098	91,157,696
AY2H - Habitat Fund	40,747,111	38,509,978
AY2J - Koniag Fund	57,621,256	54,008,031
TOTAL AUM	**195,018,465**	**183,675,705**

- Performance comparisons focus on periods ended 6/30/13
- Historic values and returns were obtained from State Street Global Advisors

Asset Distribution

As of June 30, 2013

Portfolio	AUM ($MM)	AUM (%)
AY02 - Research Fund	**96,650,098**	**100.0%**
AY02 - Russell 3000 Index	47,009,210	48.6%
AY02 - Fixed Income	27,637,434	28.6%
AY02 - International Equity	22,001,688	22.8%
AY02 - Money Market	1,767	0.0%
AY2H - Habitat Fund	**40,747,111**	**100.0%**
AY2H - Russell 3000 Index	19,819,165	48.6%
AY2H - Fixed Income	11,651,935	28.6%
AY2H - International Equity	9,275,766	22.8%
AY2H - Money Market	244	0.0%
AY2J - Koniag Fund	**57,621,256**	**100.0%**
AY2J - Russell 3000 Index	28,024,442	48.6%
AY2J - Fixed Income	16,474,766	28.6%
AY2J - International Equity	13,121,366	22.8%
AY2J - Money Market	681	0.0%
TOTAL AUM	**195,018,465**	-

- Each of the 3 sub-funds is well-diversified & close to target

Total Fund Cumulative Peformance versus Target Index

Periods Ending June 30, 2013

Portfolio	Last Quarter	Last 2 Quarters	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Since Inception	Inception Date
AY02 - Research Fund	0.40	6.58	13.96	13.08	6.65	6.00	7.14	5.38	11/01/2000
AY2H - Habitat Fund	0.40	6.58	13.88	13.07	6.51	5.89	7.08	7.55	11/01/2002
AY2J - Koniag Fund	0.40	6.69	14.04	13.15	6.49	5.87	7.05	7.52	11/01/2002
EVOS Target Index	0.36	6.68	13.87	12.29	5.95	5.63	6.98	4.91	11/01/2000
								7.46	11/01/2002

- Calendar 2012 equity market returns were strong; fixed income returns were average. Since then domestic equity markets have rallied, international equities are up modestly and fixed income is negative (especially U.S. TIPS which are down 7.4% through 6/30/13).
- All 3 funds have outpaced their target indices since inception and over the last year.
- While the post “meltdown” returns have been attractive, trailing 5 and since inception returns are still dominated by the 2008-early 2009 bear market.

EVOS Target is: 47.0% Russell 3000 Index, 23.0% MSCI EAFE Index, and 30.0% Barclays Aggregate Bond Index.

Total Fund Cumulative Returns

Returns for Periods Ended June 30, 2013
Group: CAI Endowment / Foundation DB

	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 12 Years
10th Percentile	1.18	15.16	12.54	6.27	6.29	8.40	6.89
25th Percentile	0.77	13.73	11.69	5.49	5.73	7.66	6.19
Median	0.34	12.10	10.56	4.50	5.14	7.03	5.53
75th Percentile	(0.59)	10.59	9.58	3.52	4.48	6.40	4.95
90th Percentile	(1.65)	8.81	8.63	2.76	3.84	5.90	4.33
AY02 - Research Total Fund	0.40	13.96	13.08	6.65	6.00	7.14	6.07
AY2H - Habitat Total Fund	0.40	13.88	13.07	6.51	5.89	7.08	--
AY2J - Koniag Total Fund	0.40	14.04	13.15	6.49	5.87	7.05	--
EVOS Target Index	0.36	13.87	12.29	5.95	5.63	6.98	5.65
Russell:3000 Index	2.69	21.46	18.63	7.25	5.84	7.81	4.87
MSCI:EAFE US$	(0.98)	18.62	10.04	(0.63)	1.37	7.67	4.89
Barclays:Aggregate Index	(2.32)	(0.69)	3.51	5.19	5.60	4.52	5.33

- While comparative performance is less important than performance relative to an appropriate policy benchmark, it provides a useful frame of reference for assessment of your policy & its implementation.

Total Fund Calendar Year Returns

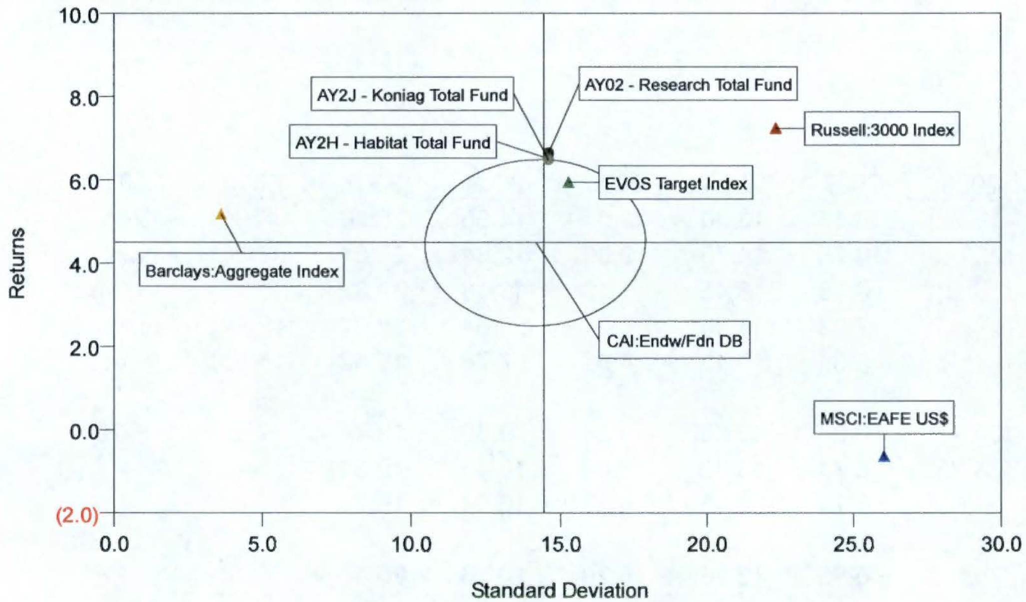
Returns for Calendar Years
12 1/2 Years Ended June 30, 2013
Group: CAI Endowment / Foundation DB

	2 Qtrs. 2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
10th Percentile	7.39	14.62	2.84	14.97	27.31	(19.12)	13.17	16.30	11.01	14.65	28.56	(2.90)	3.65
25th Percentile	6.47	13.45	0.99	13.70	24.50	(22.60)	10.75	14.75	9.00	12.84	25.04	(7.26)	(0.35)
Median	5.05	12.30	(0.41)	12.56	21.20	(26.50)	8.73	13.45	7.49	11.18	22.32	(9.75)	(3.32)
75th Percentile	3.55	11.11	(1.74)	11.19	17.26	(29.07)	7.03	11.99	5.91	9.64	18.97	(12.30)	(6.14)
90th Percentile	2.11	9.44	(3.14)	9.37	11.82	(31.57)	5.54	10.43	4.51	7.70	15.42	(15.83)	(8.66)
AY02 - Research Total Fund	6.58	14.19	1.57	13.06	21.21	(24.24)	6.64	13.05	6.24	9.89	19.74	(7.18)	(2.01)
AY2H - Habitat Total Fund	6.58	14.13	1.58	13.06	21.10	(24.75)	6.74	13.09	6.09	10.15	19.81	--	--
AY2J - Koniag Total Fund	6.69	14.17	1.63	13.10	20.87	(24.91)	6.74	13.13	6.13	10.04	19.75	--	--
EVOS Target Index	6.68	13.08	0.15	12.78	22.12	(25.06)	6.96	13.26	6.29	10.13	20.44	(7.76)	(4.97)
Russell:3000 Index	14.06	16.42	1.03	16.93	28.34	(37.31)	5.14	15.72	6.12	11.95	31.06	(21.54)	(11.46)
MSCI:EAFE US$	4.10	17.32	(12.14)	7.75	31.78	(43.38)	11.17	26.34	13.54	20.25	38.59	(15.94)	(21.44)
Barclays:Aggregate Index	(2.44)	4.21	7.84	6.54	5.93	5.24	6.97	4.33	2.43	4.34	4.10	10.26	8.43

- Calendar period performance demonstrates that the 3 funds have tended to outperform endowment and foundation peers in declining markets while often lagging slightly in strong equity markets.

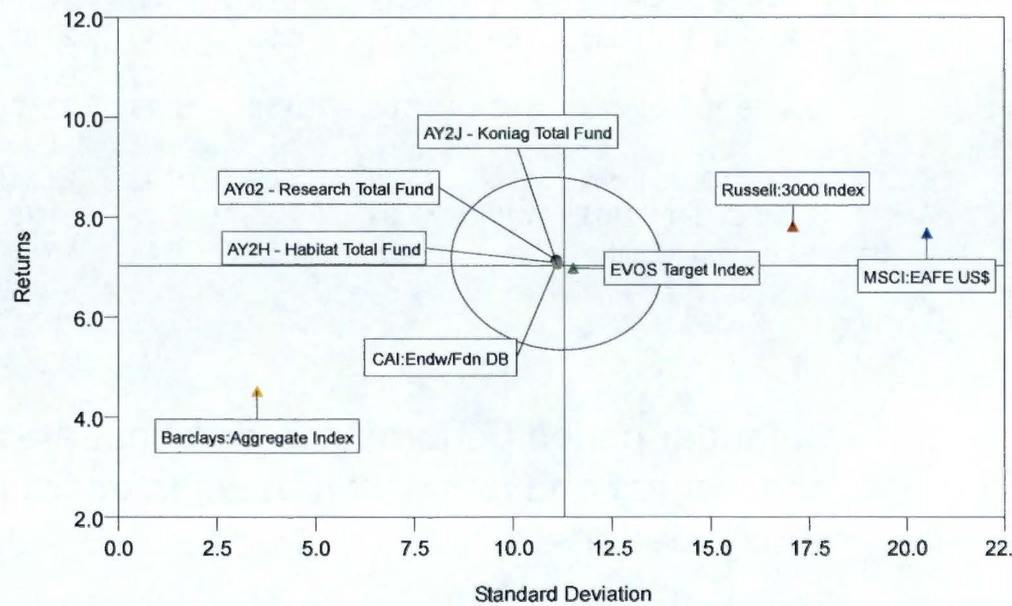
Total Fund Risk and Return

Scatter Chart
for 5 Years Ended June 30, 2013



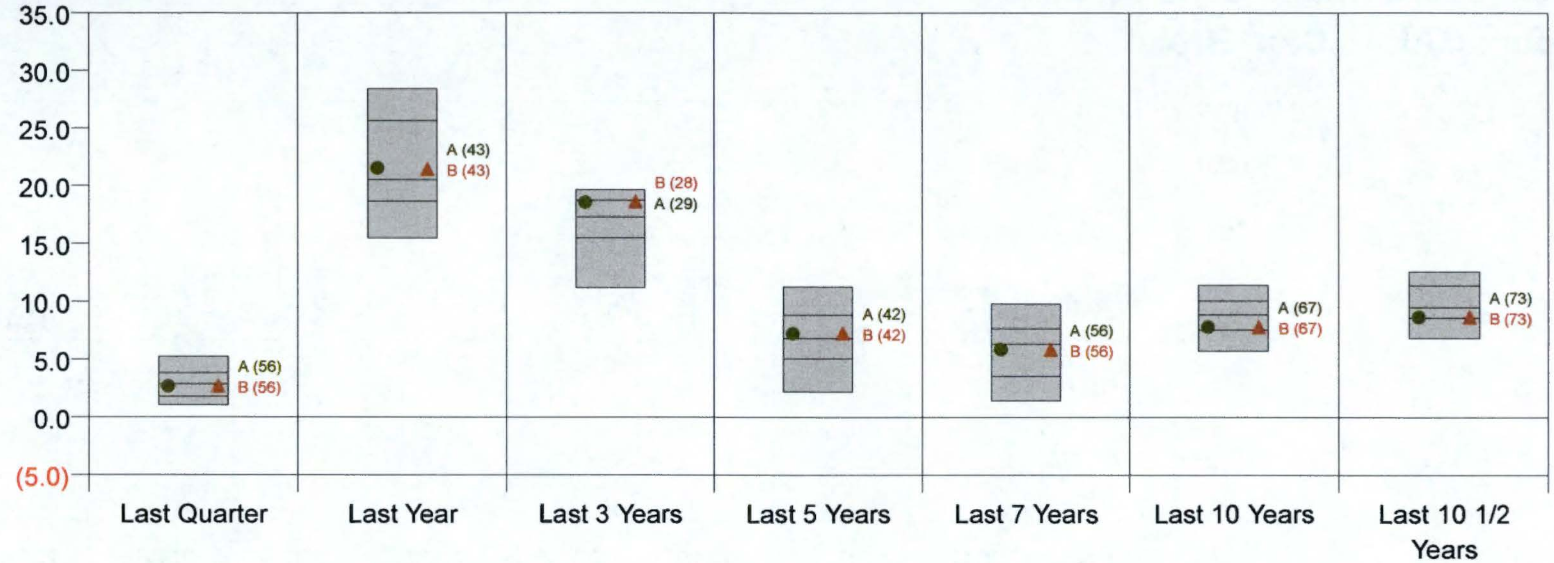
- These graphs examine risk (standard deviation of annualized return) versus return.
- The crosshairs represent the database median return & risk for each period.

Scatter Chart
for 10 Years Ended June 30, 2013



Russell 3000 Index Fund Cumulative Returns

Returns for Periods Ended June 30, 2013
Group: CAI All Cap: Broad

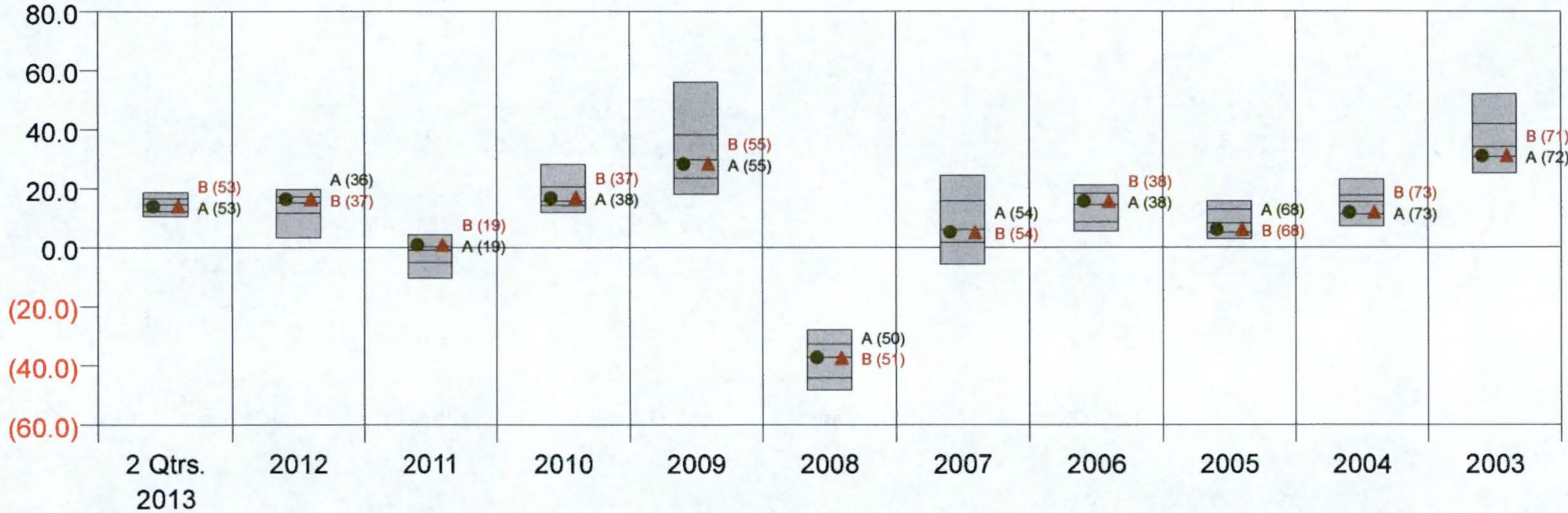


	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 10 1/2 Years
10th Percentile	5.26	28.41	19.69	11.28	9.83	11.43	12.59
25th Percentile	3.85	25.63	18.79	8.85	7.69	10.07	11.39
Median	2.87	20.54	17.32	6.82	6.35	8.87	9.53
75th Percentile	1.78	18.66	15.53	5.05	3.57	7.58	8.58
90th Percentile	1.07	15.50	11.20	2.22	1.44	5.72	6.85
AY02 - Russell 3000 Index ● A	2.69	21.55	18.60	7.25	5.87	7.84	8.67
Russell:3000 Index ▲ B	2.69	21.46	18.63	7.25	5.84	7.81	8.65

- This and the following graphs depict performance by major asset class. Again, the key frame of reference should be the market benchmark.

Russell 3000 Index Fund Calendar Year Returns

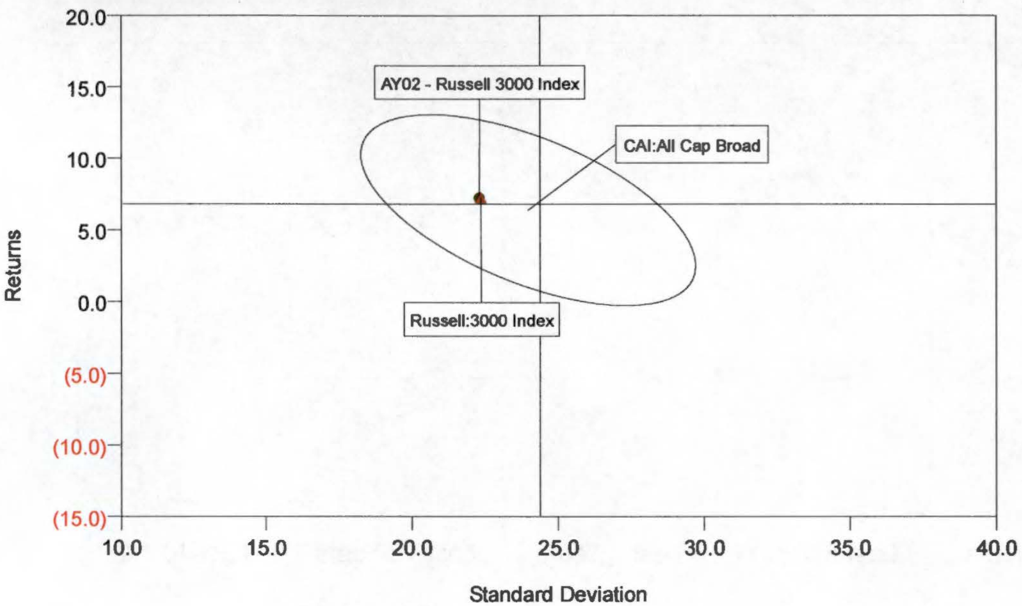
Returns for Calendar Years
10 1/2 Years Ended June 30, 2013
Group: CAI All Cap: Broad



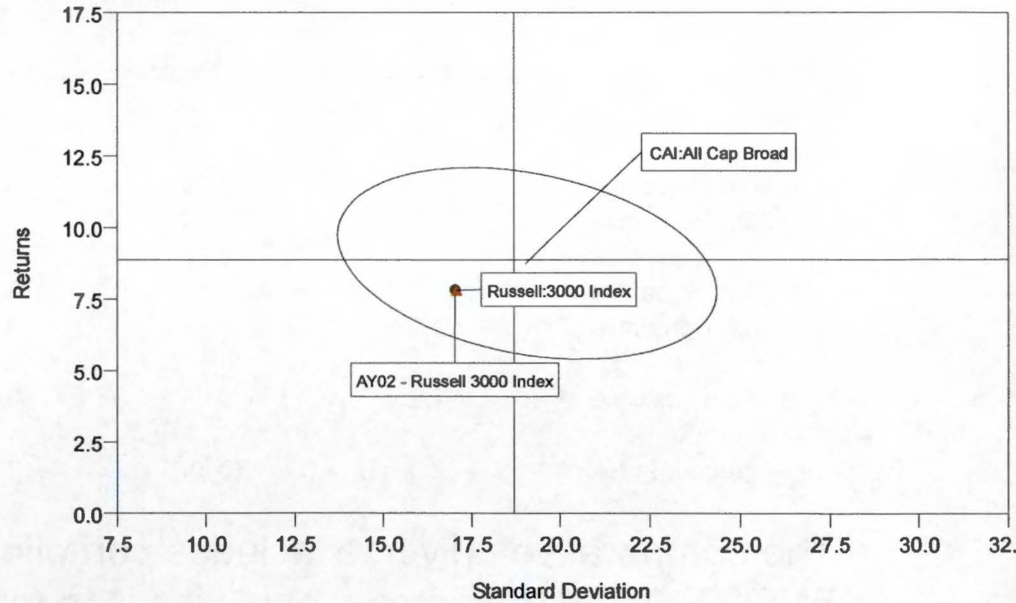
	2 Qtrs. 2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
10th Percentile	18.68	19.80	4.41	28.18	56.09	(27.86)	24.49	21.13	15.88	23.18	51.97
25th Percentile	16.60	17.18	0.22	20.64	38.19	(32.69)	15.87	18.42	12.97	17.73	41.84
Median	14.64	15.26	(0.87)	15.77	29.75	(37.13)	6.12	14.48	8.26	15.46	34.00
75th Percentile	12.31	11.73	(4.98)	14.31	23.57	(44.08)	1.78	8.62	5.14	11.35	30.68
90th Percentile	10.54	3.33	(10.34)	11.91	18.10	(48.17)	(5.67)	5.47	2.91	7.26	25.18
AY02 - Russell 3000 Index ● A	14.00	16.50	1.01	16.80	28.33	(37.17)	5.25	15.71	6.16	11.92	30.98
Russell:3000 Index ▲ B	14.06	16.42	1.03	16.93	28.34	(37.31)	5.14	15.72	6.12	11.95	31.06

Russell 3000 Index Fund Risk and Return

Scatter Chart
for 5 Years Ended June 30, 2013

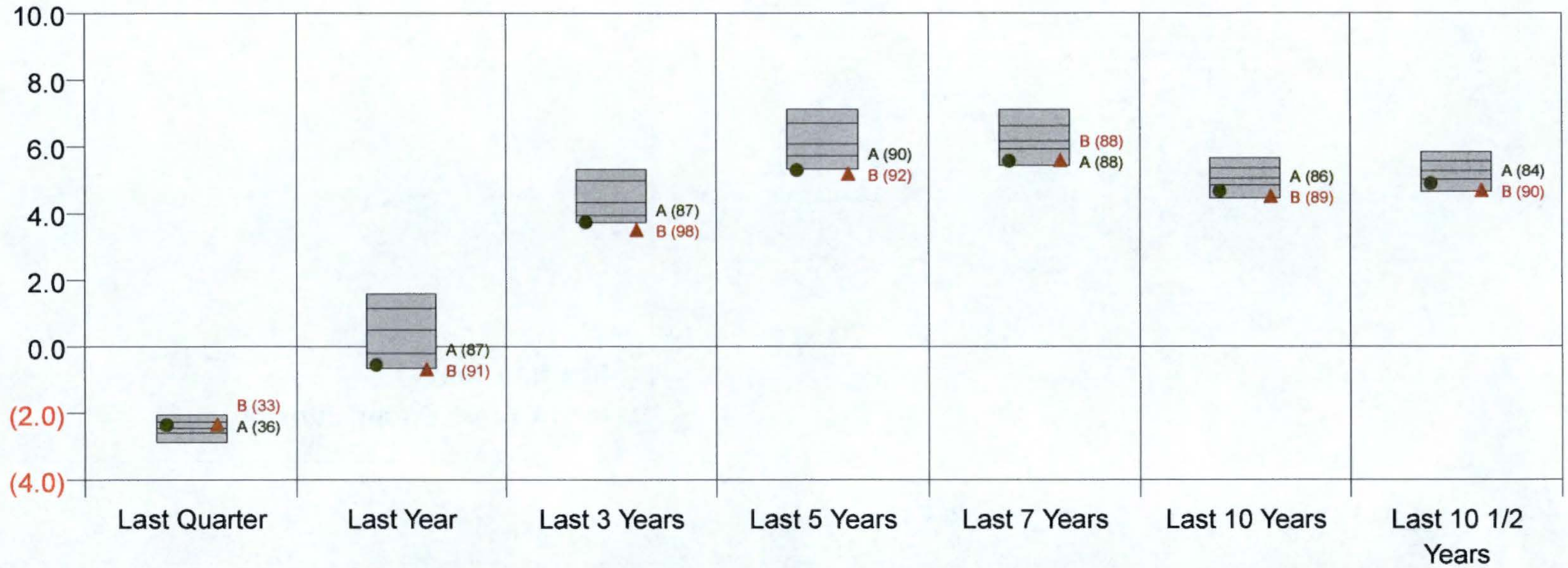


Scatter Chart
for 10 Years Ended June 30, 2013



Fixed Income Fund Cumulative Returns

Returns for Periods Ended June 30, 2013
Group: CAI Core Bond Fixed-Inc Style

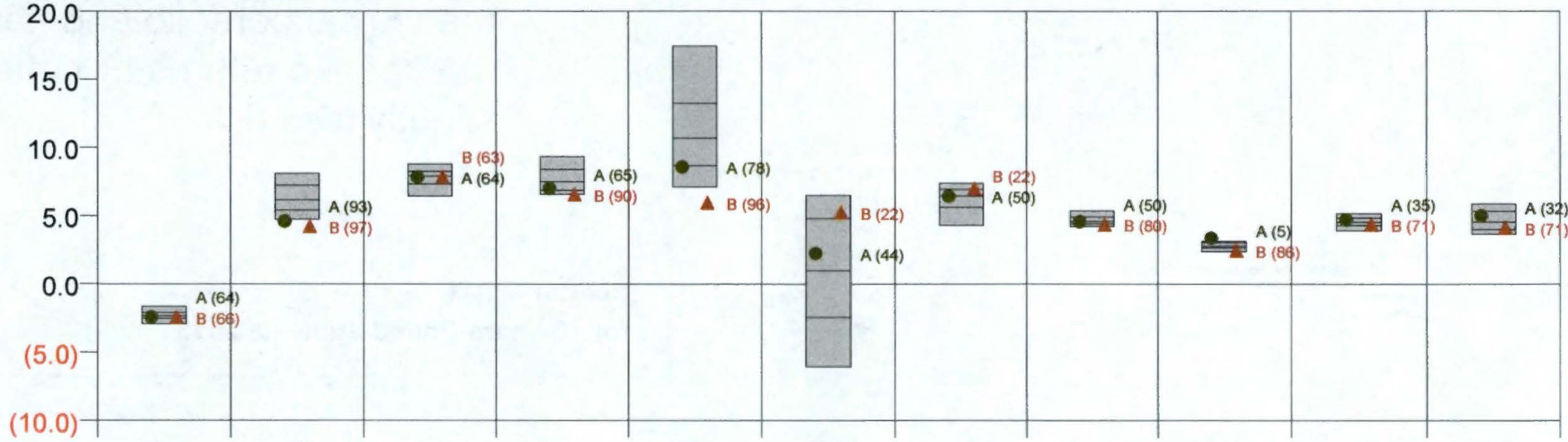


	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 10 1/2 Years
10th Percentile	(2.04)	1.59	5.33	7.12	7.12	5.67	5.85
25th Percentile	(2.25)	1.14	4.98	6.70	6.63	5.36	5.58
Median	(2.44)	0.50	4.33	6.08	6.18	5.06	5.27
75th Percentile	(2.58)	(0.21)	3.95	5.73	5.93	4.85	5.02
90th Percentile	(2.87)	(0.65)	3.73	5.33	5.44	4.46	4.66
AY02 - Fixed Income ● A	(2.35)	(0.55)	3.74	5.30	5.58	4.67	4.90
Barclays:Aggregate Index ▲ B	(2.32)	(0.69)	3.51	5.19	5.60	4.52	4.68

- The comparative universe includes portfolios that employ more aggressive strategies that EVOST. Again the primary objective is to match or exceed the market benchmark.

Fixed Income Fund Calendar Year Returns

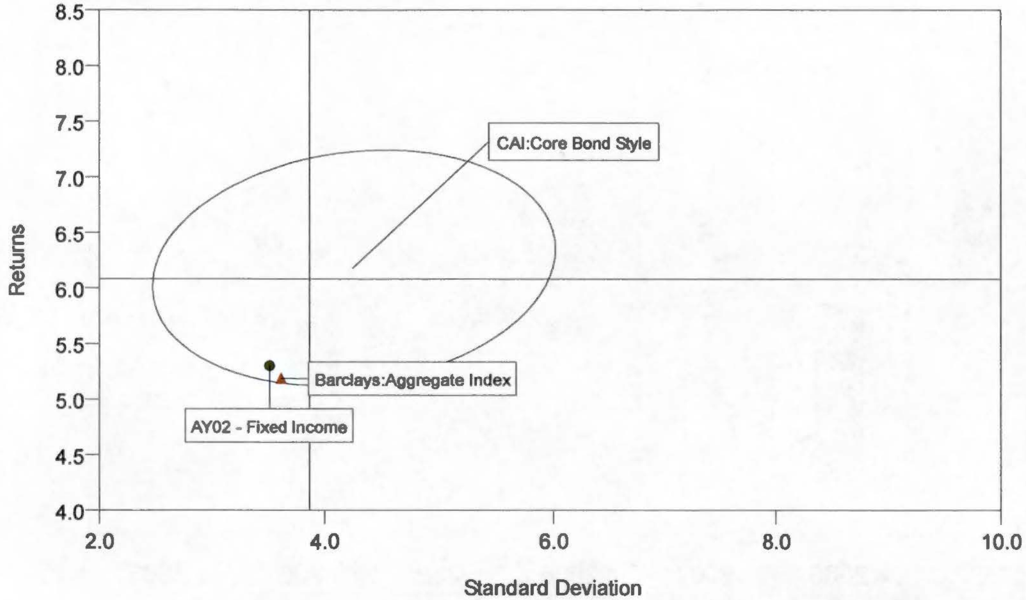
Returns for Calendar Years
10 1/2 Years Ended June 30, 2013
Group: CAI Core Bond Fixed-Inc Style



	2 Qtrs. 2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
10th Percentile	(1.64)	8.11	8.78	9.35	17.43	6.50	7.39	5.38	3.14	5.16	5.88
25th Percentile	(2.10)	7.21	8.25	8.39	13.23	4.78	6.93	4.90	3.02	4.84	5.31
Median	(2.31)	6.15	7.90	7.49	10.67	0.96	6.46	4.58	2.77	4.52	4.55
75th Percentile	(2.51)	5.40	7.32	6.86	8.65	(2.45)	5.61	4.42	2.64	4.30	4.00
90th Percentile	(2.93)	4.74	6.43	6.57	7.10	(6.08)	4.30	4.22	2.37	3.90	3.64
AY02 - Fixed Income ● A	(2.43)	4.60	7.82	7.00	8.56	2.23	6.43	4.58	3.36	4.69	4.99
Barclays:Aggregate Index ▲ B	(2.44)	4.21	7.84	6.54	5.93	5.24	6.97	4.33	2.43	4.34	4.10

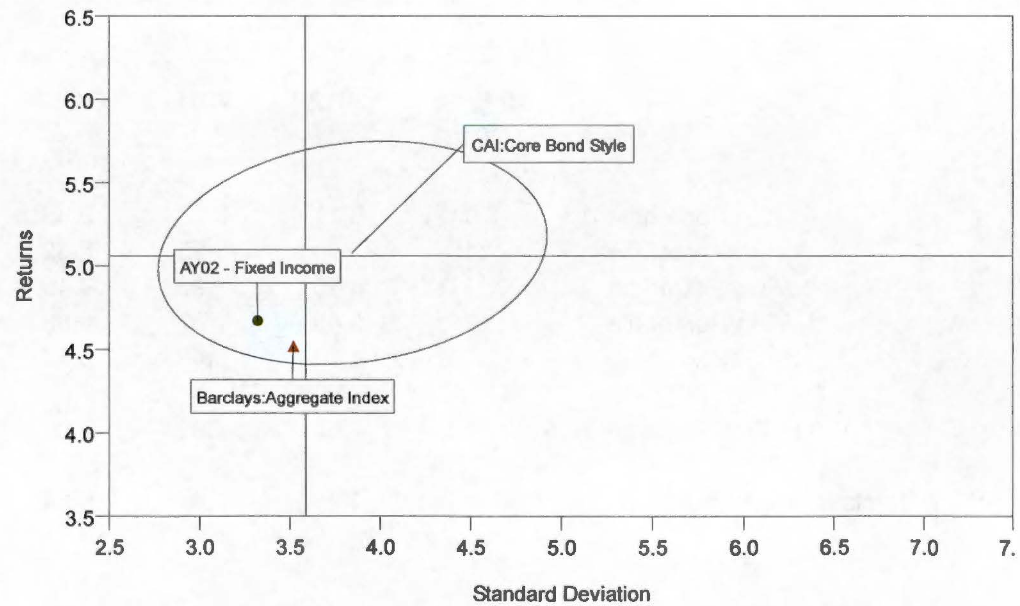
Fixed Income Fund Risk and Return

Scatter Chart
for 5 Years Ended June 30, 2013



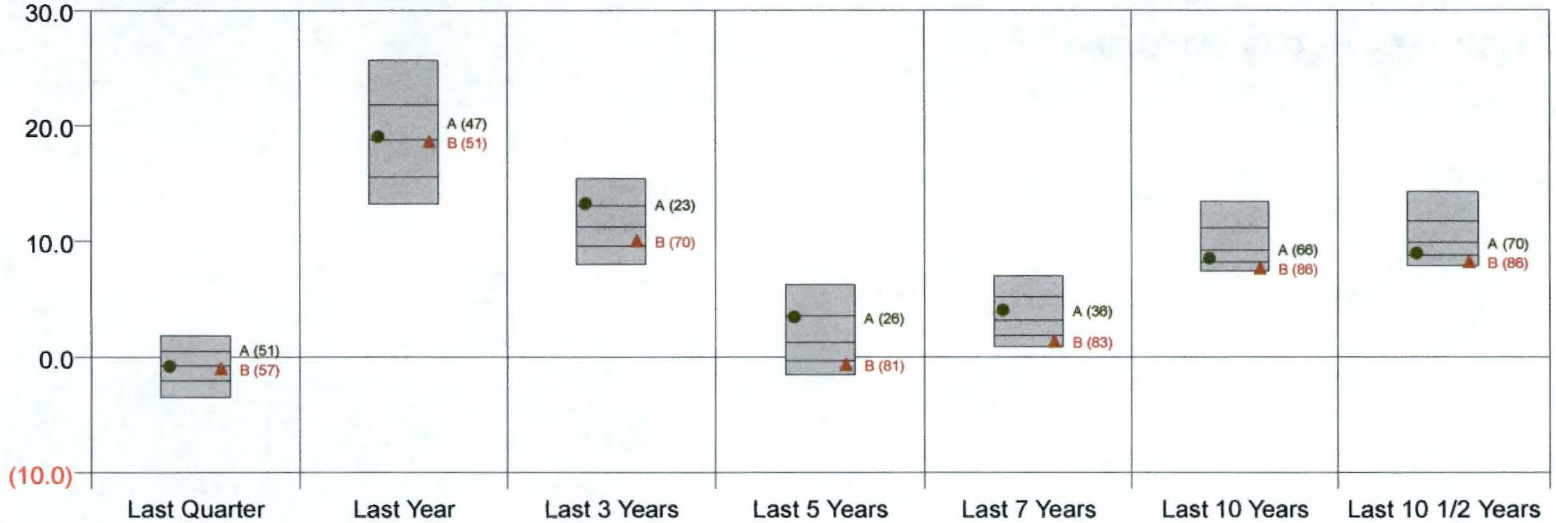
- Graphs demonstrate that your bond portfolios have been less volatile than the typical portfolio and have achieved market-like returns or better returns at slightly less risk.

Scatter Chart
for 10 Years Ended June 30, 2013



International Equity Fund Cumulative Returns

Returns for Periods Ended June 30, 2013
Group: CAI Non-U.S. Equity Database

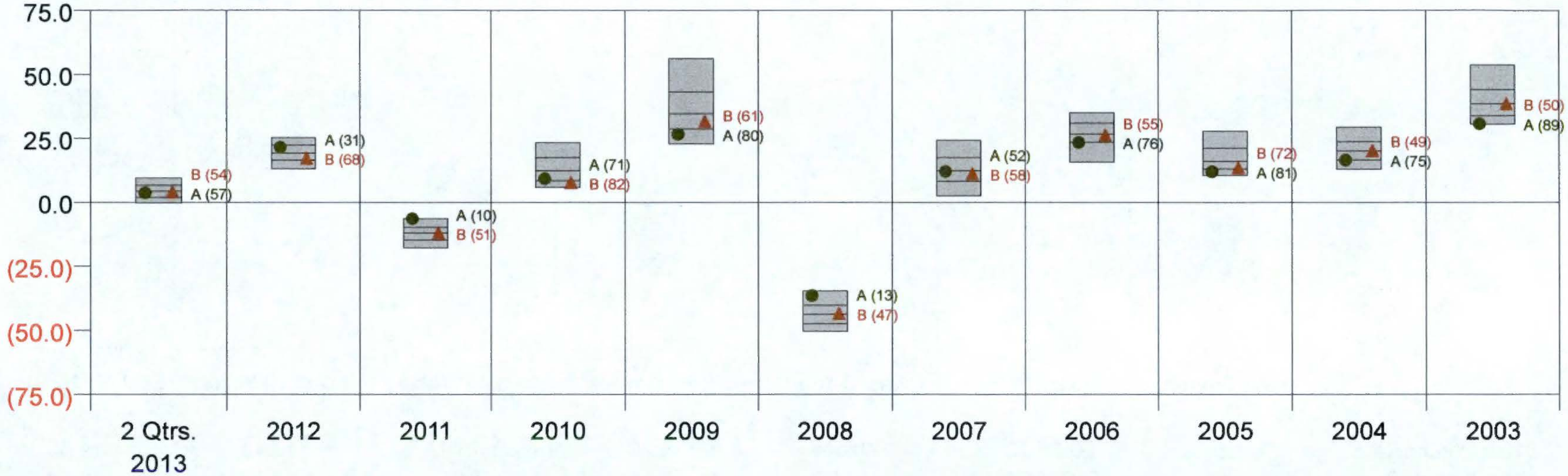


	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 10 1/2 Years
10th Percentile	1.85	25.70	15.44	6.26	7.01	13.43	14.30
25th Percentile	0.51	21.79	13.06	3.55	5.19	11.18	11.74
Median	(0.77)	18.77	11.24	1.26	3.15	9.22	9.90
75th Percentile	(2.04)	15.55	9.59	(0.34)	1.85	8.19	8.80
90th Percentile	(3.49)	13.20	7.98	(1.54)	0.87	7.40	7.89
AY02 - Intl Equity ● A	(0.80)	19.05	13.26	3.46	4.06	8.52	8.96
MSCI:EAFE US$ ▲ B	(0.98)	18.62	10.04	(0.63)	1.37	7.67	8.22

- Your international exposure is achieved through an “actively” managed fund rather than the passive management approach used in the domestic equity asset class. The long-term record includes a period during which the portfolio was passively managed.
- Cumulative returns have been better than benchmark.

International Equity Fund Calendar Year Returns

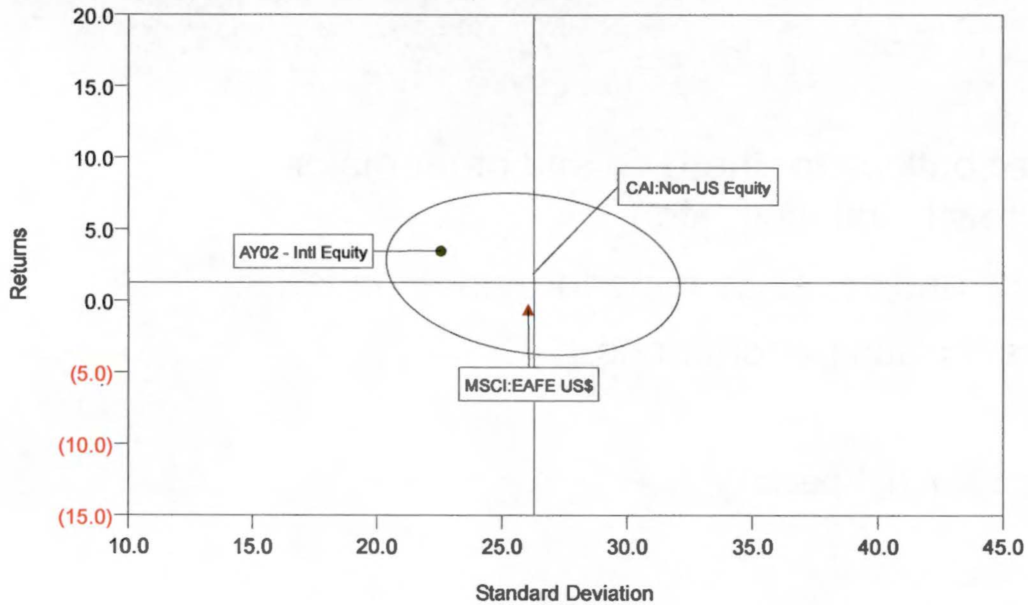
Returns for Calendar Years
10 1/2 Years Ended June 30, 2013
Group: CAI Non-U.S. Equity Database



		2 Qtrs. 2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
10th Percentile		9.51	25.37	(6.32)	23.40	56.32	(34.52)	24.40	35.11	27.92	29.57	53.72
25th Percentile		6.68	22.42	(9.81)	17.66	43.18	(40.23)	17.57	31.05	21.22	23.79	44.20
Median		4.37	19.34	(11.99)	12.45	34.63	(43.72)	12.50	26.82	16.14	20.14	38.65
75th Percentile		2.02	16.64	(14.76)	8.56	28.76	(47.41)	8.29	23.58	13.09	16.70	33.91
90th Percentile		(0.20)	13.19	(17.76)	5.84	22.85	(50.44)	2.56	15.72	10.54	12.99	30.62
AY02 - Intl Equity	● A	3.77	21.56	(6.34)	9.29	26.63	(36.39)	12.12	23.53	12.09	16.63	30.79
MSCI:EAFE US$	▲ B	4.10	17.32	(12.14)	7.75	31.78	(43.38)	11.17	26.34	13.54	20.25	38.59

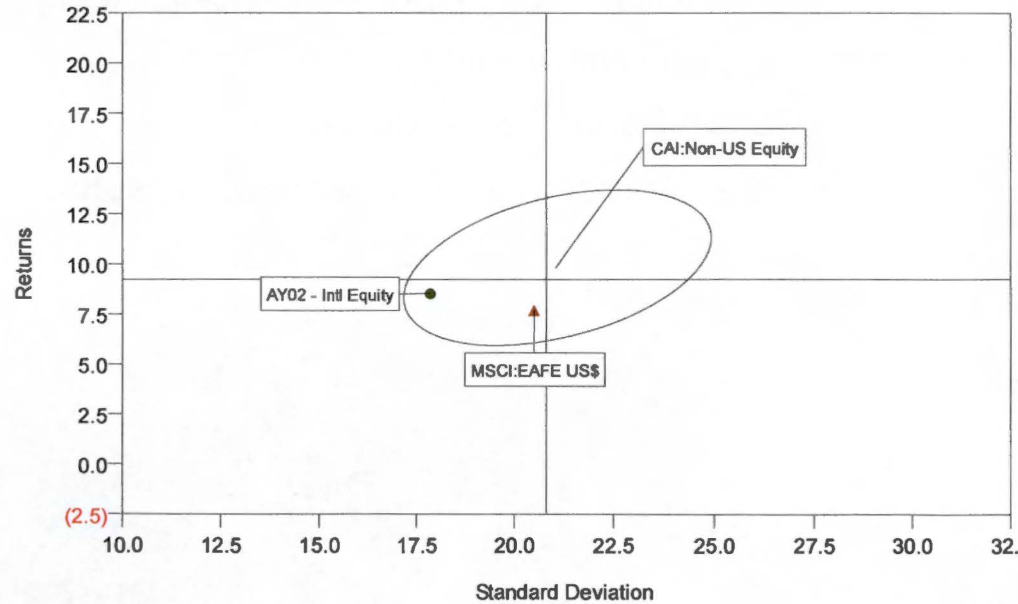
International Equity Fund Risk and Return

Scatter Chart
for 5 Years Ended June 30, 2013



- Performance has been better than "market" at lower than market risk.

Scatter Chart
for 10 Years Ended June 30, 2013



Capital Market Projection Process

Long-term economic outlook drives the process. We focus on 10 year and longer returns and carefully assess the implications associated with the current starting point.

- Evaluate the current environment and economic outlook for the U.S. and other major industrial countries (business cycles, relative growth, inflation, etc.).
- Examine the relationships between the economy and asset class performance patterns.
- Examine both recent and long-run trends in asset class performance.
- Apply market insight:
  - Consultant experience - Plan Sponsor, Manager Search, Specialty
  - Industry consensus
  - Client Policy Review Committee
- Test the projections for reasonable results.

Themes Explored in Setting the 2013 Expectations

- We are in uncharted waters. Where do we go from here?
- What are the prospects for global growth in the short and medium term?
- Has the long term trend for GDP growth changed? What does such a change imply for the capital markets?
- Has inflation disappeared as a risk?
- Bond market surprised yet again in 2012, with rates inching further down. Is THIS finally the end of the road for bonds? Negative real yields persist across wide stretches of the fixed income market. Do rising rates doom the return expectations for fixed income?
- All major asset classes appear to be fully to slightly overvalued. Which is the best of a bad lot?
- Sharp contrast between a long term, strategic vision for an investor (10+ years), the short term (1-3 years) reality, and the path from the current conditions to the long term expectations.

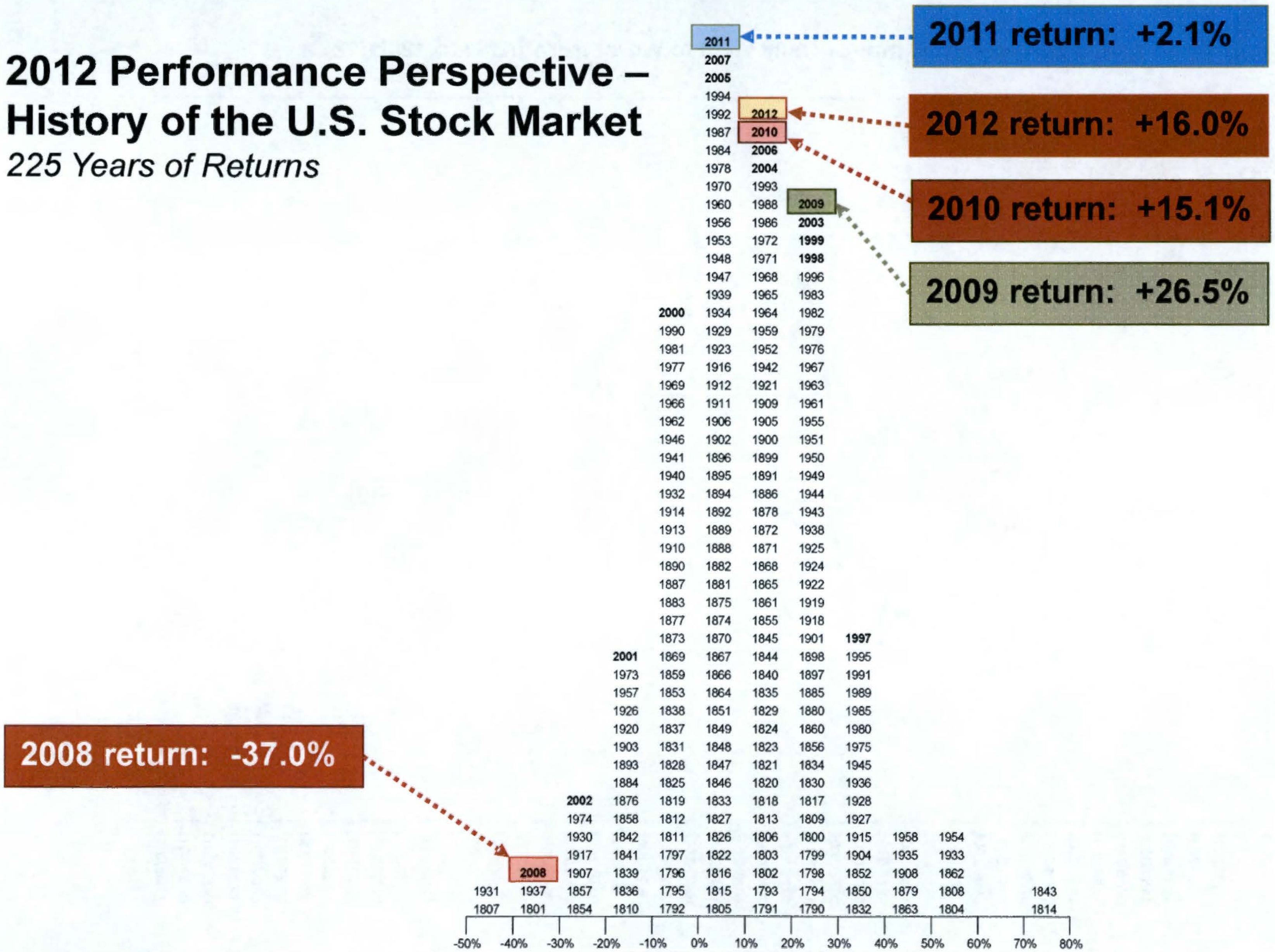
Building Long-term US Equity Expectations

- Dividend Yields Likely to Stay Near Current Levels.
  - Financing uncertainty continues so cash unlikely to be returned to investors.
  - Fixed income yields expected to remain low.
- Equity Valuations Currently Moderate but not inexpensive after another strong advance in 2012.
- Corporate Profits Strong in 2012 but Growth Slowing in 2013.
  - Companies will be pressed to sustain trend in profit growth with a in a weak recovery.
- Company Balance Sheets Are Strong, But No One is Eager to Spend. Large Cash Holdings a Drag on ROE.
- Consumption Still Dominates Economic Growth.
  - Unemployment high but finally declining slightly,
  - Wealth improving as home prices and equity values have been strong,
  - Labor force participation rates low and aggregate personal income growth constrained.
- Have We Entered a New Era of Lower Trend Growth in GDP?

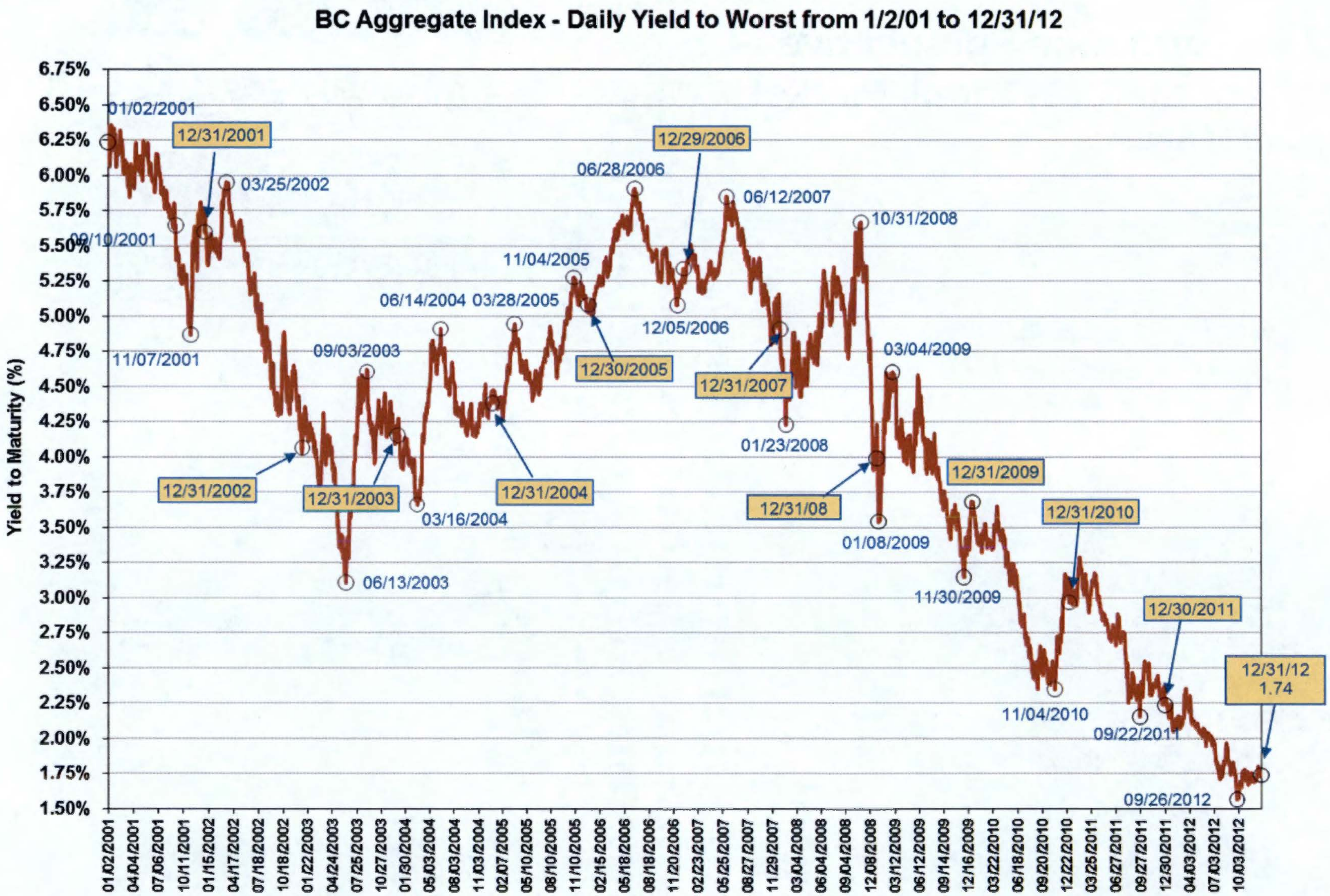
Stock Market Returns by Calendar Year

2012 Performance Perspective – History of the U.S. Stock Market

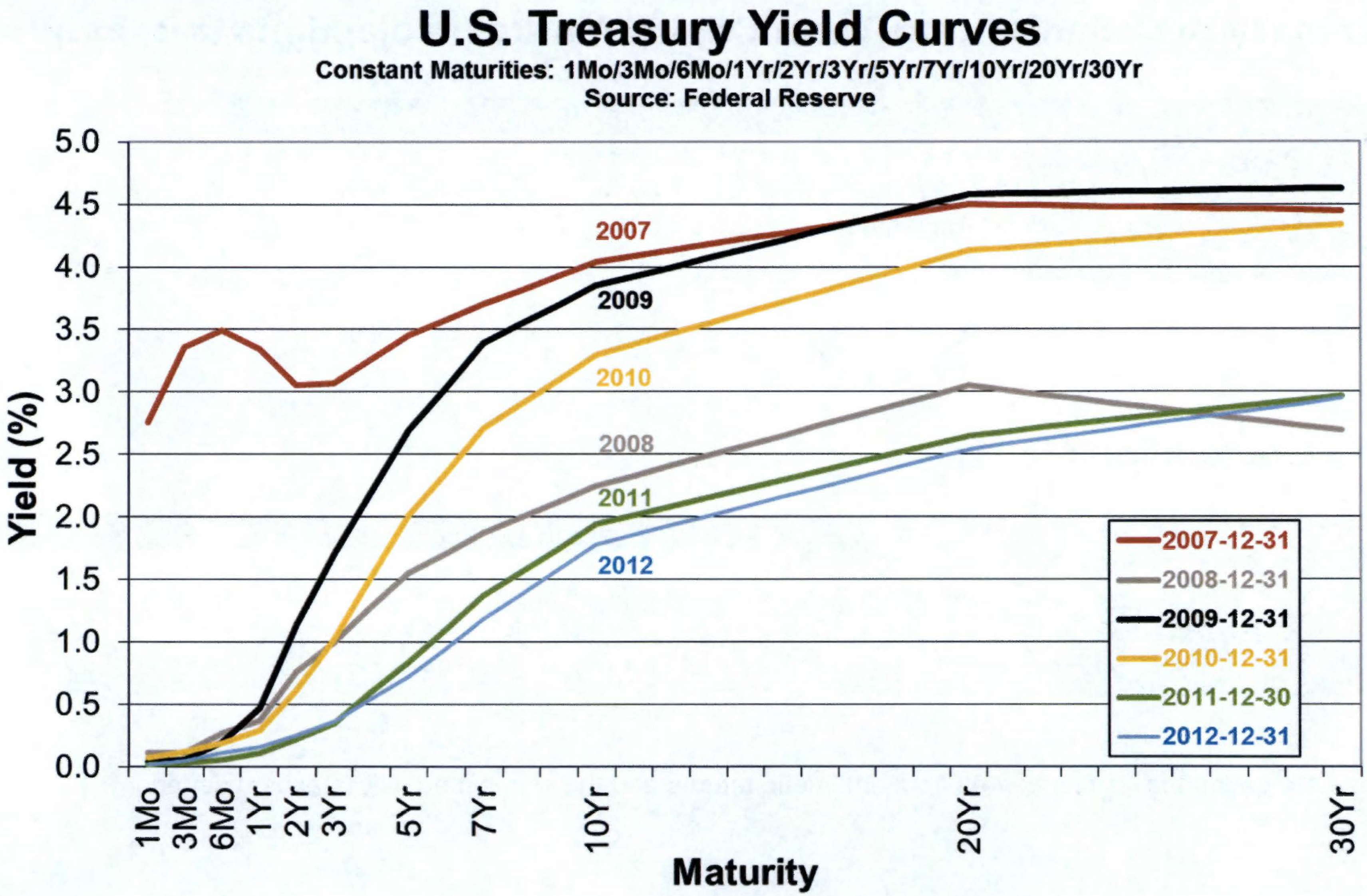
225 Years of Returns



Longer term illustration of investment grade bond yields



Yield Curve Illustration



Callan 2013 Capital Market Assumptions

Summary of Callan's Long-Term Capital Market Projections (2013 - 2022)

Asset Class	Index	Projected Return*	Projected Risk
Domestic Equity	Russell 3000	7.65%	18.95%
International Equity	MSCI World ex-US	7.50%	20.10%
Domestic Bonds	BC Aggregate	2.50%	3.75%
Cash Equivalents	90-Day T-Bill	2.00%	0.90%
Inflation	CPI-U	2.50%	1.50%

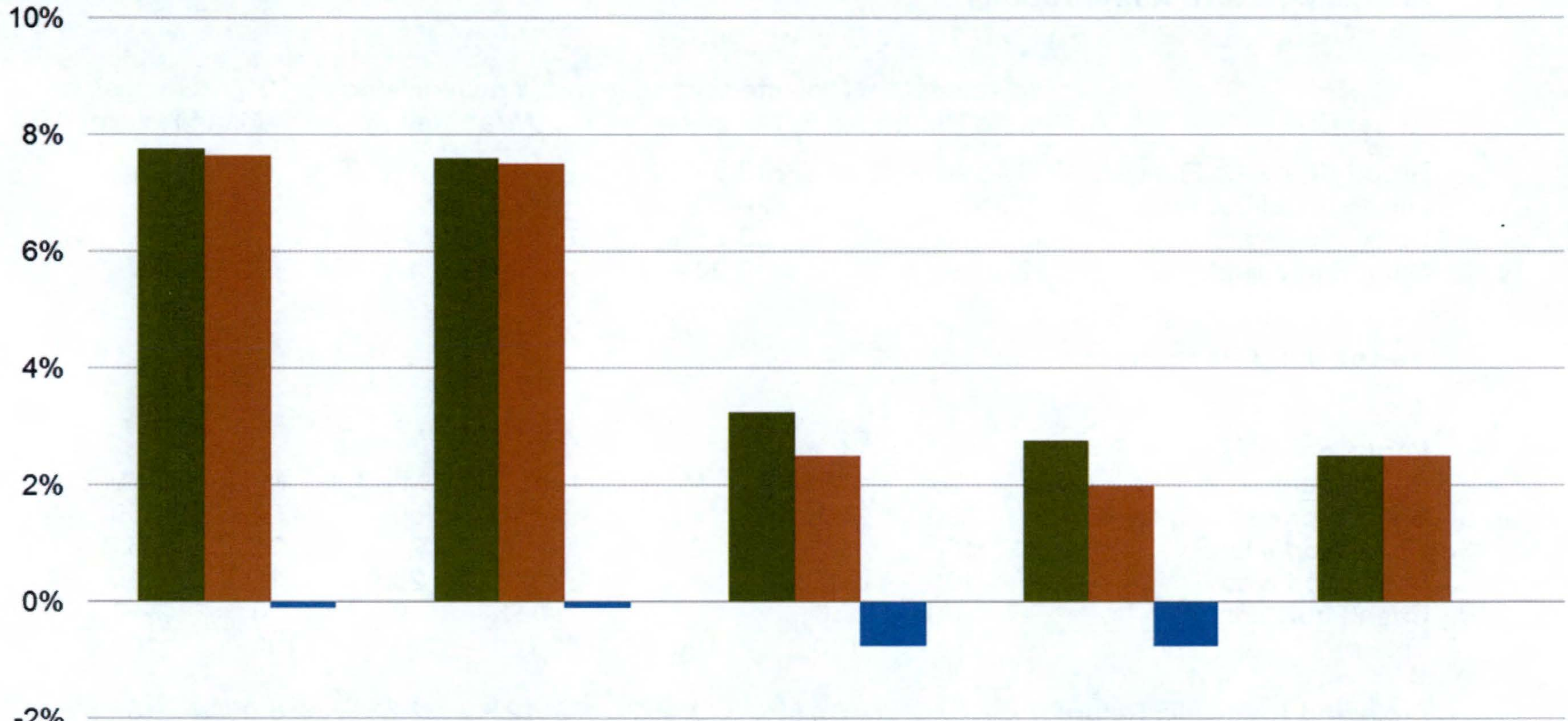
2013 Correlation Matrix

Correlations	Domestic Equity	International Equity	Domestic Bonds	Cash Eq
Domestic Equity	1.000			
International Equity	0.852	1.000		
Domestic Bonds	-0.106	-0.100	1.000	
Cash Equivalents	-0.043	-0.010	0.100	1.000

* These are geometric returns derived from arithmetic returns and the associated risk (standard deviation).

Change in Callan Capital Market Assumptions

10 Year Geomtric Return



	Domestic Equity	International Equity	Domestic Bonds	Cash Eq	Inflation
2012	7.75%	7.60%	3.25%	2.75%	2.50%
2013	7.65%	7.50%	2.50%	2.00%	2.50%
Difference	-0.10%	-0.10%	-0.75%	-0.75%	0.00%

2013 Capital Market Inputs & Resultant "Efficient" Mixes

Last year's return & risk for the current policy were 7.46% and 12.95% respectively

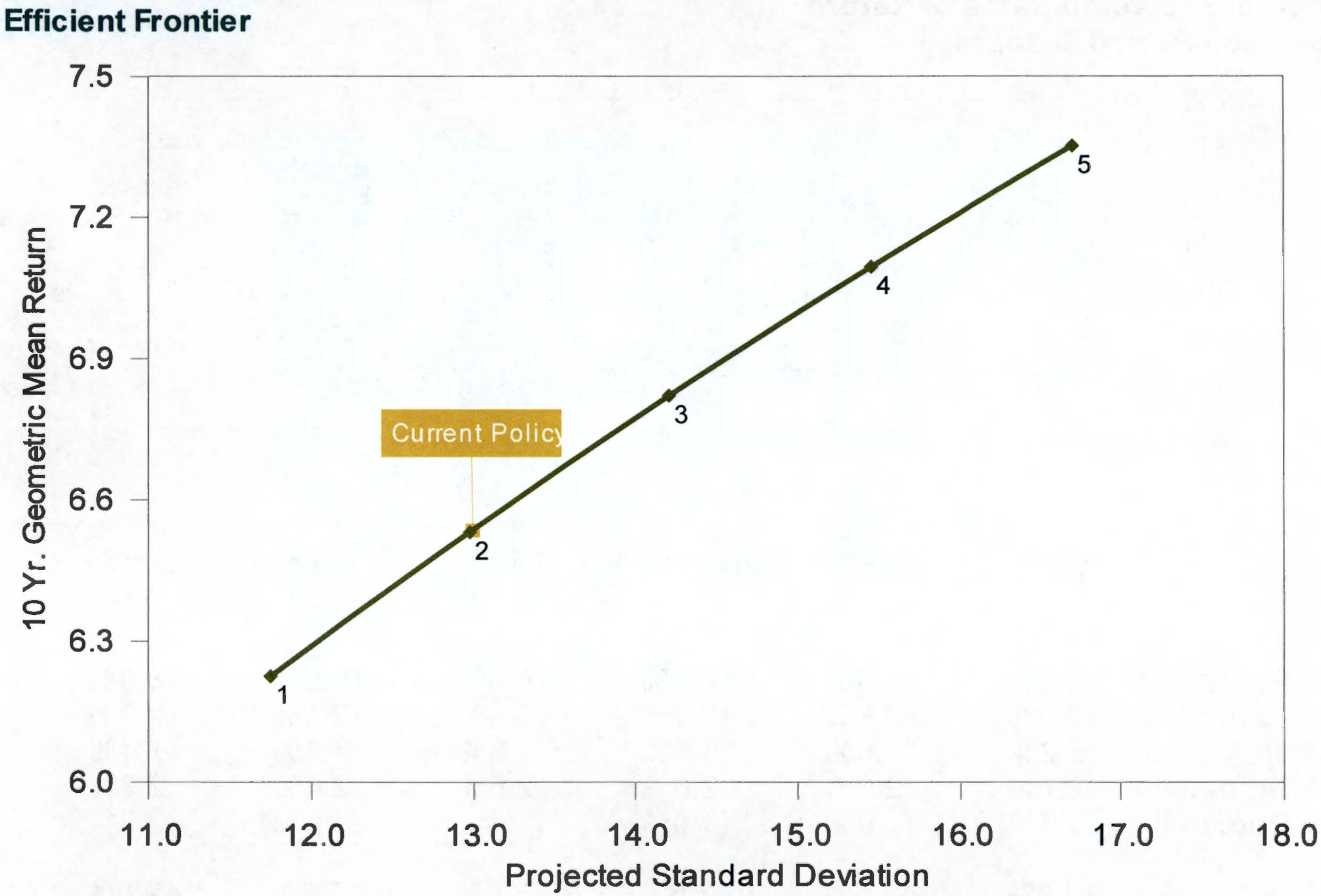
Risk and Return Assumptions

Asset Class	Projected Arithmetic Return	Projected Standard Deviation	5 Yr. Geometric Mean Return	10 Yr. Geometric Mean Return
Broad Domestic Equity	9.15%	18.94%	7.68%	7.63%
International Equity	9.25%	20.10%	7.56%	7.50%
Domestic Fixed	2.55%	3.75%	2.51%	2.51%
Cash Equivalents	2.00%	0.90%	2.01%	2.01%

Asset Mix Alternatives

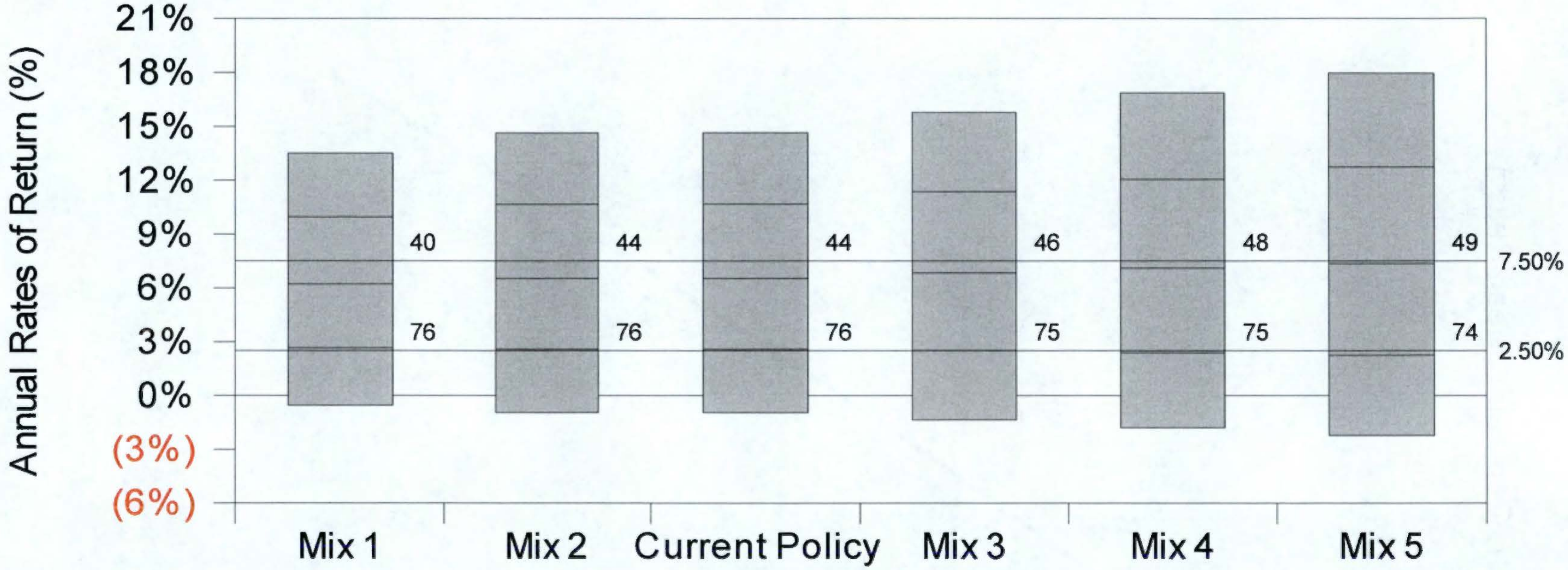
Portfolio Component	Max	Mix 1	Mix 2	Current Policy	Mix 3	Mix 4	Mix 5
Broad Domestic Equity	100	41	46	47	50	54	59
International Equity	100	22	24	23	27	29	31
Domestic Fixed	100	37	30	30	23	17	10
Cash Equivalents	100	0	0	0	0	0	0
Totals		100	100	100	100	100	100
Projected Arithmetic Return		6.75%	7.19%	7.19%	7.63%	8.06%	8.50%
Projected Standard Deviation		11.75%	12.97%	12.99%	14.21%	15.45%	16.70%
5 Yr. Geometric Mean Return		6.24%	6.55%	6.56%	6.85%	7.13%	7.39%
10 Yr. Geometric Mean Return		6.23%	6.53%	6.54%	6.82%	7.10%	7.35%
10 Yr. Simulated Sharpe Ratio		0.36%	0.35%	0.35%	0.34%	0.33%	0.32%

Efficient Frontier



5-Year Range of Returns

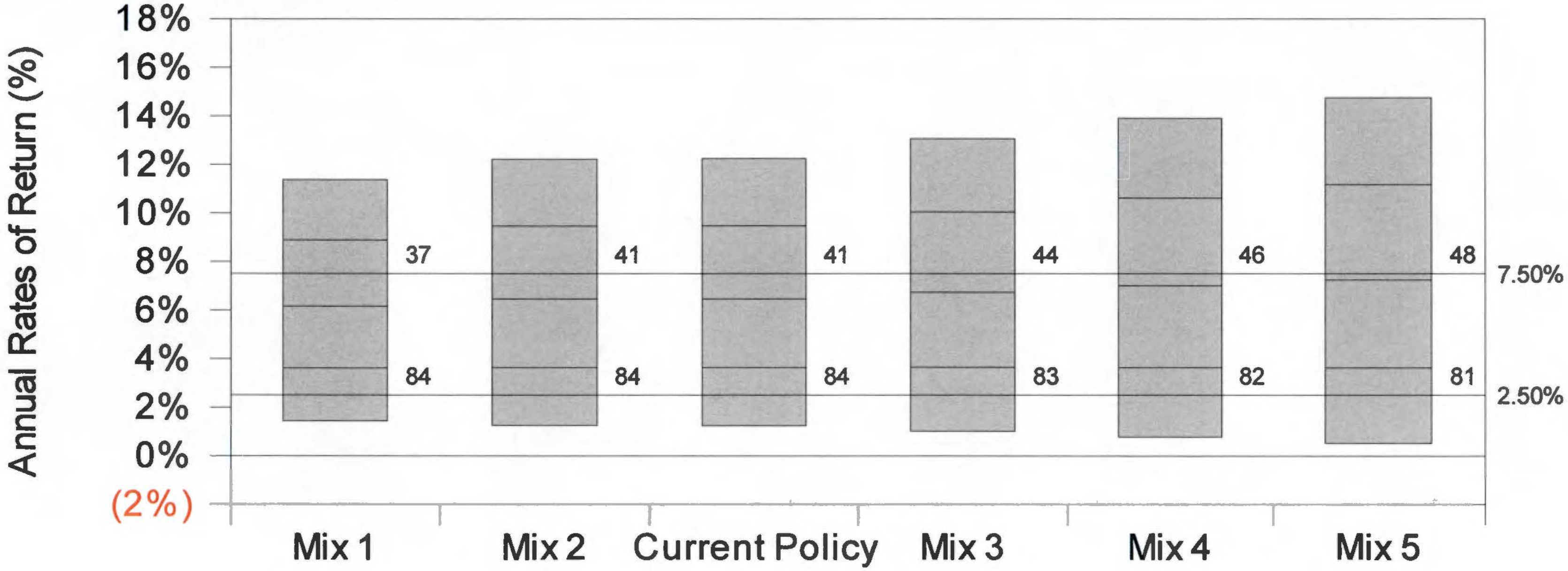
Range of Projected Rates of Return
Projection Period: 5 Years



	Mix 1	Mix 2	Current Policy	Mix 3	Mix 4	Mix 5
10th Percentile	13.5%	14.6%	14.7%	15.8%	16.9%	18.0%
25th Percentile	10.0%	10.7%	10.7%	11.4%	12.1%	12.7%
Median	6.2%	6.5%	6.5%	6.8%	7.1%	7.4%
75th Percentile	2.7%	2.6%	2.6%	2.5%	2.4%	2.3%
90th Percentile	(0.6%)	(1.0%)	(1.0%)	(1.4%)	(1.8%)	(2.2%)
Prob > 7.50%	39.8%	43.5%	43.6%	45.6%	47.6%	49.0%
Prob > 2.50%	75.9%	75.5%	75.5%	74.9%	74.5%	73.7%

10-Year Range of Returns

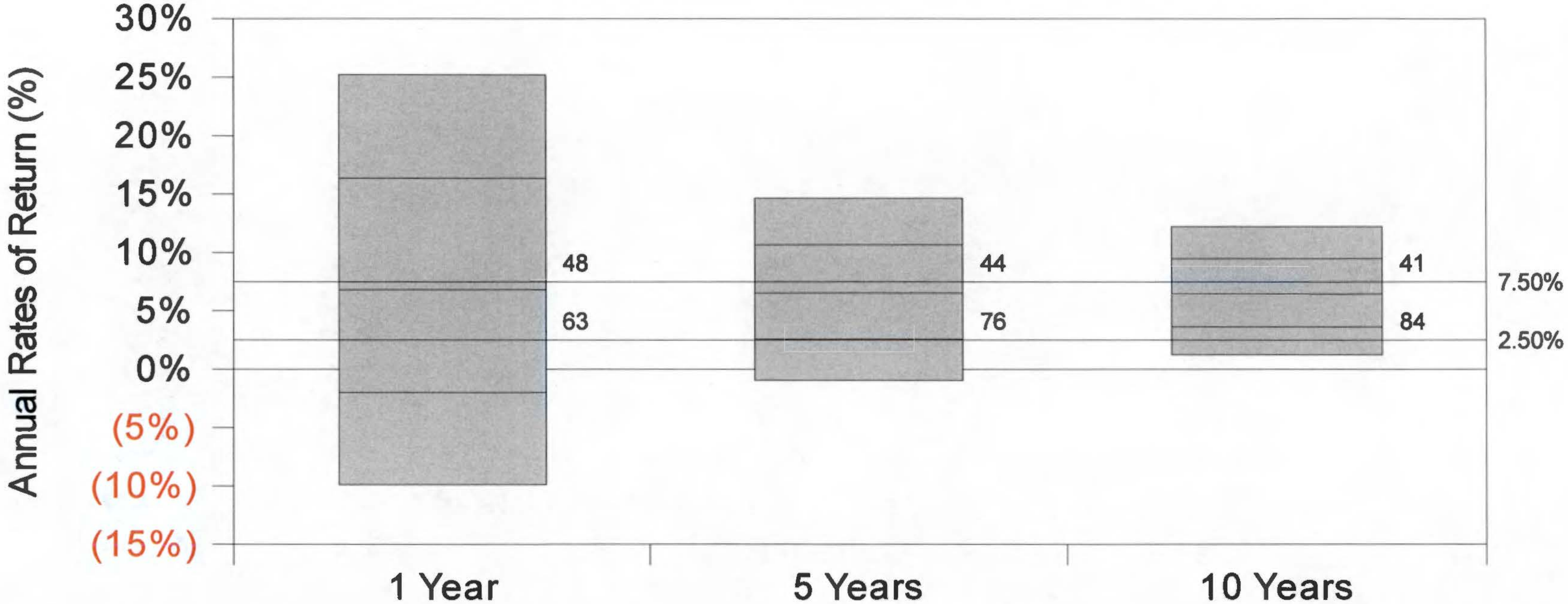
Range of Projected Rates of Return
Projection Period: 10 Years



	Mix 1	Mix 2	Current Policy	Mix 3	Mix 4	Mix 5
10th Percentile	11.4%	12.2%	12.2%	13.1%	13.9%	14.8%
25th Percentile	8.9%	9.5%	9.5%	10.0%	10.6%	11.2%
Median	6.2%	6.5%	6.5%	6.7%	7.0%	7.3%
75th Percentile	3.6%	3.6%	3.6%	3.7%	3.6%	3.6%
90th Percentile	1.4%	1.2%	1.2%	1.0%	0.8%	0.5%
Prob > 7.50%	37.0%	40.9%	40.9%	43.5%	46.0%	48.0%
Prob > 2.50%	84.0%	83.6%	83.6%	82.6%	81.9%	81.1%

Current Policy – Multiple Time Frames

Range of Projected Rates of Return
Current Policy



	1 Year	5 Years	10 Years
10th Percentile	25.2%	14.7%	12.2%
25th Percentile	16.4%	10.7%	9.5%
Median	6.8%	6.5%	6.5%
75th Percentile	(2.0%)	2.6%	3.6%
90th Percentile	(9.9%)	(1.0%)	1.2%
Prob > 7.50%	47.8%	43.6%	40.9%
Prob > 2.50%	63.5%	75.5%	83.6%

Other Items

- Several thoughts on structure & costs
  - Extensive use of low cost investment vehicles: Russell 3000 Index Fund; Revenue Department managed bond and cash funds. Returns are unknown but costs are known and should be minimized. EVOST, in our opinion, has done an excellent job of minimizing controllable costs.
- Callan is not a law firm and never provides legal advice
  - However, it is important to note that at recent interest rate levels, high quality fixed income obligations and short-term investment instruments are expected to provide investors with a negative real return (i.e. the expected return for such instruments is less than the expected rate of inflation and therefore provide a negative real return).
- Diversification remains a critical requirement
  - Total portfolio risk is dominated by equity risk. Equity risk is much greater than bond risk.
  - Increasing the targeted equity allocation would raise expected return but would increase total fund volatility by a large amount.
- Introduction of Treasury Inflation Protected Securities may warrant future consideration
  - As noted last year, this would further diversify the fixed income portfolio.
  - Timing and recent weakness in TIPS may warrant addition to program
  - Callan would be pleased to discuss this matter at an appropriate time.

APDI EVOSTC Admin
Budget

Exxon Valdez Oil Spill Trustee Council
FY14 Annual Program Development and Implementation (APDI) Budget
February 1, 2014– January 31, 2015

This budget structure is designed to provide a clearly identifiable **12-month** allocation of the funds supporting Trustee Council activities. The program components are:

- Administration Management
- Data Management
- Science Program
- Public Advisory Committee (PAC)
- Habitat Protection Program
- Trustee Council Member Expenses
- Trustee Agency Support/Project Management
- Alaska Resources Library & Information Services (ARLIS)

The budget estimates detailed within those specified program components are projected based upon prior year actual expenditures and include the application of estimated merit step increases, as well as payroll benefits increases. Detailed **12-month** budget component items cover necessary day-to-day operational costs of the *Exxon Valdez* Oil Spill Restoration Office and administrative costs associated with overseeing current Trustee Council program objectives.

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BUDGET SUMMARY INFORMATION - $1,756,475

The Council's FY14 APDI Budget is funded by the *Exxon Valdez* Oil Spill Investment Fund which is managed by the Alaska Department of Revenue. The following summary tables show budget allocations by component, budgeted amount, and include 9% General Administration (GA) costs. The remainder of the document provides additional **12-month** detail for each component and, where applicable, the agency distribution for the funds.

Component	FY13 Total 12-Month Budget	**FY14 Total 12- Month Budget**
Administration Management	$726,893	$710,545
Data Management	$57,143	$63,874
Science Program	$160,662	$273,797
Public Advisory Committee (PAC)	$16,486	$19,047
Trustee Council Member Expenses	$1,635	$1,962
Habitat Protection Program	$208,311	$242,634
Trust Agency Support/Project Management	$297,510	$326,312
Alaska Resources Library & Information Services (ARLIS)	$75,406	$118,304
Total	**$1,544,046**	**$1,756,475**

($212,429 more than FY13 **12-month** allocations due to new contracts vs. rollovers, science workshop)

APDI 5-Year 12-Month Budget Comparison FY10 – FY14					
Component	FY10 Budget	FY11 Budget	FY12 Budget	FY13 Budget	FY14 Budget
Administration Management	$804,663	$813,693	$708,137	$726,893	$710,545
Data Management	$149,991	$152,080	$137,885	$57,143	$63,874
Science Management	$468,539	$231,336	$287,471	$160,662	$273,797
Public Information & Outreach	$136,850	$0	$0	$0	$0
Public Advisory Committee (PAC)	$37,605	$37,060	$16,132	$16,486	$19,047
Trustee Council Member Direct Expenses	$29,975	$29,975	$1,199	$1,635	$1,962
Habitat Protection Program	$109,000	$109,000	$192,274	$208,311	$242,634
Trust Agency Support/Project Management	$367,033	$339,774	$297,510	$297,510	$326,312
Alaska Resource Library & Information Services	$166,372	$137,119	$71,182	$75,406	$118,304
Total	**$2,270,028**	**$1,834,123**	**$1,711,790**	**$1,544,046**	**$1,756,475**

(Public Information & Outreach added to Administration Management in FY2011)

APDI 5-Year 12-Month Budget Cost Type Comparison FY10 – FY14					
Cost Type	FY10 Budget	FY11 Budget	FY12 Budget	FY13 Budget	FY14 Budget
Personnel	$1,312,115	$1,112,766	$913,325	$959,996	$1,070,942
Travel	$69,000	$67,000	$45,100	$23,000	$92,300
Contractual	$632,480	$473,095	$554,775	$395,634	$407,040
Commodities	$34,000	$32,500	$32,250	$28,701	$26,163
Equipment	$35,000	$24,500	$25,000	$9,225	$15,000
Subtotal	**$2,082,595**	**$1,682,681**	**$1,570,450**	**$1,416,556**	**$1,611,445**
GA – 9%	$187,433	$151,442	$141,340	$127,490	$145,030
Total	**$2,270,028**	**$1,834,123**	**$1,711,790**	**$1,544,046**	**$1,756,475**

Total FY14 12-Month APDI Budget from Restoration Sub-Account	
Admin Mgmt	$710,545
Data Mgmt	$63,874
Science Prgm	$273,797
PAC	$19,047
TC Expense	$1,962
Trust Agency	$326,312
ARLIS	$118,304
Total	**$1,513,841**

Total FY14 12-Month Budget from Habitat Sub-Account	
Habitat	$242,634
Total	**$242,634**

Vacant, but Retaining. PCN/Title	Cost Not Budgeted in APDI
11-7703/Sci Coord	$121,430
Total	$121,430

In FY12, PCN 11-7707 was deleted and PCNs 11-7701, 11-7705, & 11-7706 were transferred to ADF&G

	Total FY14 12-Month APDI Budget by Agency from Research Sub-Account								
Cost Type	ADF&G	ADEC	NOAA	DOI USGS	DOI FWS	DOI SEC	DOI OEPC	USFS	Total Budget
Personnel	$666,699	$0	$90,000	$54,000	$9,400	$22,969	$6,774	$43,000	$892,842
Travel	$86,500	$0	$1,500	$0	$0	$1,800	$0	$0	$89,800
Contractual	$271,540	$0	$2,500	$91,000	$0	$0	$0	$0	$365,040
Commodities	$23,500	$0	$0	$2,663	$0	$0	$0	$0	$26,163
Equipment	$15,000	$0	$0	$0	$0	$0	$0	$0	$15,000
Subtotal	$1,063,239	$0	$94,000	$147,663	$9,400	$24,769	$6,774	$43,000	$1,388,845
GA – 9%	$95,692	$0	$8,460	$13,290	$846	$2,229	$610	$3,870	$124,996
Total	**$1,158,931**	**$0**	**$102,460**	**$160,953**	**$10,246**	**$26,998**	**$7,384**	**$46,870**	**$1,513,841**

	Total FY14 12-Month APDI Budget by Agency from Habitat Sub-Account				
Cost Type	ADF&G	ADOL	ADNR	DOI FWS	DOI BLM	Total Budget
Personnel	$0	$97,100	$50,000	$25,000	$6,000	$178,000
Travel	$2,500	$0	$0	$0	$0	$2,500
Contractual	$0	$0	$40,000	$0	$2,000	$4,200
Commodities	$0	$0	$0	$0	$0	$0
Equipment	$0	$0	$0	$0	$0	$0
Subtotal	$2,500	$97,100	$90,000	$25,000	$8,000	$222,600
GA – 9%	$225	$8,739	$8,100	$2,250	$720	$20,034
Total	**$2,725**	**$105,839**	**$98,100**	**$27,250**	**$8,720**	**$242,634**

ADMINISTRATION MANAGEMENT - $710,545

Cost Category	FY13 Total 12- Month Budget for Comparison	FY14 Total 12- Month Budget
Personnel	$466,260	$478,163
Travel	$2,500	$4,500
Contractual	$177,063	$145,050
Commodities	$18,426	$22,163
Equipment	$2,625	$2,000
Subtotal	$666,874	$651,876
GA - 9%	$60,019	$58,669
Total	**$726,893**	**$710,545**

($16,348 less than FY13)

PERSONNEL - $478,163

Position	Range /Step	Months	Monthly Cost	12-Month Cost
Executive Director – Elise Hsieh	28/E	12	$14,886	$178,627
Librarian III – Carrie Holba	19/N	6	$11,606	$69,636
Associate Coordinator – Cherri Womac	18/K	12	$9,946	$119,356
Administrative Manager – Linda Kilbourne	19/D	12	$9,212	$110,544
Personnel Total			$45,650	$478,163

Cost includes benefits. Librarian 12-month allocation split between ARLIS/Admin.

TRAVEL - $4,500

These funds are for travel support for meetings and trainings.

CONTRACTUAL – $145,050

- **Professional Development** **$250**

Administrative funds are budgeted for in-state training and professional meetings with state, federal or program agency representatives on administrative, program or budget issues as necessary.

- **Trustee Council's Office Space** **$91,000**

The Trustee Council's office relocated to Grace Hall on the Alaska Pacific University campus in Anchorage in summer 2012. The space for the Trustee Council's office is administered through a Memorandum of Agreement (MOA) with the U.S. Geological Survey of the Department of Interior.

- **Agreed-Upon Services Contract** **$20,000**

These funds support an Agreed-Upon Procedures (AUP) contract (currently Elgee, Rehfeld, Mertz) for the review of targeted financial transactions of the Trustee Office and agencies receiving EVOSTC funds.

- **Investment Services Contract** **$8,000**

These funds support investment consultation services (currently Callan Associates) in association with the Investment Working Group.

- **Telephone Service** **$2,900**

These funds are for telecommunications, teleconferencing meetings, and long distance phone services. Also includes annual cell phone allowance each for ED and AM.

- **Public Notices** **$1,900**

These funds are for advertising Trustee Council public meetings and workshops in newspapers in the spill-affected areas

- **Transcription** **$2,500**

These funds are for the transcription service contract to record and preserve Trustee Council meetings

- **Administrative Operations** **$2,000**

These funds are for services beyond those provided under lease agreement

- **Interagency Contracted Services** **$16,500**

These funds are for the Trustee Office's share of the Reimbursable Services Agreement costs relating to the EPR Telecommunications, Computer Services, ADA, Central Mail and AKSAS & AKPAY charge-backs paid by all ADF&G divisions These costs are based on the number of full time positions divided by the total cost

COMMODITIES - $22,163

- **Office Supplies** **$4,000**

These funds are for miscellaneous office supplies, paper, toner, meeting materials, etc Also includes supplies needed to complete the official record

- **Trustee Council Meetings** **$2,500**

These funds are for materials and incidentals for one teleconferenced and one in-person TC meeting

- **Administrative Operations** **$8,000**

These funds are for unanticipated expenses due to the extensive tailoring of the budget

- **Interpretive Information** **$5,000**

These funds are to purchase materials to produce documents, including those for meetings, public outreach, and general information

- **Interagency Supplies** **$2,663**

These funds are for the Trustee Office's share of USGS costs for office supplies, postage usage, office equipment usage, Glen Olds Hall receptionist, flu shots paid through the lease agreement

EQUIPMENT - $2,000

These funds are to purchase equipment (i e fax, scanner, and /or printer) as needed to meet the needs of the EVOSTC office

AGENCY DISTRIBUTION:

Admin Management Cost Category	ADF&G	USGS	12- Month TOTAL
Personnel	$478,163	$0	$478,163
Travel	$4,500	$0	$4,500
Contractual	$54,050	$91,000	$145,050
Commodities	$19,500	$2,663	$22,163
Equipment	$2,000	$0	$2,000
Subtotal	$558,213	$93,663	$651,876
GA - 9%	$50,239	$8,430	$58,669
Component Total	**$608,452**	**$102,093**	**$710,545**

DATA MANAGEMENT - $63,874

Cost Category	FY13 Total 12- Month Budget for Comparison	FY14 Total 12- Month Budget
Personnel	$0	$0
Travel	$0	$0
Contractual	$35,925	$42,100
Commodities	$9,900	$3,500
Equipment	$6,600	$13,000
Subtotal	$52,425	$58,600
GA - 9%	$4,718	$5,274
Total	**$57,143**	**$63,874**

($6,731 more than FY13 due to renewing contracts vs. rollovers)

PERSONNEL - $0

TRAVEL - $0

CONTRACTUAL – $42,100

- **Equipment Maintenance** **$1,500**

These funds are for minor equipment maintenance and repairs.

- **IT Services RSA: Alaska Dept. of Fish & Game** **$35,600**

The funds are for supporting the IT needs of the Trustee Council office. (RSAs for support from Sport Fish IT group: $25,600 and $10,000 from DAS IT group).

- **IT Services: Database Consultation** **$5,000**

The funds are for supporting the IT needs of the Trustee Council database overhaul.

COMMODITIES - $3,500

- **Computer Software, Hardware & Upgrades** **$3,000**

These funds are for necessary purchases and upgrades to computer hardware, software, software licenses, and networking equipment for the Trustee Council Office (i.e. annual Microsoft licensing Agreement).

- **Equipment Supplies** **$500**

These funds are for miscellaneous supplies.

EQUIPMENT - $13,000

These funds are for needed upgrades to the SQL server for maintaining/updating the Trustee Council Office database, and any other necessary replacement of equipment.

AGENCY DISTRIBUTION

Data Management Cost Category	ADF&G 12- Month TOTAL
Personnel	$0
Travel	$0
Contractual	$42,100
Commodities	$3,500
Equipment	$13,000
Subtotal	$58,600
GA - 9%	$5,274
Component Total	**$63,874**

SCIENCE PROGRAM – $273,797

Cost Category	FY13 Total 12- Month Budget	FY14 Total 12- Month Budget
Personnel	$0	$0
Travel	$7,500	$74,500
Contractual	$139,896	$176,690
Commodities	$0	$0
Equipment	$0	$0
Subtotal	$147,396	$251,190
GA - 9%	$13,266	$22,607
Component Total	**$160,662**	**$273,797**

($113,135 more than FY13 due to renewing contracts vs. rollovers and Science Workshop)

PERSONNEL – $0

TRAVEL - $74,500

- **Travel & Support** **$10,000**

Includes support and travel for science oversight, TC meetings, Science Panel meetings, and symposia.

- **February 2015 Long-Term Programs Science Overview Workshop and PAC Workshop** **$64,500**

This FY14 budget provides funding through January 31, 2015; the Science and PAC Workshops are scheduled for mid-February 2015. These funds support for travel to the Long-Term Programs Science Workshop (50 participants for 2 days) and the PAC Workshop (25 participants for 1 day) to include:

1.	Airfare	$26,000
2.	Lodging	$22,000
3.	Per Diem	$ 7,000
4.	Surface Transportation	$ 5,500
5.	Catering	$ 3,000
6.	FACA Public Notice if necessary or Other Expenses	$ 1,000
	Total	$64,500

Funds for Science Panel participation (contractual services) will be included in the FY15 APDI.

CONTRACTUAL - $176,690

- **Science Coordinator Contract: Catherine Boerner of Natura Consulting** **$99,190**

This contract provides travel and science management services including project management, proposal coordination, implementation and oversight, and Work Plan support.

- **Science Panel** **$70,000**

The Science Panel provides advice and feedback to the Executive Director and Council. Their work includes: Providing funding recommendations on scientific proposals to the Executive Director, providing assistance on special projects at the Executive Director's or Trustee Council's request, and participating at one in-person meeting.

The members are: George Boehlert, Gary Cherr, Douglas Hay, Gordon Kruse, Steven Morgan, Roger Nisbet, Ronald O'Dor, Charles Peterson, Robert Spies, and John Stachowicz. Each contract covers services provided for the period of

February 1, 2014 through January 31, 2015, including travel and payable by actual time invoiced. The contracts are set at **$7,000 each.**

- **Herring Program Oversight Committee** **$4,000**

This group works with the Long-Term Herring Program to ensure the Program meets its goals, assist setting future research priorities, and to provide feedback to the Council, through the Executive Director. Members approved by the EVOSTC Executive Director, in consultation with the Program, ADF&G and NOAA. Current members include ADF&G representative: Sherri Dressel; NOAA representative: Jeep Rice; an Academic position: To be Selected; and Herring Program Team Lead: W. Scott Pegau.

- **Peer Review Contracts** **$2,500**

To ensure the scientific integrity of findings, and to assist with the review of the Council's programs, the Trustee Council requires peer review by nationally-recognized experts within applicable scientific and technical disciplines.

- **Science Administration** **$1,000**

These funds are for unanticipated costs for services to the Science Coordinator, Executive Director, and the Trustee Council, which may include additional science review activities.

COMMODITIES – $0

EQUIPMENT – $0

AGENCY DISTRIBUTION:

Science Program Cost Category	ADF&G TOTAL	NOAA TOTAL	12- Month TOTAL
Personnel	$0	$0	$0
Travel	$73,000	$1,500	$74,500
Contractual	$174,190	$2,500	$176,690
Commodities	$0	$0	$0
Equipment	$0	$0	$0
Subtotal	$247,190	$4,000	$251,190
GA - 9%	$22,247	$360	$22,607
Component Total	$269,437	$4,360	**$273,797**

PUBLIC ADVISORY COMMITTEE (PAC) - $19,047

Cost Category	FY13 Total 12- Month	FY14 Total 12- Month Budget
Personnel	$5,000	$6,774
Travel	$9,000	$9,000
Contractual	$750	$1,200
Commodities	$375	$500
Equipment	$0	$0
Subtotal	$15,125	$17,474
GA - 9%	$1,361	$1,573
Component Total	**$16,486**	**$19,047**

($2,561 more than FY13)

PERSONNEL - $6,774

Annual funds are provided for the **designated federal officer** (currently Pamela Bergmann) assigned to the PAC as required by the Federal Advisory Committee Act (FACA). This individual coordinates the scheduling of meetings, development of the agenda and meeting minutes, and provides assistance to the PAC Chair and the EVOSTC Restoration Office as needed.

TRAVEL - $9,000

- **PAC Meetings** **$9,000**

Travel support for **10** PAC members for one teleconferenced PAC meeting and to attend one in-person PAC meeting at an estimated average cost of **$900** per person per trip to include: airfare, ground transportation, per diem, and lodging.

- For the February 2015 Long-Term Programs PAC Workshop, see the Science Program component.

CONTRACTUAL - $1,200

- **Public Notices** **$1,200**

These funds are for advertising PAC meetings in newspapers in the spill-affected areas.

COMODITIES - $500

- **PAC Meetings** **$500**

These funds are for materials and incidentals for one teleconferenced and one in-person PAC meeting.

AGENCY DISTRIBUTION

PAC Cost Category	ADF&G	DOI-OEPC	12-Month Total
Personnel	$0	$6,774	$6,774
Travel	$9,000	$0	$9,000
Contractual	$1,200	$0	$1,200
Commodities	$500	$0	$500
Equipment	$0	$0	$0
Subtotal	$10,700	$6,774	$17,474
GA - 9%	$963	$610	$1,573
Component Total	$11,663	$7,384	**$19,047**

TRUSTEE COUNCIL MEMBER EXPENSES- $1,962

Cost Category	FY13 Total 12- Month Budget for Comparison	**FY14 Total 12- Month Budget**
Personnel	$0	$0
Travel	$1,500	$1,800
Contractual	$0	$0
Commodities	$0	$0
Equipment	$0	$0
Subtotal	$1,500	$1,800
GA - 9%	$135	$162
Component Total	**$1,635**	**$1,962**

($327 more than FY13)

PERSONNEL - $0

TRAVEL - $1,800

- **DOI Trustee Council Member Travel** **$1,800**

Travel support for the Trustee Council member or Alternate's travel expenses to participate in one meeting in Anchorage.

CONTRACTUAL - $0

COMMODITIES - $0

EQUIPMENT - $0

AGENCY DISTRIBUTION

Trustee Council Cost Category	ADF&G	ADEC	ADOL	NOAA	USFS	DOI-SEC	12-Month Total
Personnel	$0	$0	$0	$0	$0	$0	$0
Travel	$0	$0	$0	$0	$0	$1,800	$1,800
Contractual	$0	$0	$0	$0	$0	$0	$0
Commodities	$0	$0	$0	$0	$0	$0	$0
Equipment	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$0	$0	$0	$0	$1,800	$1,800
GA - 9%	$0	$0	$0	$0	$0	$162	$162
Component Total	$0	$0	$0	$0	$0	$1,962	**$1,962**

HABITAT PROTECTION PROGRAM - $242,634

Cost Category	FY13 Total 12- Month Budget for Comparison	**FY14 Total 12- Month Budget**
Personnel	$146,611	$178,100
Travel	$2,500	$2,500
Contractual	$42,000	$42,000
Commodities	$0	$0
Equipment	$0	$0
Subtotal	$191,111	$222,600
GA - 9%	$17,200	$20,034
Component Total	**$208,311**	**$242,634**

($34,323 more than FY13)

PERSONNEL - $178,100

- **ADOL** **$97,100**

Funds are for an RSA to cover salary costs for designated ADOL personnel (currently Jen Schorr and Lauri Adams) to provide legal oversight for habitat acquisitions, easements, timber rights, etc., and information to the public and Council regarding this program. This amount is an estimate of potentially needed services, payable by actual time billed.

- **ADNR** **$50,000**

Funds are for designated habitat personnel (currently Samantha Carroll) to oversee large and small parcel habitat acquisitions, easements, timber rights, etc., and provide information to the public and Council regarding this program.

- **DOI-FWS/DOI-BLM** **$31,000**

Funds provided to assist with habitat acquisitions, easements, timber rights, etc.

DOI-FWS	$25,000
DOI-BLM	$6,000
Total	$31,000

TRAVEL - $2,500

Funds for designated ADOL travel.

CONTRACTUAL - $42,000

- **PARCEL ACQUISITION** **$42,000**

Funds are provided in support of agency efforts to bring viable proposals to the Council for consideration. Expenses such as title review, hazmat review and survey review and similar expenses are appropriate due diligence efforts which may be undertaken by sponsoring agencies under this program. The budgeted due diligence expenditures under contractual services are those contracted out by the agency as most efficient and/or cost effective. The purchase of any interest in land requires additional Trustee Council review and approval.

ADNR	$40,000
DOI-BLM	$2,000
Total	$42,000

COMMODITIES - $0

EQUIPMENT - $0

AGENCY DISTRIBUTION

Habitat Cost Category	ADF&G	ADOL	ADNR	DOI-FWS	DOI-BLM	12-Month Total
Personnel	$0	$97,100	$50,000	$25,000	$6,000	$178,100
Travel	$2,500	$0	$0	$0	$0	$2,500
Contractual	$0	$0	$40,000	$0	$2,000	$42,000
Commodities	$0	$0	$0	$0	$0	$0
Equipment	$0	$0	$0	$0	$0	$0
Subtotal	$2,500	$97,100	$90,000	$25,000	$8,000	$222,600
GA - 9%	$225	$8,739	$8,100	$2,250	$720	$20,034
Component Total	$2,725	$105,839	$98,100	$27,250	$8,720	**$242,634**

TRUST AGENCY SUPPORT/PROJECT MANAGEMENT – $326,312

Cost Category	FY13 Total 12- Month Budget for Comparison	**FY14 Total 12- Month Budget**
Personnel	$272,945	$299,369
Travel	$0	$0
Contractual	$0	$0
Commodities	$0	$0
Equipment	$0	$0
Subtotal	$272,945	$299,369
GA - 9%	$24,565	$26,943
Component Total	**$297,510**	**$326,312**

($8,092 more than FY13)

PERSONNEL - $280,369

Project Management – USGS & NOAA - $134,000

Project Management funds to provide lead Trustee Agency staff with funds necessary to manage contracts and report on the status of projects; to facilitate communication between the agencies, Principal Investigators, and the Restoration Office; to assist with the annual financial audit; and perform other administrative functions necessary for implementation of projects authorized by the Trustee Council. Project management funds are also included below for management of multi-year projects that have been previously authorized.

DOI/USGS – Dede Bohn or other USGS staff	$54,000
NOAA – Pete Hagen, Shawn Carey, or other NOAA staff	$80,000
TOTAL	**$134,000**

Project Management: ADF&G Herring Program Coordinator - $70,000

This funding provides for 70% of an ADF&G Fisheries Specialist I to coordinate with the Council's Herring program. This position will provide review and feedback to the Council and work with the Program to ensure coordination and relevancy with ADF&G resource management and Council goals.

ADF&G – Sherri Dressel or other ADF&G staff	$70,000
TOTAL	**$70,000**

Project Management- USFS - $15,000

This funding provides for administration of the issuance of special use permits for EVOSTC projects on Chugach National Forest lands and USFS staff to support Trustee Council activities. It includes the environmental assessment and tribal consultation work needed to issue special use permits related to EVOSTC projects within Prince William Sound. These funds also include development of the Minimum Guidance documents related to projects within the Prince William Sound Wilderness Study area.

DOI/USFS – Carole Jorgensen or other USFS staff	$34,000
TOTAL	**$34,000**

Trustee Council Staff Support - $61,369

Trustee Council Staff Support funds to cover staff costs related to preparing for, communicating with and representation of the Trustee Agency at EVOSTC sponsored meetings or when participating in EVOSTC program activities, and providing future program direction, unless waived by the agency

ADF&G – Tom Brookover or other ADF&G staff	$10,000
USFS – Carole Jorgensen or other USFS staff	$9,000
NOAA – Agency Support Staff – to be determined	$10,000
DOI /FWS – Veronica Varela or other FWS staff	$9,400
DOI/SEC – Federal Budget Officer – Bruce Nesslage	$22,969
TOTAL	**$61,369**

TRAVEL - $0

CONTRACTUAL - $0

EQUIPMENT - $0

AGENCY DISTRIBUTION:

Agency Support Cost Category	ADEC	ADF&G	ADNR	DOI/USGS	USFS	NOAA	FWS	DOI/SEC	12-Month Total
Personnel	$0	$80,000	$0	$54,000	$43,000	$90,000	$9,400	$22,969	$299,369
Travel	$0	$0	$0	$0	$0	$0	$0	$0	$0
Contractual	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commodities	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$80,000	$0	$54,000	$43,000	$90,000	$9,400	$22,969	$299,369
GA - 9%	$0	$7,200	$0	$4,860	$3,870	$8,100	$846	$2,067	$26,943
Component Total	$0	$87,200	$0	$58,860	$46,870	$98,100	$10,246	$25,036	**$326,312**

ALASKA RESOURCES LIBRARY & INFORMATION SERVICES – $118,304 (ARLIS)

Cost Category	FY13 Total 12- Month Budget for Comparison	**FY14 Total 12- Month Budget**
Personnel	$69,180	$108,536
Travel	$0	$0
Contractual	$0	$0
Commodities	$0	$0
Equipment	$0	$0
Subtotal	$69,180	$108,536
GA - 9%	$6,226	$9,768
Component Total	**$75,406**	**$118,304**

($42,898 more than FY13 due to digitization)

PERSONNEL – $108,536

Position	Range/Step	Months	Monthly Cost	12-Month Cost
Librarian III – Carrie Holba	19/N	6	$11,606	$69,636
Personnel Total			$11,606	$69,636

Cost is with benefits. 12-month allocation split between ARLIS/Admin

Funding provides one .50 FTE librarian to meet the ongoing information and research needs of the Trustee Council staff, Public Advisory Committee, researchers, and the general public; manage the EVOS collection at ARLIS; and represent the Trustee Council on the ARLIS Management Team.

Phase II ARLIS EVOSTC Document Digitization Services **$38,900**

TRAVEL – $0

CONTRACTUAL – $0

COMMODITIES – $0

EQUIPMENT – $0

AGENCY DISTRIBUTION:

ARLIS Cost Category	ADF&G 12-Month Total
Personnel	$108,536
Travel	$0
Contractual	$0
Commodities	$0
Equipment	$0
Subtotal	$108,536
GA - 9%	$9,768
Component Total	**$118,304**

Document Digitizing

EVOSTC Document Digitizing Project

Phase 2:

EVOSTC Project Files
and
Chief Scientist Project Files

August 30, 2013

PROPOSAL SUMMARY

Phase 1: nearing completion: This project was funded by the Council in February of this year to digitize select EVOSTC files for ease of retrieval, to facilitate web access where appropriate, save future storage/office space and expense, and ensure long-term preservation of information. To address EVOSTC records, ARLIS initially recommended digitizing EVOSTC collections which are public, complete and previously organized.

Phase 1 of the project, approved by the Trustee Council on February 21, 2013, focused on digitizing the administrative records of the Restoration Planning Work Group (RPWG) and Restoration Plan Final Environmental Impact Statement (FEIS). This project is nearing completion well ahead of schedule.

Proposed Phase 2: The EVOSTC staff had planned to focus Phase 2 on the EVOSTC Official Record; however, recent work by the National Center for Ecological Analysis and Synthesis (NCEAS) identified the need to consolidate project information, which is currently a mix of paper and digital formats. When the EVOSTC project database was created in 2005, subsequent projects were entered into the database. Some digital conversion was done for older projects, however, gaps remain. In addition, the paper files contain documents, such as correspondence documenting the administration of projects, letters of support, and publicity, which the project database cannot currently accommodate. Staff must check the database plus two sets of paper files, the EVOSTC Project Files 1991-2009 and the Chief Scientist Project Files 1992-2002, to ensure that information retrieval on older projects is complete. Phase 2 proposes to digitize the project files, as the first step in consolidating the project information into one location. Additional database work will be needed to complete the consolidation. Digitizing the EVOSTC Official Record and other document collections will be addressed in subsequent digitizing proposals.

PROPOSAL DETAILS

Background: Alaska Resources Library and Information Services (ARLIS, www.arlis.org), is a special library focusing on the natural and cultural resources of Alaska and arctic areas. Established in 1997 and located on the campus of the University of Alaska Anchorage, ARLIS is an innovative partnership of state, federal and university entities whose primary purpose is to meet the information needs of its founding agencies: the Alaska Department of Fish and Game, *Exxon Valdez* Oil Spill Trustee Council, U.S. Bureau of Land Management, U.S. Bureau of Ocean Energy Management, U.S. Fish and Wildlife Service, U.S. National Park Service, U.S. Geological Survey and University of Alaska Anchorage. ARLIS is open to the public and also serves the university community, non-profits and the private sector. ARLIS is directed by the ARLIS Management Team, which is responsible to the ARLIS Founders Board. The Board consists of representatives from the above founding agencies.

ARLIS serves as the EVOSTC repository for EVOS-related materials and has housed this collection since the Trustee Council's Oil Spill Public Information Center became part of ARLIS in 1997. ARLIS also maintains the EVOSTC Public Record and public versions of the administrative records of the Restoration Planning Work Group (RPWG) and Restoration Plan Final Environmental Impact Statement (FEIS).

Phase 2 Proposed Scope: Phase 2 of the project will digitize the EVOSTC Project Files and the Chief Scientist Project Files. The final deliverable will be a collection of searchable full-text digital versions of the documents contained in these files. The digitized documents will be provided to the EVOSTC office and added to the intranet by EVOSTC staff or associated IT staff. The documents will be searchable in-house via the Google Search Box. The documents are not publicly available, as they contain peer review comments and other confidential information; however, EVOSTC staff use the files to respond to questions pertaining to the projects, and electronic files will reduce response time and ensure a complete response.

EVOSTC Project Files: Volume – 35 boxes, 561 inches, 112,200 pages. The EVOSTC Project Files document the administration of projects related to natural resource damage assessment, restoration, and GEM programs. Housed in eight four-drawer file cabinets, this file collection is largely letter- and legal-sized papers in folders or binders, with some documents contained with staples, clips, or rubber bands. Some items have comb or glue bindings. The collection contains some handwritten notes.

Chief Scientist Project Files: Volume – 52 boxes, 840 inches, 168,000 pages. The Chief Scientist Project Files document the scientific review of projects associated with natural resource damage assessment, restoration, and GEM programs. Housed in ten four-drawer file cabinets, this collection is largely letter-sized papers in folders, with some documents contained with staples, clips or rubber bands. Some items have comb or glue bindings. The collection contains some handwritten notes.

Total: 87 boxes, 1,401 inches, 280,200 pages

Process: Scanning will be done from originals to ensure image quality and collection completeness. Non-print items, such as audio or video tapes, CDs or DVDs, and documents protected by copyright will not be scanned, but will be noted with an entry that will refer the user to a source for the item. Metadata will be created as needed for handwritten documents. Boxes of documents will be sent to ARLIS and returned to the EVOSTC office in batches.

EVOSTC staff will:

- Provide ARLIS with a copy of the project number format which has changed over the years.
- Review the files to identify bound items without marginalia that have already been scanned.
- Provide extra copies of bound items without marginalia, as available, that will not require reassembly after scanning.
- Identify items protected by copyright that will not be scanned, and provide citations for these items, to be included in the digital collection.
- Box the files, label the boxes, and route them to ARLIS in batches via the UAA courier.
- Unbox and re-file the documents after scanning.
- After delivery of the digital documents, add the files to the EVOSTC intranet.

ARLIS staff will:

- Prepare the documents for scanning, including removing staples, other fasteners, and/or bindings.
- Scan each project file into a separate electronic file.
- Apply Optical Character Recognition (OCR) software to each file for searchability.
- Provide each file with an appropriate file name that indicates the file collection and includes the project number.
- Create metadata for handwritten documents, as needed.
- Provide quality assurance by reviewing each file for image quality and OCR.
- Return each document to the original folder or binder, and re-fasten to pre-scanning condition.
- Return the folders and binders to the appropriate box and return the boxes to the EVOSTC office via the UAA courier.
- Deliver the digital documents to the EVOSTC office.

Final Deliverable: The final deliverable of the Phase 2 project will be a collection of searchable full-text digital versions of the documents contained in the EVOSTC Project Files and the Chief Scientist Project Files. The digitized documents will be provided to the EVOSTC office and added to the intranet by EVOSTC staff or associated IT staff. The documents will be searchable in-house via the Google Search Box.

Timeline: Due to the EVOSTC funding cycle and ARLIS's workload with several current scanning projects, this project will begin after February 1, 2014 and be completed by January 31, 2015. The bulk of the work will be done by student workers, whose schedules tend to vary.

BUDGET

Staff	Tasks	Cost	Funding
Student labor	EVOSTC Project Files – 35 boxes – Prep, scan, return documents to pre-scanning condition, QA, create metadata as needed, and file transfer Chief Scientist Project Files – 52 boxes – Prep, scan, return documents to pre-scanning condition, QA, create metadata as needed, and file transfer	$300 per box	$10,500 $15,600
Librarian	Oversee the project	200 hours at $64/hour	$12,800
	Total		$38,900

Habitat Appraisal
Instructions

Exxon Valdez Oil Spill Trustee Council

4210 University Drive • Anchorage, AK 99508-4626 • (907) 278-8012 • fax (907) 276-7178

Exxon Valdez Oil Spill Trustee Council

Habitat Protection Program

Appraisal Instructions

Update approved by EVOSTC October 28, 2013

UNLESS SPECIFICALLY STATED OTHERWISE, THE FOLLOWING SPECIFICATIONS APPLY TO BOTH FEE SIMPLE LAND APPRAISALS AND PARTIAL ESTATE INTEREST APPRAISALS.

This appraisal instruction update supersedes the EVOSTC appraisal instructions dated April 21, 1994 and supplemental instruction letter from J. Robinson dated September 12, 2002.

GENERAL SPECIFICATIONS

A. Copies of Appraisal Report: The Contractor shall furnish all materials, supplies, tools, equipment, personnel, travel and shall complete all requirements of this contract including performance of the professional services listed herein.

1. Contractor to provide three hard copies of the Draft Appraisal Report, submitted in a three ring loose-leaf binder.

2. The Contractor will furnish one original and three hard copies and a cd with an electronic copy of the final Appraisal Report.

3. The report shall provide an estimate of cash fair market value for the fee simple estate free of all assessments, and shall conform to the Uniform Standards of Professional Appraisal Practice (USPAP) as published by The Appraisal Foundation, and the Uniform Appraisal Standards for Federal Land Acquisitions, 2000 Edition, (ISBN 0-922154-66-X) (UASFLA).

4. The Narrative Appraisal Report shall conform to recognized appraisal format, principles, and practices applicable to estimating cash fair market value, as required in the UASFLA.

B. Narrative Appraisal Report: The Contractor shall make a detailed field inspection and identification of the item(s) of property as specified in the Task Order, and shall make such investigations and studies as are appropriate and necessary to enable the Contractor to derive sound conclusions and to prepare the appraisal report.

C. Examination Notice: The Contractor shall provide the property owner and the governmental representative a minimum of ten (10) days advance notice of the examination date and shall give the owner, or his/her designated representative, and the Government an opportunity to accompany the Contractor during their inspection of the property. These notices shall be documented in the Contractor's transmittal letter of the appraisal report. The Contractor shall certify that the signature of the report has personally visited the subject property(s) and all of the comparable transactions used in the comparative analysis.

D. Testimony: Upon the request of the United States Attorney of the Department of Justice, or the Alaska Attorney General, the Contractor shall testify in any proceedings, as the value as of the valuation date of any and all property included in the appraisal report.

E. Estate to be Appraised: Applicable to partial estate interest appraisal only.

   1. When a partial estate interest is appraised, it will conform to UASFLA and will incorporate a before and after appraisal meeting agency standards as described in the Task Order.

   2. After the market value of the fee estate has been determined, the appraiser may be requested to determine the contributory value of the various estates. The contributory value of the various estates must equal the market value of the fee estate.

TECHNICAL SPECIFICATIONS

APPRAISAL REPORT

A. Format: The final report shall be typewritten on bond paper sized 8 ½ by 11 inches with all parts of the report legible and shall be bound with a durable cover and labeled on the face. The label will identify the appraised property, the contract number, appraiser's name and address, and the date of the appraisal. All pages of the report, including the exhibits, shall be numbered.

B. Contents: The report shall be divided into tabulated parts:

Part I - Introduction
Part II - Factual Data
Part III - Analyses and Conclusions
Part IV - Addenda

The content of the report shall, as a minimum, contain the following:

1. INTRODUCTION (Part I)

   a. Title Page shall include (1) the borough name(s) and general location(s) of the property; (2) that the appraisal is for the lead government agency identified in the Task Order; (3) name and address of individual and the firm or corporation making the appraisal report; (4) the report data.

   b. Table of Contents shall be arranged in accordance with the sequence of topical headings with corresponding page numbers.

   c. Summary of Facts and Conclusions shall be a brief resume of the essential highlights of the report in order to offer a convenient reference to basic facts and conclusions. Items which shall be included are (1) name of project and requesting government agency; (2) owner of record; (3) location of legal description; (4) name of appraiser; (5) dates of field work; (6) date of inspection; (7) effective date of appraisal; (8) interest under appraisement; (9) size; (10) highest and best use; (11) appraised values.

   d. Statement of Assumptions and Limiting Conditions: The Contractor shall include in the report a statement of assumptions and limiting conditions related to the appraisal of the property.

   e. References: The Contractor shall list the sources of data incorporated in the report, such as records, documents, technicians, or other persons consulted along with a statement of their qualifications and identification of their contribution to the report.

2. FACTUAL DATA (Part II)

   a. Scope of estate to be appraised

      1. Purpose of Appraisal for Partial Estate Interest Appraisal: The Contractor shall state that the purpose is to estimate total compensation for the estate to be acquired considering damages and/or benefits to the remainder. It shall include the function of the appraisal and a description of the estates appraised in both the before and after conditions.

      2. Purpose of Appraisal for Fee Simple Land Appraisal: The Contractor shall state that the purpose is to estimate fair marker value for the property. It shall include the function of the appraisal, and a definition of all values required and property rights appraised.

b. Definition of Fair Market Value: The definition is that as described in the UASFLA and expanded upon in USPAP.

c. Estate Appraised: Describe the Estate to be appraised and the legal description of the subject property.

d. Area and Neighborhood Data: The report shall include a concise discussion of market area, trends in use, and neighborhood and area analysis. This data (social, economic, and political) shall provide the basic information that directly affects the value of the property being appraised.

e. Property Data: The report shall include a narrative description of significant land features and all improvements. This section shall show the availability and suitability or adaptability of the property for the highest and best use. The property data shall include, as a minimum the following:

   1. A description of the land, giving dimensions, size, shape, access status and characteristics, land types, topography, timber, livestock forage, mineral character, and other characteristics that might affect value. If there is an indication that timber or mineral deposits have commercial value, this should be stated If part of the property is assigned higher value than other portions, prepare a map delineating the various land classes.

   2. A discussion of outstanding rights or possessory interests (easements, permits, leases, adverse possession, etc.) describing the type, area, condition, terms, rates and their effect on value.

   3. A description of all improvements, a discussion of each with reference to its physical condition, present use, obsolescence, and its contribution to the highest and best use.

   4. A statement of the current assessed value and dollar amount of property taxes and discussion of their effect on value

   5. A description of the zoning and other restrictions for the subject property and discussion of their effect on value.

   6. A discussion of the effect on value of reservations and covenants described in the estate.

   7. Distinguish between any real property and personal property values.

   8. A discussion of any environmentally threatening factors that may affect the property such as toxic waste, physical hazards, or noxious materials.

3. ANALYSES AND CONCLUSIONS (Part III)

a. Analyses of Highest and Best Use: State the highest and best use or combination of uses that can be made of the property (land and improvements) for which there is a current private open market. Give evidence of the demand for such use. If the highest and best use is different than the present use, discuss how the property is available, suitable, adaptable, and in demand for the new use. Be cautious in identifying highly speculative uses that are contingent on occurrences that are not demonstrated in the marketplace within which the subject might compete. Investment for profit or speculation in and of themselves are not acceptable highest and best uses without the identification of the physical interim use and future use that is being anticipated. Highest and best use cannot be predicated on a demand created solely by the project for which the property is acquired (e.g., rock quarry, when the only market is a highway project for which the property was acquired). A proposed highest and best use cannot be the use for which the government is acquiring the property (e.g., missile test range, airfield, park), unless there is a prospect and demand for that use by others than the government.

b. Data Analysis: This section, divided into topical headings, shall contain the appraiser's discussion and analysis of market trends and elements of value. The text may refer to factual data included in the Addenda to the report.

   The appraiser shall specifically state their conclusion, the factual data calculations, and the process of reasoning that led to that conclusion.

The following items, as a minimum, shall be discussed in this section:

1. Cash Versus Contract Sales: All value estimates made in the appraisal report will be on the basis of cash or cash equivalence. The effect of financing on market value will be considered and the conclusions documented in this section. Cash equivalent is defined as: the price that would have been in effect, had the terms been all cash.

2. Price-time Trends.

3. Physical Characteristics: The effect on value of elements such as size, location, access characteristics and status, road or highway frontage, restrictive covenants, zoning, utilities, view, vegetative cover, water frontage, mineral character and potential, and other elements of value as demonstrated in the market will be explored and analyzed.

c. Estimate of Value: The appraiser's estimates of value shall be developed in a logical sequence using accepted approaches to value supported by confirmed factual data.

1. Approaches to Value: Value shall be based upon the properties' highest and best use, which may differ from present use, and shall be supported by confirmed transactions of comparable lands having similar highest and best uses. In all cases, the three approaches to value (cost, income, and direct sales comparison) shall be considered, and used, if applicable. At a minimum, the appraisal report shall contain a direct sales comparison approach which analyzes and compares the subject to all appropriate comparable sales, ending in a subject property value indication based on each sale. All such direct comparison indications shall then be correlated to a final estimate of value.

2. Comparable Sales: The appraiser shall personally visit, investigate, list in the report, and be prepared to testify with respect to all sales which may be pertinent to the valuation of the subject. The sales considered and not actually used by the appraiser shall be listed in a table in the Addenda. This list shall cite pertinent facts such as date, size, buyer and seller, price, terms, location, etc., and include a remark as to why each sale was not used in the estimate of value. All comparable sales used in the valuation discussion shall meet the test of market value. All transactions used shall be verified with parties knowledgeable of the sale, (grantor, grantee, and broker). Include date of confirmation, the name of the party with whom the sale was confirmed, and the name of the person confirming the sale.

   The appraiser shall examine all prices and terms of comparable sales as to their equivalency to cash. Where comparable sales prices are adjusted because of terms or for other reasons, the amount of the adjustment shall be supported by the presentation of factual evidence and the appraiser's reasoning.

   The sale price of comparable sales used in this appraisal report shall be adjusted for appreciation or depreciation, if any, for the period of time between the sale date and the valuation date (Market condition). The amount of the adjustment shall be clearly stated. The basis for the adjustment in the form of an analysis of available pertinent market evidence shall be presented. Sales and resales of unaltered properties similar to the comparables and in the same market area are preferred indicators of market condition. To be useful, such sales and resales must have occurred during the approximate period for which other comparables are being adjusted. Raw statistics on broad classes of property and covering large geographic areas will not suffice as a basis for the above described adjustments.

When using the direct sales comparison approach, the appraiser shall, for each sale listed, discuss: parties to the transaction, date of the transaction, acreage, legal description of the property, interest conveyed, consideration, conditions of payment (cash or terms—contract sales will be discussed and conclusions made as to their cash equivalence), improvements (kind and whether they contribute to the highest and best use), personal property, any outstanding rights and reservations and their effect on value, and physical description—topography, cover, etc. Each comparable site should be described in narrative form in sufficient detail to indicate how it compares to the subject property in elements affecting value. Buyer and seller motivation of the comparable transaction must be discussed. The potential for development as of the date of purchase shall be explored and presented.

When adjustments are made to comparable sales, the basis for the adjustments shall be shown in sufficient detail and supported by all available market evidence to allow the reviewer to judge their validity and acceptability. The data will be presented in narrative form as well as in comparison grids or tables. When the value of the subject property and comparables are highly similar, lump sum adjustments are acceptable, although the elements of dissimilarity affecting value shall be listed. If quantified adjustments are made, they shall be directly supported by verified market evidence.

3. In the direct sales comparison approach, the last sale of the subject property shall be listed. If it is a valid sale, it shall be qualified and given appropriate consideration in the value conclusion.

4. In the income and cost approaches, all cost and income estimates shall be supported by comparative costs or rental data for similar properties. The methods used to determine capitalization rates, accrued depreciations, and depreciation rates shall be discussed and computations and comparisons shown. Comparison charts (such as rental comparisons, construction cost comparisons, etc.) shall be developed where feasible.

Items 5 through 8 below are applicable <u>only to partial estate interest</u> appraisals:

5. In accordance with established legal principles and procedures, the before value of the property shall be estimated as of the date of the appraisal

without allowance of enhancement and/or diminution in value due to the project.

6. In the before acquisition appraisal, sales occurring after the date of the project shall be used in estimating value only if there is no project-related enhancement and/or diminution. In the after acquisition appraisal, applicable sales occurring up to the date of the appraisal shall be used with full consideration given to the effects of the acquisition and the project in the estimate of value.

7. In the after acquisition appraisal, the estimate of value shall be developed by comparison with sales of properties encumbered by similar easements. If this cannot be done, the appraiser shall develop the estimate by direct comparison or other use of sales which give evidence of the value attributable to the subject's utility in its encumbered state.

8. The after acquisition appraisal shall, as a minimum, contain the following:

    a. A brief description of the partial estate interest acquired.

    b. A description of the property rights acquired and a discussion of all the restrictions on the grantor and effect, if any, on the value of the subject.

    c. A discussion of the appraiser's interpretation of the property rights acquired.

    d. A comprehensive description of the remainder in the after acquiring condition.

    e. A discussion of the effect of the acquiring and the project on the remainder, showing highest and best use in the after condition and describing how benefits or damages occur.

d. <u>Correlation and Final Value Estimate.</u> The appraiser shall interpret the foregoing estimate and shall state his/her reasons why one or more of the conclusions reached in the estimate of value section are the best indicators of market value of the subject. The indicated value estimates derived through more than one approach to value will be correlated to reach the final estimate of value. If only the direct sales comparison approach is used, the indications given by the various sales will be correlated to reach the final estimate showing which sale or sales were considered most comparable and provided the best value indicators. Where the "before and after" method is used to estimate just compensation, separate correlations are needed for the "before estimate" and the "after estimate".

The following item is applicable to partial estate interest appraisals only:

e. Estimate of Total Compensation: The appraiser's estimate of total compensation shall be derived as the difference between the estimated market value before the acquiring and the estimated market value of the property after the acquiring and as affected by the project. The method automatically takes into account diminution in value of and any benefits to the remainder.

This shall be shown as follows:

Value Before $______________

Value After $______________

Estimate of Just Compensation $______________

The estimate of just compensation shall be summarized as follows:

Value of Part Acquired $______________

Damages $______________

Benefits $______________

Estimated Total Just Compensation $______________

The sum of the value of the part acquired and damages, less the benefits, must equal the difference between the before and after values.

f. A Certification Statement will be included that is consistent with USPAP and UASFLA.

4. ADDENDA (Part IV)

All maps shall be originals of high quality with properties depicted in color (i.e. subject – red; comparable – green). They shall be of sufficient detail, with legend, scale, and North arrow, in order that properties may be readily located on the ground using the maps.

The addenda shall include:

a. Area map: Small-scale map showing the general location of the subject neighborhood.

b. Neighborhood Map: Shall show the subject property and its immediate vicinity. The area and the neighborhood maps may be combined if appropriate.

c. Subject Property Map or Plat: A large scale map that clearly shows the dimensions and topography of the subject property.

d. Comparable Sales Location Map: This shall show the location of sales used in estimating market value of the subject property in relationship to the subject.

e. Comparable Sales Form: For all transactions used in the appraisal, show all of the pertinent information concerning each comparable. At a minimum, each verification will display the names of the state and geographic location, recording district, community area, grantor, grantee, estate purchased, instrument, tax parcel number, book/page, date, size, price, unit access, utilities, zoning, highest and best use, current use, improvements, vegetation, topography, and soils. There should also be a remarks section.

f. Full legal description of subject property as presented in the preliminary title report.

g. Statement of the date(s) the subject property was inspected with the property owner or its representative and the governmental representative (or a state that the property owner or the governmental representative(s) was invited but declined to accompany appraiser on the inspection).

h Photographs: The Contractor shall provide representative original color photographs of the subject property and all comparables in each copy of the final report. Photographs may be provided as a separate exhibit in the addenda or included along with the narrative description of the subject property and sales. The following information shall be shown with each photograph:

Identification of scene in photograph (direction of view, etc.). The direction of view may be indicated on a map. If the photograph was taken from a distance such as an aerial of high vantage point, the approximate property boundaries must be clearly shown on the photograph. The boundaries of an area being appraised must be identified on one or more photographs of the subject, as appropriate.

a. The name of the individual taking the photograph.

b. The date the photograph was taken.

1. Other Material – the appraiser shall include all other pertinent documents provided by the Contracting Officer or representative, plus appropriate charts, maps, etc.

2. Qualifications of Appraiser – The qualifications of the appraiser shall be included in the report as evidence that the responsible person is qualified to make such an appraisal.

Great Land Trust
(GLT) Proposal

GREAT LAND TRUST
SOUTHCENTRAL ALASKA

Working with willing landowners and other partners to conserve Southcentral Alaska's lands and waterways.

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ACCREDITED
LAND TRUST ACCREDITATION COMMISSION

September 1, 2013
GLT Proposal for PAC

public

approved

EVOSTC Great Land Trust Spill Area Ecosystem Habitat Conservation Project
YEARS 2 & 3

Project Summary

Great Land Trust (GLT) requests funding from the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) Habitat Acquisition Fund to continue work on up to five conservation projects that will implement habitat conservation actions to aid in the recovery and enhancement of the long term health and viability of those resources injured by the *Exxon Valdez* oil spill (EVOS) and spill area ecosystems. GLT will carry out this work over a multi-year period. Beginning in 2013, the first year of the project, GLT focused on the Kodiak Afognak Archipelago area; the scope will broaden to include all of the spill area in 2014, the second year of the project. Using a land conservation prioritization that GLT developed specifically for the Kodiak Afognak Archipelago, we identified multiple high ranking conservation projects and have begun due diligence and negotiations with landowners on six of the highest ranking projects. During Years 2 and 3, GLT will expand the land conservation prioritization to include the entire spill area and will continue due diligence and negotiations.

GLT will work closely with EVOSTC, United States Fish and Wildlife Service (USFWS), and the Alaska Departments of Natural Resources and Law in order to complete these projects. GLT will actively seek significant grant funding from other sources to compliment EVOS funding to carry out the top projects. Of the projects developed, we intend to complete or make substantial progress on at least two or three large-scale (greater than 1,000 acres) conservation projects with landowners on Kodiak Afognak Archipelago during Years 2 and 3.

Project Narrative

Statement of Need

This project seeks to contribute to the objectives of the EVOSTC to aid in the recovery and enhancement of the long term health and viability of the resources injured by the EVOS. This project will seek to acquire priority lands within the EVOS area and increase the capacity of the existing, established EVOS habitat program.

This proposal will provide funding for Years 2 and 3 of a multi-year project.

GLT has completed significant projects with a wide range of partners including the Municipality of Anchorage, the Mat-Su Borough, State of Alaska Department of Fish and Game, State of Alaska Department of Natural Resources and State Parks, USFWS, Army Corps of Engineers, NOAA, Alaska Native Corporations, Ducks Unlimited, Pacific Coast Joint Venture and numerous private businesses and landowners. GLT has experience raising and managing significant public and private funding, having completed nearly $14 million in conservation projects over the last 24 months GLT also has extensive experience with mitigation funding, having operated an In-lieu Fee program under a Memorandum of Understanding with the Army Corps of Engineers since 1998. As part of this program, GLT has completed 9 conservation projects and received hundreds of payments totaling over $12 million. Two recent projects are described below.

The Campbell Creek Estuary Conservation Project:
GLT succeeded in raising $7.5 million dollars to purchase and conserve Campbell Creek Estuary, the last undeveloped estuary of the original seven salmon streams in Anchorage. GLT worked with the Municipality of Anchorage and many other partners for three years to raise funds to purchase the 60-acre parcel and donate it to the Municipality as a new Natural Area; GLT retained a conservation easement. The Project conserved ½ mile of Campbell Creek's lower reaches including the Estuary and its critical tidal marsh habitat as well as 25 acres of coastal forest. This parcel also provides access to the Anchorage Coastal Wildlife Refuge. Project funding included dollars to clean up the property, develop a park plan, create a modest trailhead and gravel trails, as well as monitor and address the conservation needs of the property annually.

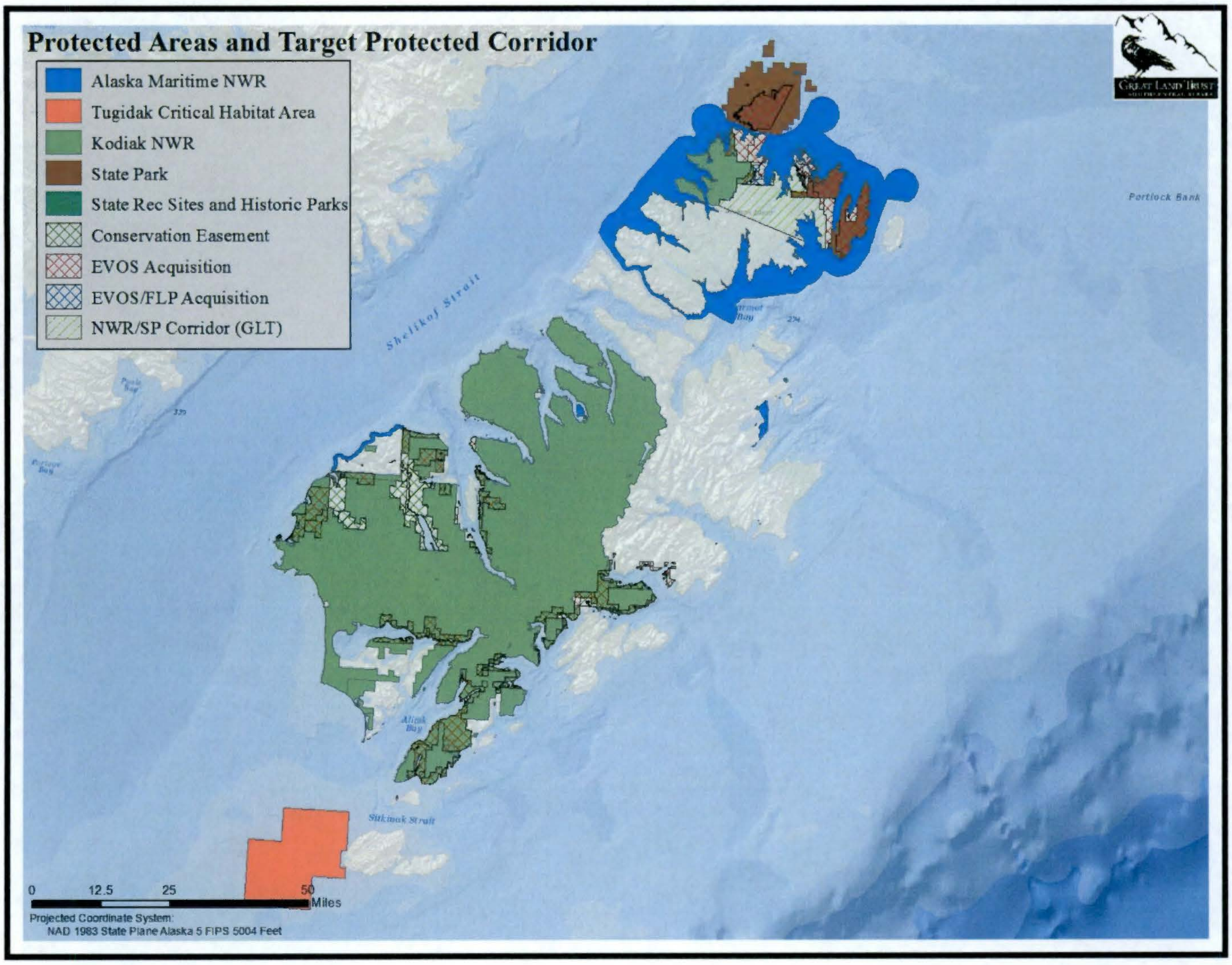
Knik Islands Conservation Project:
The Knik Islands Conservation Project was completed in the fall of 2011 as a partnership between GLT and Eklutna, Inc. The project permanently conserves nearly 4800 acres at the mouth of the Knik and Matanuska Rivers with a conservation easement. This land will remain under the ownership of Eklutna, Inc. and traditional uses such as hunting and fishing by Shareholders, and public access through permits, will continue. This property contains excellent habitat for all five species of salmon in Cook Inlet as well as many other wildlife species. In addition, the property provides a wildlife and recreational corridor between Palmer Hay Flats State Game Refuge and Chugach State Park. Scenic views of the property are well known by travelers crossing the Knik River Bridge on the Glenn Highway. This project was made possible through a collaborative effort with the Mat-Su Salmon Partnership, USFWS, the Army Corps of Engineers, NOAA Fisheries, Alaska Department of Fish and Game, and CIRI. Funding for this conservation easement was made possible through resources set aside to offset habitat losses associated with the expansion of the Port of Anchorage.

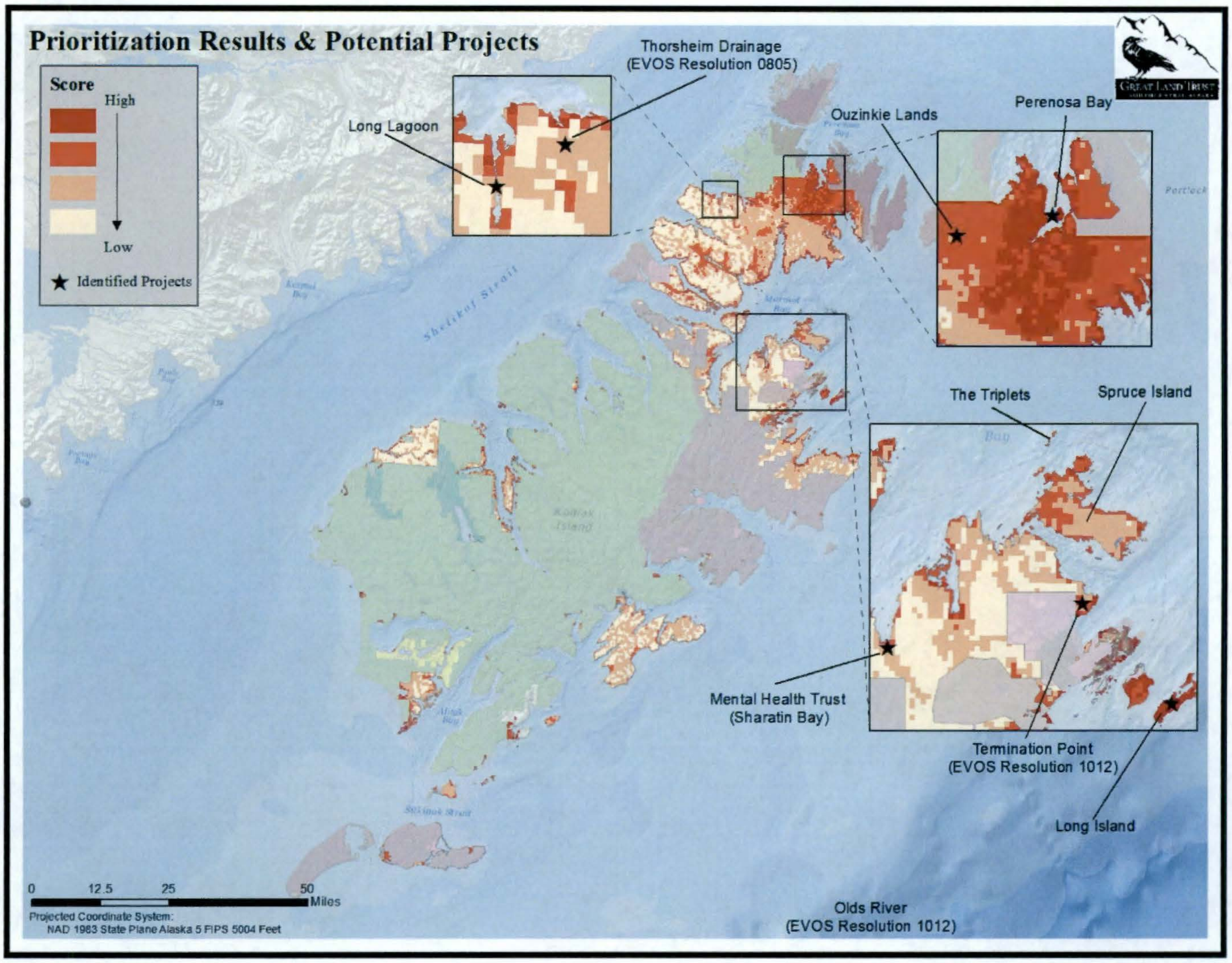
Update on 2013 Project Accomplishments

This 2014 proposal will fund Year 2 of a multi-year project. During Year 1 GLT accomplished numerous tasks from our list of deliverables for the grant. Using data from the Kodiak prioritization completed early in 2013, GLT staff met numerous times with key landowners, both in Kodiak and here in Anchorage. Landowners included multiple Native corporations, as well as the Kodiak Borough Mayor, Manager and staff from Mental Health Land Trust Office. In addition, GLT met multiple times with the realty staff at USFWS as well as Kodiak Refuge staff and numerous Fish and Game staff in Kodiak. GLT staff met with Kodiak Soil and Water Conservation District staff and staff at both Rep. Austerman's and Sen. Steven's Offices. GLT met with Alaska State Parks staff several times and consulted with staff at NOAA and The Conservation Fund regarding conservation projects on Kodiak. In gathering data for the prioritization we consulted with additional staff including individuals from Kodiak Island Borough, Koncor, Pacific Coast Joint Venture, Audubon Alaska and the others mentioned above.

During the grant period GLT made site visits to numerous properties and were accompanied by staff from Alaska State Parks and Alaska Department of Law in addition to representatives from the landowners on several visits.

Great Land Trust has also applied for matching funding from USFWS and is working with the Conservation Fund to coordinate the use of the mitigation funds available from the Kodiak airport expansion.





Project Goals and Objectives

GLT seeks to continue to permanently conserve important habitat in the EVOS-affected area with the acquisition of fee title properties of high conservation value. GLT will continue to implement a multi-year project by expanding the Kodiak Archipelago conservation prioritization to include the entire spill area. GLT will continue negotiations and due diligence for high priority projects identified in the Kodiak Prioritization and will contact landowners of parcels with high ranking conservation value in the entire spill area to determine their interest in habitat conservation. During the period of performance for this grant, GLT will develop up to 5 large acquisition projects within the EVOS area. GLT will contract a phased appraisal (described below) of the highest ranking parcels with willing landowners. GLT will seek matching funds for projects appropriate for EVOS funding, and working closely with partners, will complete or make substantial progress on at least 2-3 large scale conservation projects within the grant period.

Project Activities, Methods and Timetable

Funding Compliance

GLT intends to adhere to the following conditions regarding project methodology. The following conditions are from Resolution 13-03 of the EVOSTC:

a. The funds are to be used by GLT, as described in the Proposal, to facilitate the acquisition of lands and interests in lands (e g., fee title, conservation easements, mineral rights, timber rights) important to the conservation and protection of marine and coastal resources, ecosystems, and habitats in order to aid in the overall recovery of, and to enhance the long-term health and viability of, those resources injured by the *Exxon Valdez* oil spill and the spill-area ecosystems;

b. GLT shall pursue parcels only from willing sellers and the sellers shall complete the relevant Council nomination form;

c. GLT shall pursue protection, including identification, appraisal, commitments and approvals, of any specific parcel only after consultation and agreement by the entities that would own or manage the interests in the parcel and with the U.S. Fish and Wildlife Service (USFWS). Alaska Department of Natural Resources (ADNR), and the Alaska Department of Law (ADOL);

d. GLT shall ensure that any entity which would own or manage the interests in the parcel, as well as USFWS, ADNR, and ADOL, shall review and approve all conveyance documents and required actions, such as determining the required appraisal instructions, environmental reviews and site visits;

e. GLT shall submit quarterly updates to ADNR, ADOL and the EVOSTC Executive Director in addition to the semi-annual reports it submits to the USFWS, as per the USFWS reporting schedule, and shall ensure the reports convey the information needed by USFWS, ADNR, ADOL and EVOSTC.

f. GLT shall acquire parcels only after unanimous approval of the Council; the approval process shall include reasonable and adequate public notice about the proposed acquisition and an opportunity for public comment.

Great Land Trust proposes to carry out the project objectives in the EVOS area through a multi-step process:

1. Project Identification

GLT will use a recently completed conservation prioritization for the entire Kodiak archipelago, funded by the USFWS Coastal Program, to identify habitat with the highest conservation value (see "Prioritization Results & Potential Projects" map). GLT will create a new conservation prioritization for the entire spill area to identify habitat with the highest conservation value. These prioritizations incorporate the latest information on land ownership including all projects previously completed with EVOS funding. All unprotected private lands, in addition to State lands owned by Mental Health Trust, are ranked for their conservation value. The prioritization includes current bird distribution data for all special status species as well as subwatershed rankings for anadromous fish diversity throughout the Kodiak archipelago. GLT will continue to obtain feedback on the prioritizations from EVOS Trustees, staff, USFWS, ADFG, ADNR, ADOL, and other key landowners and government officials.

2. Landowner Contact

GLT will contact the landowners of high-ranking parcels to determine their willingness to sell fee simple or a conservation easement. This will also include discussions with the landowners regarding acreage and parcel configuration, timelines, and due diligence. GLT will meet frequently with agency and EVOSTC staff during this phase of the project to get feedback on the projects that seem to have the most promise.

3. **Appraisal**
GLT will contract a phased appraisal of the highest ranking parcels with willing landowners based on the meetings conducted in step two. The first phase of the appraisal will include a meeting with the appraiser after research has been conducted by the appraiser. The appraiser will report the expected high and low range of values for the value of the property. A full appraisal will be completed only if the initial range of values is acceptable to both the buyer and the seller.

4. **Matching Funds Partner Outreach**
GLT will seek matching funds for projects that appear to be a good fit for EVOS funding. This will include funding from sources including the Forest Legacy Program, USFWS National Coastal Wetlands Program, and private foundations. This process takes 6-18 months but can yield significant funding that may allow more acres to be purchased.

5. **Final Project Completion**
GLT will work closely with EVOS Trustee Council Staff, DNR, USFWS, ADNR, ADOL, and other partners to complete up to approximately $27 million in high priority conservation projects with willing landowners in the Spill Area as part of this project.

Project Milestones:

April 15-September 30, 2013:

- Finish project parcel identification using recently completed Kodiak Archipelago conservation prioritization.

June 1- August 30, 2013:

- Initiate site assessments of 3-5 high ranking projects.

October 1, 2013- March 30, 2014:

- Develop conservation prioritization of the entire spill area.
- Continue landowner outreach on Kodiak Archipelago.
- Complete 2-3 appraisals of high-ranking projects on Kodiak Archipelago.
- Initiate Kodiak Archipelago project negotiations.

April 1, 2014- January 31, 2015
- Landowner outreach to landowners of high ranking parcels in the entire spill area to determine willing parties.
- Complete due diligence on 2-3 Kodiak Archipelago projects.
- Submit Kodiak Archipelago project packages to EVOSTC for full funding.
- Continue landowner outreach in the entire spill area.
- Complete 1-2 appraisals of high ranking projects in the spill area outside of Kodiak.
- Initiate project negotiations for projects in the greater spill area.

February 1, 2015 – January 31, 2016

- Complete due diligence on 2-3 additional spill area projects.
- Submit additional spill area project packages to EVOSTC for full funding.

Budget:

		Year 2	Year 3
		Feb 1, 2014 - Jan 31, 2015	Feb 1, 2015 – Jan 31, 2016
GLT Staff	3 staff, 20hr/wk for 40 weeks @ $50/hour	$131,830	$152,000 *Year 3 Staff time expected to increase by 1/3 due to increased negotiating efforts and increased number of active projects throughout the spill area
Travel	Airfare from ANC to KOD (or Prince William Sound, Alaska Peninsula, and other Spill area project locations) $480/trip/staff @ 5 trips for 2 staff = $4,800; travel within Kodiak via float plane @ $650/hr @ 25 hrs= $16,250; $3,750 food, lodging, rental car.	$24,800	$32,000 *Year 3 travel expected to increase by 1/3 due to increased number of active projects throughout the spill area
Appraisal	Appraisals @ $25,000 each	$50,000	$50,000
Phase I Environmental Site Assessment	Phase I ESA reports @ $7,000 - $10,000 each	$27,000	$27,000
Legal	@ $370/ hr	$14,800	$14,800
Total		$248,430	$275,800

Anticipated Products/Outputs

Anticipated outputs for this grant include the prioritization and acquisition of high priority fee title properties within the EVOS area. In addition, some projects may be conservation easements held by USFWS or ADNR. Specific goals below:

- Substantial progress toward completion of fee title property acquisition of 10,000 acres within the EVOS area.
- Permanent protection of 2,000 acres of wetlands within the EVOS area.
- Permanent protection of up to 2 miles of coastline within the EVOS area.
- Permanent protection of up to 5 miles of anadromous streams within the EVOS area.

Project Monitoring and Evaluation

GLT will submit quarterly updates to USFWS, ADNR, ADOL, and EVOSTC on the status of the completion of project objectives. Upon completion of purchase of habitat with EVOSTC funding, a permanent conservation easement will be held by either ADNR or USFWS requiring annual monitoring of conservation values.

Description of Organization Undertaking the Project

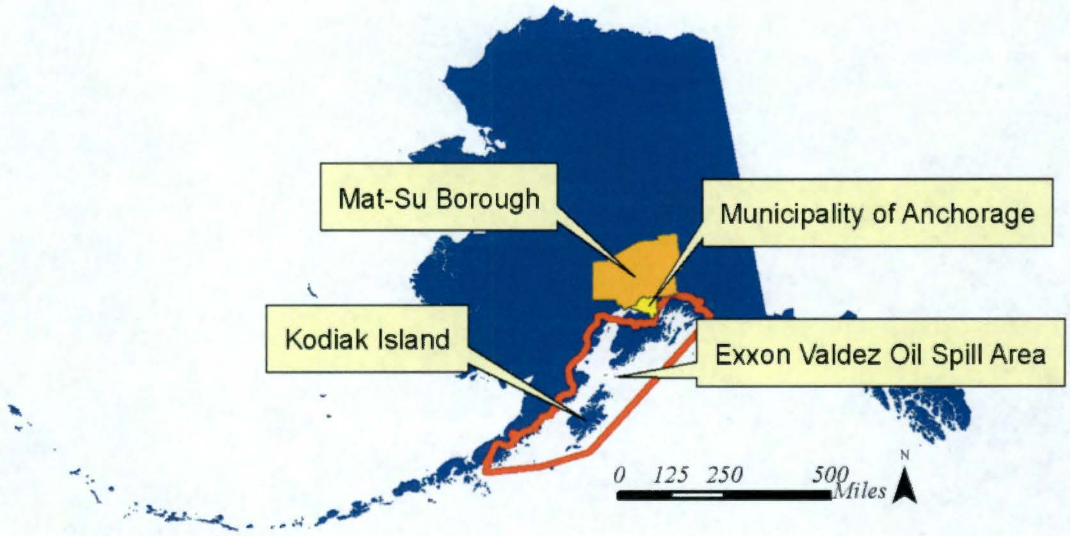
GLT is Southcentral Alaska's regional land trust. It is an independent nonprofit land conservation organization founded by and for Alaskans in 1995. Our service area includes more than 50 percent of Alaska's total population and ranges from the Alaska Range in the North to Prince William Sound and Kodiak in the south. GLT is the only Alaska-based land trust working in Kodiak and is in an excellent position to work there because of our broad expertise. The other adjacent land trusts and national conservation organizations in Alaska were consulted prior to GLT's expansion to Kodiak and felt GLT was in the best position to work in this important area. GLT works in partnership with willing private and public landowners to permanently conserve special lands, signature landscapes, and waters essential to the quality of life and economic health of communities in the region We seek to protect the integrity of the natural ecosystems, wetlands and streams, access to recreational lands, and conserve lands important for towns and cities.

GLT, an accredited land trust, has extensive experience with wildlife habitat and wetland conservation projects. Since 1995, GLT has completed 27 land conservation projects totaling nearly 8500 acres in southcentral Alaska, including over 40 miles of salmon streams. GLT has professional staff skilled at carrying out complex land transactions. GLT has been nationally recognized for wetland conservation successes including the LTA Living Lands Publication, the Coastal America 2007 Partnership Award, the US DOI Cooperative Conservation Award 2008 and was awarded the Outstanding Partner Award by the Region 7 Director of USFWS for 2011 In addition, GLT recently became the first land trust in Alaska and one of only 200 nationwide to achieve accreditation with the Land Trust Alliance Accreditation Commission.

Sustainability

Upon completion of purchase of habitat with EVOSTC funding, a permanent conservation easement will be held by either ADNR or USFWS.

Map of Project Area



Great Land Trust Service Area
Municipality of Anchorage, Mat-Su Borough, and the Exxon Valdez Oil Spill Affected Area

SMALL PARCEL NOMINATION FORM

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

Part 1: Landowner Information

Phone: ~~907-694-9060~~

Landowner: The Conservation Fund   Fax:

Address: 1655 North Fort Myer Drive, Suite 1300

Arlington, Virginia 22209-3199

Co-owner:

Part 2: Parcel Information

Legal description of property: (township, range, section)

Portion of Sections 18 and 19, Township 5 North Range 10 West, Seward Meridian, Alaska
Parcels also identified as Kenai Peninsula Borough Parcels 057-660-012 and 057-660-015

General description of property, including habitat restoration or other biological or recreational value. Also please provide photos and maps if available:

This property is located at River Mile 14 on the east bank of the Kenai River. This is one of the largest undeveloped tracts of land on the lower river. The tract contains extensive sloughs and wetlands which provide spawning habitat for chinook and coho salmon. The salmon of the Kenai River support important economic and recreation activities.

approved

Approximate acreage: 82.49 acres

Is your property located within or adjacent to a State or Federal Park, Refuge or National Forest or other public land unit? If so, which one? Kenai River Special Management Area

Are there any developments on the site? No

Are there any hazardous materials on the property? (waste oil, mine tailings, dump) No

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Approximate acreage 82 49 acres

Is your property located within or adjacent to a State or Federal Park, Refuge or National Forest or other public land unit? If so, which one? Kenai River Special Management Area

Are there any developments on the site? No

Are there any hazardous materials on the property? (waste oil, mine tailings, dump) No

Part 3: Signatures

Signature of landowner: Brad Mattingly Date: January 10, 2013

A nomination does not bind you to sell your property, nor does it bind the Trustee Council to buy your lands.

Stewart Property (KEN 3011)
Kenai River, Alaska

Property Name:	Stewart parcel
Owner:	The Conservation Fund
Acreage:	82 acres
Description:	T 5 N, R 10 W, Sec. 18, Lot 05766015; Sec. 19, Lot 05768012
Agency Sponsor:	Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation
Appraised Value:	$1,075,000
Funding Request:	$544,620 ($525,000 purchase price plus $19,620 due diligence and GA)

Overview: The Conservation Fund seeks $525,000 from the *Exxon Valdez* Oil Spill Trustee Council to purchase the surface estate of the Stewart parcel, an 82-acre property on the lower Kenai River. The appraised fair market value of the property is $1,075,000, and The Conservation Fund proposes a 1:1 match of funding from the Trustee Council to assist with the acquisition of this property.

Since its inception, the Trustee Council's Habitat Protection Program on the Kenai Peninsula has largely focused on the Kenai River Watershed, the Anchor River, the Ninilchik River and the Homer Spit. The program has provided the Trustee Council with a unique opportunity to address local needs and concerns by securing parcels that provide important restoration values for those resources and services injured by the *Exxon Valdez* Oil Spill.

Injured resources in the Kenai River area are dependent on the habitat provided along the river corridor. These habitats are threatened by the development and diverse uses of the Kenai River, which degrade fish and migratory bird habitat, important wetlands and sources of nutrients essential to the continued health of recovered and recovering Injured Species. In addition, injured services such as recreation and tourism that depend on injured resources are high on the Kenai River and are dependent on the wellbeing of injured fish species that were injured by the Spill. Addressing injured resources and services has been the focus of the Trustee Council's program on the Kenai River.

Property Description and Habitat: The Stewart property is 82 acres consisting of two contiguous, undeveloped tracts and is one of the few remaining large tracts of intact habitat along the lower Kenai River. Located at river mile 14, the parcel has approximately 1/2 mile of river frontage. An anadromous stream runs through the northeast portion of the parcel and is identified in the Alaska Department of Fish and Game's (ADF&G) Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes. As described in *Wetland Mapping and Classification of the Kenai Lowland, Alaska* (Gracz et al. 2008; www.kenaiwetlands.net/), the majority of the 82 acres is classified as wetlands, containing kettle, drainageway, discharge slope and riparian wetlands. There is just under an acre of uplands, comprised of spruce, birch and alder trees.

ADF&G is currently evaluating this segment of the river for placement of the Kenai River Chinook Salmon Sonar Assessment Project to enumerate Chinook salmon escapement. If

ADF&G decides to transition the Chinook salmon sonar project to this location at river mile 14, there may be a future need to access the sonar project from the Stewart parcel. This will be determined after the Division of Parks and Outdoor Recreation (DPOR) finalizes their policy for permitting ADF&G activities in the Kenai River Special Management Area.

Restoration Benefits: Injured resources that benefit from the protection of the Stewart property include pink (recovered), Chinook, coho and sockeye salmon (recovered), Dolly Varden (recovered), Bald Eagles (recovered), Harlequin Ducks (recovering), Barrow's Goldeneyes (recovering), Common Loons (recovered), Cormorants (recovered) and river otter (recovered). Though many of these species are considered recovered, the continued protection of their habitat is essential to maintaining recovery objectives in the Kenai River corridor.

The Stewart property contains wetlands and riparian areas important to injured resources, and acquisition of this parcel will ensure that protection of these valued habitats is in perpetuity. The 81 acres of undeveloped wetlands and riparian lands act as a filter system and nutrient provider for the Kenai River, which is important to migration, rearing and overwintering habitat for fish species such as Dolly Varden, Chinook, coho, and sockeye salmon. The riverbank also supports spawning habitat for pink and Chinook salmon, and Dolly Varden. Continuous and intact riparian habitats are more effective at protecting a diversity of fauna and aquatic ecosystems by providing good water quality, while also supporting the food web of injured resources.

In addition, Bald Eagles, Harlequin Ducks and Barrow's Goldeneyes use the Kenai River as a habitat corridor. These injured resources use the river's riparian area as a spring and fall migration corridor, for feeding, staging, nesting and rearing broods along the river and its tributaries (mostly further upstream and at Kenai and Skilak lakes.)

Bald Eagles use the river corridor for all life stages and there are documented nesting sites along the entire river corridor. The Barrow's Goldeneyes use the corridor for nesting in mature trees and use the main channel of the river in the spring and fall for feeding. There is also a documented population of Barrow Goldeneye's that overwinters just below Skilak Lake on the Kenai River. Bald Eagles and river otters frequent the area and utilize the undisturbed habitat on the parcel. In addition, Common Loons and Cormorants have been known to use the Kenai River corridor as a migration route.

The acquisition of the Stewart property will assist with efforts to restore and maintain healthy fisheries in the Kenai River watershed that Injured Services are dependent on, such as recreation and tourism, subsistence, commercial fisheries and passive use.

The lower 20 miles of the Kenai River, which includes the Stewart property, supports a high percentage of the total recreational fishing effort on the river. With 1/2 mile of river frontage, and with Kenai Riverbend and Stewart's Landing boat launches nearby, the protection of this parcel is an important contribution to boat anglers and shore-based anglers targeting pink and coho salmon in August and September. Rainbow trout also inhabit the Kenai River and provide recreational opportunities throughout the year.

In recent years, the Kenai River Chinook salmon fishery has barely met minimum escapement goals and now it is even more imperative to protect Chinook salmon habitat. In addition, as Chinook salmon numbers decline, injured services such as recreation and commercial fisheries have become more dependent on other salmon fisheries. Therefore, it is critical to ensure that Kenai River habitat is protected for all salmon species.

Potential Threats: Development along the Kenai has been extensive and has resulted in problems with non-point runoff and habitat degradation. Because of the size and location of this parcel on the lower Kenai River, and the significant river frontage, the development potential is high. There are few properties like this remaining on the lower Kenai River and the State of Alaska indicated that this was a high priority for protection due to the conservation and recreation values, and development threats

Proposed Management: The Conservation Fund works to assist state, federal and local organizations with achieving conservation objectives for priority properties. The DPOR identified the Stewart property as a priority for protection and worked with The Conservation Fund to secure this parcel. The Conservation Fund would like to convey the Stewart property to the Alaska Department of Natural Resources, DPOR to protect resources and services injured by the *Exxon Valdez* Oil Spill. The Conservation Fund recommends that the property be added to the Kenai River Special Management Area. ADF&G supports the acquisition, as this site supports recreation services, habitat protection, and will be important for fisheries management should the department relocate the Chinook salmon sonar project to this section of the river.

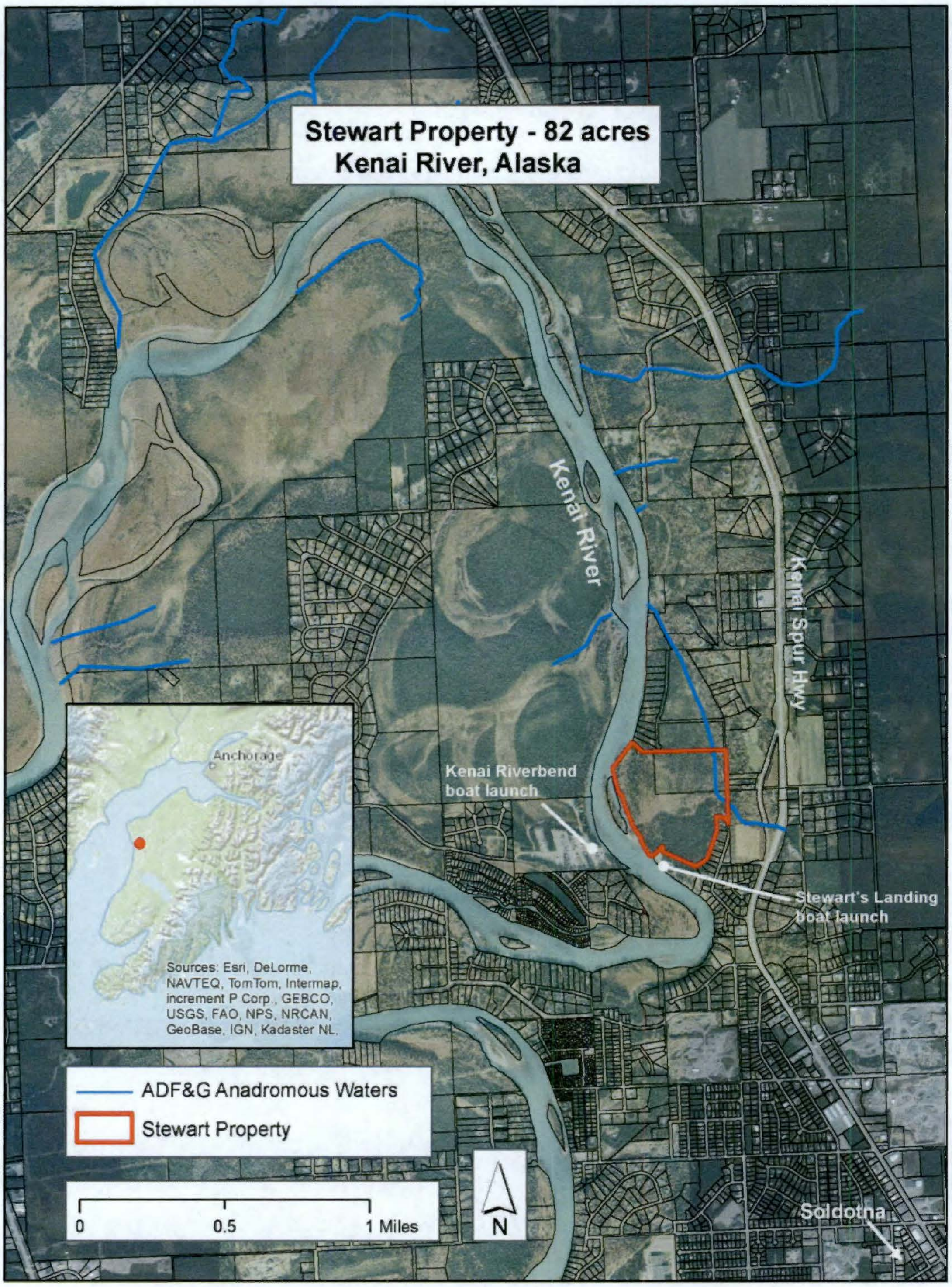
Funding Request: Due Diligence Funding and Conditional-Purchase Authorization Request

Total funding request = $544,620

Due Diligence activities: $18,000 + $1620 GA (@ 9%) = $19,620
Hazmat = $10,000
Title Insurance = $8,000

Conditional approval to purchase at $525,000 if:

1. Due diligence reports are acceptable to the Alaska Departments of Natural Resources (DNR) and the Department of Law (DOL); and
2. Provided that the Trustee Council's Executive Director, DNR and DOL find that it is in the best interest of the Trustee Council to move forward with acquisition of the parcel.


Stewart Property - 82 acres
Kenai River, Alaska
Kenai River
Kenai Spur Hwy
Kenai Riverbend boat launch
Stewart's Landing boat launch
Anchorage
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL.
ADF&G Anadromous Waters
Stewart Property
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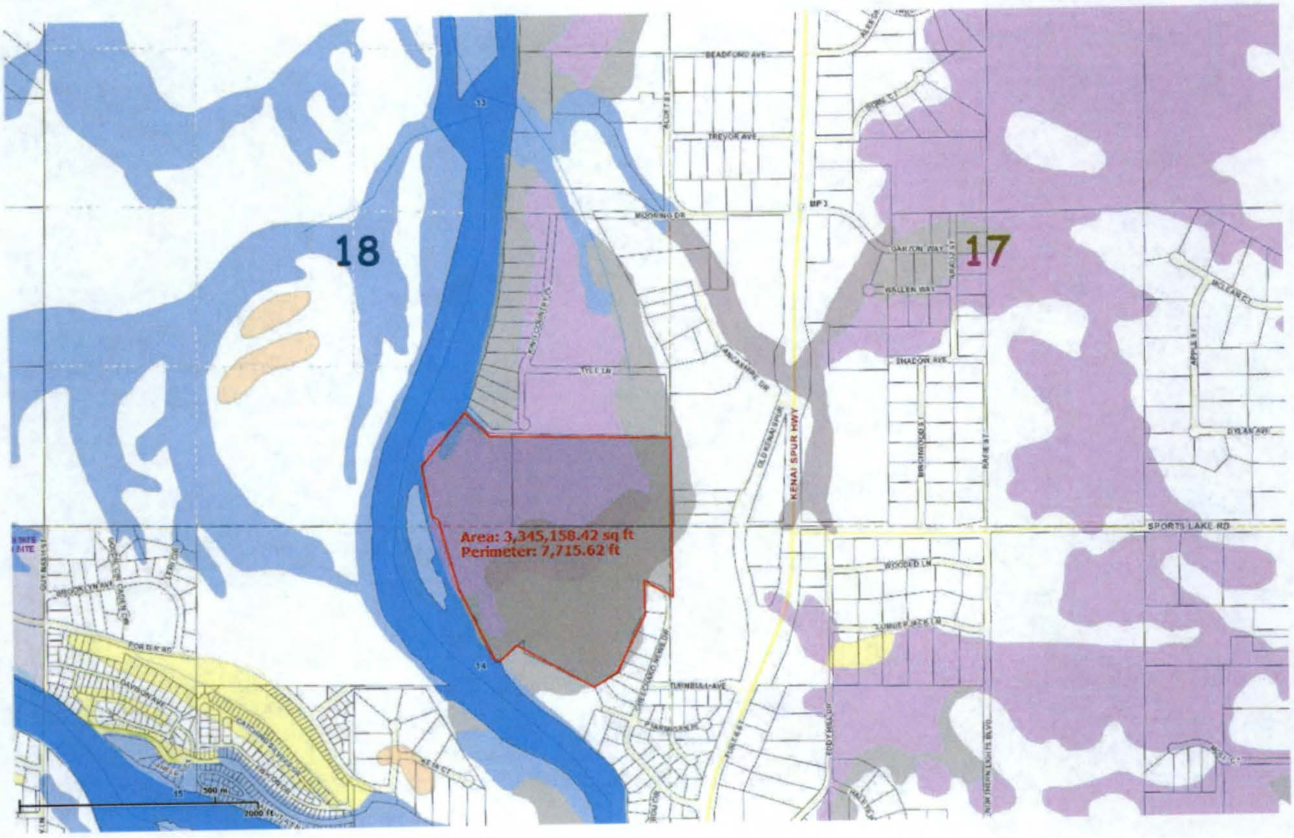
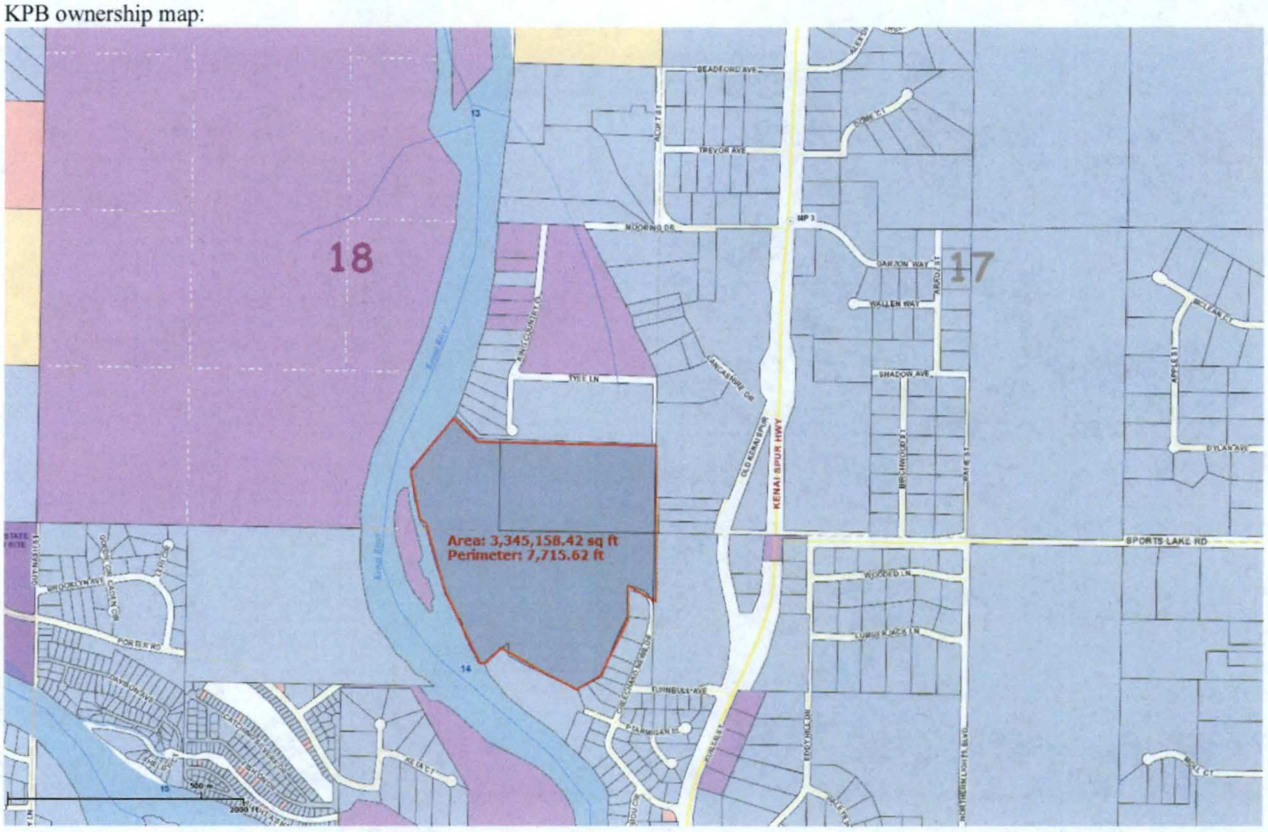
0.5
1 Miles
N
Soldotna

KPB Wetlands map



KPB ownership map:



KENAI RIVER SPORTFISHING
ASSOCIATION

January 29, 2013

Ms. Elise Hsieh, Executive Director
Exxon Valdez Oil Spill Trustee Council
4210 University Drive
Anchorage, Alaska 99508-4626

RE: Stewart Property Acquisition

Dear Ms. Hsieh,

I am writing on behalf of the Kenai River Sportfishing Association to encourage the *Exxon Valdez* Oil Spill Trustee Council to fund the acquisition and protection of the 82-acre Stewart property on the Kenai River. The Conservation Fund has generously proposed to share the cost of this important acquisition with the Trustee Council, and has already done the hard work of acquiring the property.

The Stewart property is one of the few large tracts along the Kenai River, and contains wetlands of great importance to migratory waterfowl and spawning salmon. The protection of riparian habitat along the Kenai River is one the top priorities of the Kenai River Sportfishing Association. These areas are vital to maintaining water quality and sport fisheries on the Kenai.

I ask you to accept this generous offer from The Conservation Fund and partner in the protection of this property.

Sincerely,

Ricky Gease

Ricky Gease, Executive Director
Kenai River Sportfishing Association

Kachemak Heritage Land Trust

315 Klondike Avenue • Homer, AK 99603 • ph: 907-235-5263 • fax: 907-235-1503 • www.kachemaklandtrust.org

June 24, 2013

Ms. Elise Hsieh, Executive Director
Exxon Valdez Oil Spill Trustee Council
4210 University Drive
Anchorage, Alaska
99508-4626

RECEIVED
JUN 27 2013
EXXON VALDEZ OIL SPILL
TRUSTEE Council

RE: Stewart Property Acquisition

Dear Ms. Hsieh,

I am writing on behalf of Kachemak Heritage Land Trust to encourage the Exxon Valdez Oil Spill Trustee Council to award $525,000 to The Conservation Fund for the acquisition of the 82.49-acre Stewart property. This undeveloped large wetland property (KPB Parcel 05768012) will protect roughly a half-mile of river frontage at lower Kenai River Mile 14 that is within the EVOS Small Parcel Program Spill Affected area. The requested funds will be matched by The Conservation Fund dollar-for-dollar. The Conservation Funds proposes that the State of Alaska becomes the owner of the property with a conservation easement held by the Bureau of Land Management.

Kachemak Heritage Land Trust strongly supports this acquisition, as it will help prevent further injury to species & services on the EVOS Injured Species and Associated Injured Services lists, and because Kachemak Heritage Land Trust has identified it as a priority parcel for conservation.

The mission of Kachemak Heritage Land Trust is to preserve, for public benefit, land on Alaska's Kenai Peninsula with significant natural, recreational, or cultural values by working with willing landowners. Conservation of the Stewart property fits squarely within our organizational mission.

Kachemak Heritage Land Trust Priority
The Stewart property ranked as a priority parcel within our comprehensive GIS mapping project titled "Focused Conservation: Resource Mapping of Alaska's Kenai Peninsula." The Kachemak Heritage Land Trust project weighed natural resources on all privately owned Kenai Peninsula parcels five acres or greater, including Native lands and allotments, University of Alaska and Mental Health Trust lands, as these parcels can all be purchased by private parties.

The project weighted natural resources including moose, caribou, Dall Sheep, brown bear, harbor seal, Steller Sea Lion, ducks and geese, swan, sandhill crane nesting habitat, known locations of eagle and seabird nests, salmon, rare plant locations, mature conifer forests, wetlands, coastal hydrology, flood zones, parks and trails, parcel size and proximity to protected land. Within this project each conservation value was given equal weight in the ranking, with the exception of brown bear, salmon, caribou, and parcel size, which were more heavily weighted based on their economic and ecological significance to the Kenai Peninsula.

Other values of interest
Wetlands
The Stewart property consists primarily of discharge slope and kettle wetlands as classified by the Kenai Watershed Forum and identified as Coho Support Habitat. It is also identified by the Kenai Watershed Forum as salmon spawning habitat.

Surrounding properties
The Stewart parcel is directly across the river from a 401-acre parcel owned by DNR (KPB parcel 05525023 with a KRSMA designation) and is across the river and near an almost 18-acre parcel owned by DNR (KPB Parcel # 05525030 with a KRSMA designation).

EVOS Species of Interest
The Stewart property contains the following **EVOS Species of Interest**;

According to the 2010 DNR/DOPR *Kenai River Recreation Study*, about 98,000 Dolly Varden are caught in the Kenai each year, roughly 15% are caught in the Lower River.

According to Audubon Alaska, the Kenai River as an area Common Loons use. The northwest Kenai Peninsula is a hotspot for the species. An Audubon Alaska Map is attached.

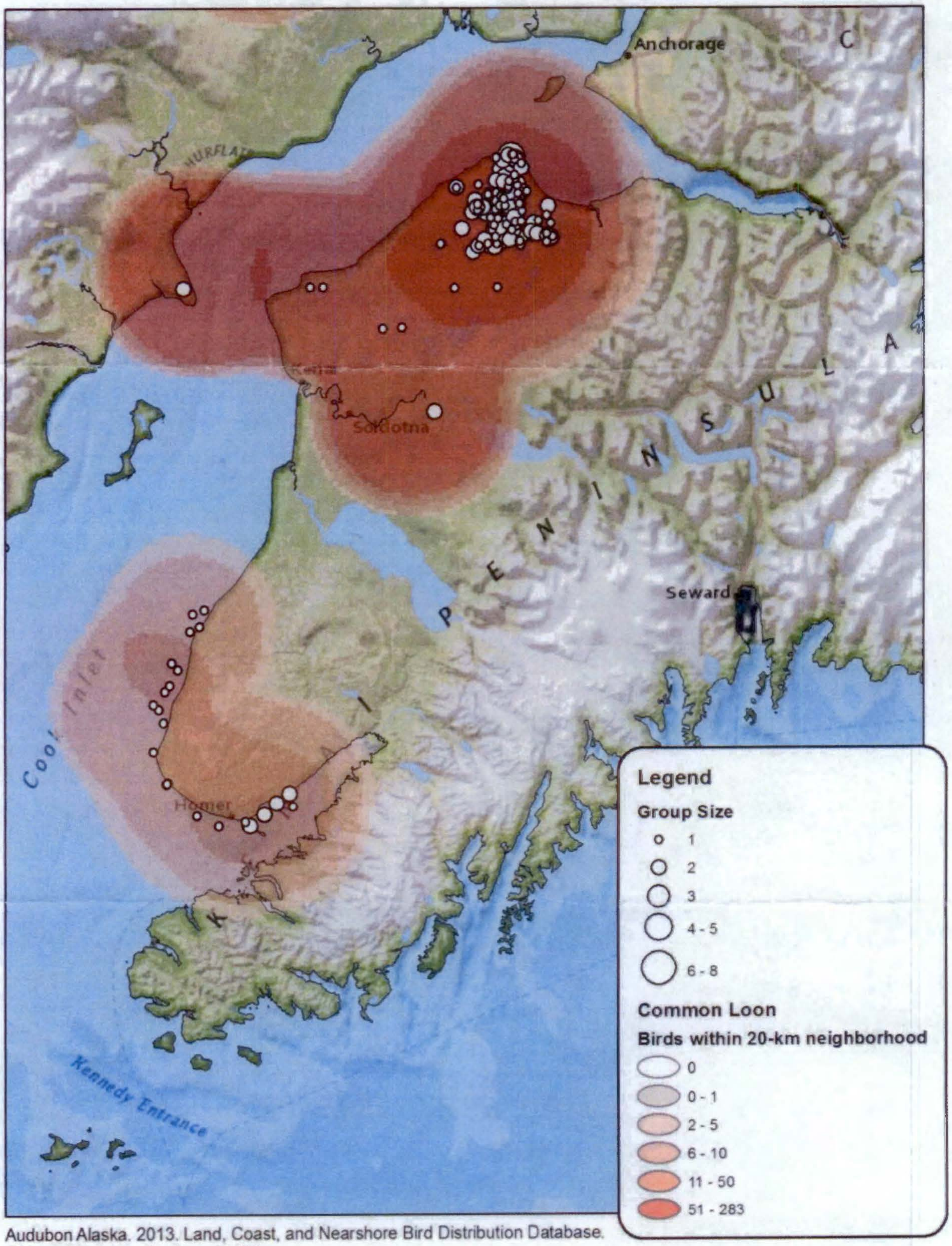
EVOS Associated Injured Services

Recreation
According to ADF&G, the Kenai River is the most heavily used freshwater sportfisheries in Alaska with an average of 275,000 angler days/year. The 2010 DNR Recreation Study indicated that 47% of angler effort occurs in the Lower Kenai River.

Kachemak Heritage Land Trust wholly supports the Exxon Trustee Oil Spill Council funding half of the purchase price for this important and unique Kenai River property. The opportunity to preserve large parcels such as the Stewart property is a rare occurrence.

Sincerely,

Marie McCarty
Executive Director



Audubon Alaska. 2013. Land, Coast, and Nearshore Bird Distribution Database. GIS geodatabase. Anchorage, AK.

United States Department of the Interior
KENAI NATIONAL WILDLIFE REFUGE
P.O. Box 2139
Soldotna, Alaska 99669-2139
(907) 262-7021

In Reply Refer to:
13018ajl

June 27, 2013

Ms. Elise Hsieh, Executive Director
Exxon Valdez Oil Spill Trustee Council
4210 University Drive
Anchorage, Alaska
99508-4626

RE: Stewart Property Acquisition

Dear Ms. Hsieh:

I am writing on behalf of the Kenai National Wildlife Refuge (Refuge) to encourage the Exxon Valdez Oil Spill (EVOS) Trustee Council to award $525,000 to The Conservation Fund for the acquisition of the 82.49-acre Stewart property on the lower Kenai River. This parcel (Kenai Penisula Borough Parcel 05768012), which is within the EVOS Small Parcel Program Spill Affected area, will help prevent further injury to species & services on the EVOS Injured Species and Associated Injured Services lists. Acquisition of this undeveloped parcel, which includes approximately one half-mile of river frontage near River Mile 14, would also permanently protect important wetland habitats.

The Stewart property consists almost entirely of discharge slope and kettle wetlands as classified by the Kenai Watershed Forum. These wetlands are contiguous with and hydrologically connected to the Kenai River, and lie at the upstream extent of tidal influence in the Kenai River estuary. These wetlands serve to provide habitat and/or ecological functions critical to Dolly Varden and Common Loon, two EVOS species of interest. They also serve a direct habitat function for Chinook, Coho and Sockeye salmon, and as such help support the State's most heavily used recreational fishery.

The requested funds will be matched equally by The Conservation Fund. The Conservation Fund proposes that the State of Alaska becomes the owner of the property with a conservation easement held by the Bureau of Land Management. The Stewart parcel is directly across the river from a 401-acre parcel and proximal to an 18-acre parcel owned by Alaska Department of Natural Resources (KPB parcel 05525023; KPB parcel 05525030), both of which are part of the Kenai River Special Management Area, administered by the Alaska Division of Parks and Outdoor Recreation.

We strongly support acquisition of the Steward property and the EVOS Council funding half of its purchase price. Permanent protection of wetland habitats along the lower River is critically important to the long-term ecological health and productivity of the entire Kenai River watershed, and will enhance values and resources currently protected on the Refuge and throughout the Kenai River Special Management Area. Thank you for your consideration.

Sincerely,

Andy Loranger

Andy Loranger
Refuge Manager

ALASKA STATE LEGISLATURE

REPRESENTATIVE KURT OLSON

- Chair: Labor and Commerce
- Vice Chair: Rules
- Member: Resources, Community & Regional Affairs, Economic Development Trade & Tourism, Fisheries, Legislative Budget & Audit

Session: January – April
State Capitol, Room 24
Juneau, AK 99801-1182
Phone: 907-465-2693
Fax: 907-465-3835

Interim: May – December
145 Main Street Loop, Ste. 221
Kenai, AK 99611
Phone: 907-283-2690
Fax: 907-283-2763

Official Business

June 28, 2013

Ms. Elise Hsieh, Executive Director
Exxon Valdez Oil Spill Trustee Council
4210 University Drive
Anchorage, Alaska
99508-4626

RE: Stewart Property Acquisition

Dear Ms. Hsieh,

I am writing to encourage the Exxon Valdez Oil Spill Trustee Council to award $525,000 to The Conservation Fund for the acquisition of the 82.49-acre Stewart property. This undeveloped, large wetland property (KPB Parcel 05768012) will protect roughly a half-mile of river frontage at lower Kenai River Mile 14 that is within the EVOS Small Parcel Program Spill Affected Area. The requested funds will be matched by The Conservation Fund dollar-for-dollar. The Conservation Fund proposes that the State of Alaska becomes the owner of the property with a conservation easement held by the Bureau of Land Management.

I strongly support this acquisition, as it will help prevent further injury to species and services on the EVOS Injured Species and Associated Injured Services lists. The availability of this large parcel is a rare preservation opportunity. I support the Exxon Trustee Oil Spill Council funding half of the purchase price for this important and unique Kenai River property.

Sincerely,

Kurt Olson
Representative
District 29

Email: rep.kurt.olson@akleg.gov

ALASKA STATE LEGISLATURE

SESSION ADDRESS:
Alaska State Capitol, Rm. 125
Juneau, Alaska 99801-1182
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Kenai, AK 99611
Phone: (907) 283-7996

270 W. Pioneer Ave.
Homer, AK 99603
Phone: (907) 235-0690

SENATOR PETER A. MICCICHE

DISTRICT O
Anchor Point
Clam Gulch
Cohoe
Diamond Ridge
Fox River
Fritz Creek
Funny River
Halibut Cove
Happy Valley
Homer
Kachemak City
Kachemak Selo
Kalifornsky
Kasilof
Kenai
Nikolaevsk
Ninilchik
Razdolna
Ridgeway
Seldovia
Soldotna
Voznesenka

June 28, 2013

Ms. Elise Hsieh, Executive Director
Exxon Valdez Oil Spill Trustee Council
4210 University Drive
Anchorage, Alaska
99508-4626

RE: Stewart Property Acquisition

Dear Ms. Hsieh,

I am writing in support of the Exxon Valdez Oil Spill Trustee Council awarding $525,000 to The Conservation Fund for acquisition of the 82.49-acre Stewart property on the banks of the Kenai River. I am normally reticent to transfer private land to public ownership. However, this property currently in conservation status, has the highest value remaining in stewardship and ownership by the State of Alaska.

The value to my district's social, cultural and economic well-being, as well as the recreational opportunities for all Alaskans derived from the Kenai River and its associated fisheries are without question. The ecological functions of this wetland parcel connected to the Kenai River motivate me to encourage the EVOS Trustee Council to seriously consider this purchase, protecting and keeping intact roughly a half-mile of river frontage within the EVOS Small Parcel Program Spill Affected Area. The requested funds will be matched by The Conservation Fund dollar-for-dollar and proposes that the State of Alaska becomes the owner of the property with a conservation easement held by the Bureau of Land Management. I support this action.

Sincerely,

P.A. Micciche

Senator Peter A. Micciche
State of Alaska, District O

E-Mail: Senator.Peter.Micciche@akleg.gov

Beeson Small Parcel

Beeson Property (KEN 3012)
Kenai River, Alaska

Property Name:	Beeson parcel
Owner:	Stephan & Cheryl Beeson and Earl & Alice Mundell
Acreage:	4.59 acres
Description:	T 5 N, R 10 W, Sec. 18, SM, KN 2012066 Lofsdell Acres Sub. No 5 Tract A3 (KPB parcel # 05764044)
Agency Sponsor:	Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation
Appraised Value:	unknown
Funding Request:	$36,160 ($10,000 purchase price and $26,160 in due diligence funds)

Overview: The owners seek $10,000 from the *Exxon Valdez* Oil Spill Trustee Council to fund the protection of the Beeson parcel, a 4.59-acre surface estate located on the lower Kenai River. The Kenai Peninsula Borough assessed this lot at $103,900 in 2013; however the property owners would sell this property to the Trustee Council at a greatly reduced price. The property owners desire to conserve this undeveloped property in perpetuity, and they request a conservation easement be attached to the property. The property would then be managed by the Alaska Division of Parks and Outdoor Recreation (DPOR).

Since its inception, the Trustee Council's Habitat Protection Program on the Kenai Peninsula, has largely focused on the Kenai River Watershed, the Anchor River, the Ninilchik River and the Homer Spit. The program has provided the council with a unique opportunity to address local needs and concerns by securing parcels that provide important restoration values for those resources and services injured by the *Exxon Valdez* oil spill.

Injured Species in the Kenai River area are dependent on the habitat provided along the river corridor. These habitats are threatened by the diverse uses of the Kenai River, which degrade fish and migratory bird habitat, important wetlands and sources of nutrients essential to the continued health of recovered and recovering Injured Species. In addition, Injured Services, such as recreation is high on the Kenai River and is dependent on the wellbeing of injured fish species. This has been the focus of council's program on the Kenai River.

approve

Property Description and Habitat: The Beeson parcel is located along the lower Kenai River, south of Honeymoon Cove at river mile 13.1. The parcel contains approximately 674 linear feet of river frontage. There are no improvements, and most of the parcel is lowland wetlands. *Wetland Mapping and Classification of the Kenai Lowland, Alaska* (Gracz et al. 2008; www.kenaiwetlands.net/) characterizes the parcel as kettle, discharge slope, and riparian wetlands. These wetlands function as a filter system and nutrient provider for the Kenai River, and support important rearing and overwintering habitat for Dolly Varden, Chinook and coho salmon. The parcel also abuts a small tributary of the Kenai River, which is identified in the Alaska Department of Fish and Game's (ADF&G) *Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes*. The small stream provides rearing habitat for coho and sockeye salmon. The Kenai River and associated bank along the Beeson parcel support spawning habitat for pink and Chinook salmon and Dolly Varden.

Beeson Property (KEN 3012)
Kenai River, Alaska

Property Name:	Beeson parcel
Owner:	Stephan & Cheryl Beeson and Earl & Alice Mundell
Acreage:	4.59 acres
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Restoration Benefits:

Injured species that benefit from this parce acquisition include pink (recovered), Chinook, coho and sockeye salmon (recovered), Dolly Varden (recovered), Bald Eagles (recovered), Harlequin Ducks (recovering), Barrow's Goldeneyes (recovering), Common Loons (recovered), Cormorants (recovered) and river otter (recovered). Though many of these species are considered recovered, the continued protection of their habitat is essential to maintaining recovery objectives in the Kenai River corridor.

The Beeson parcel contains wetlands and riparian areas important to Injured Species, and acquisition of this parcel will ensure that protection of these valued habitats is in perpetuity. The undeveloped wetlands and riparian lands act as a filter system and nutrient provider for the Kenai River, which is important to migration, rearing and overwintering habitat for fish species such as Dolly Varden, Chinook, coho, and sockeye salmon. The riverbank also supports spawning habitat for pink and Chinook salmon, and Dolly Varden. Continuous and intact riparian habitats are more effective at protecting a diversity of fauna and aquatic ecosystems by providing good water quality, while also supporting the food web of Injured Species.

In addition, Bald Eagles Harlequin Ducks and Barrow's Goldeneyes use the Kenai River as a habitat corridor. These Injured Species use the river's riparian area as a spring and fall migration corridor, for feeding, staging, nesting and rearing broods along the river and its tributaries (mostly further upstream and at Kenai and Skilak lakes.)

Bald Eagles use the river corridor for all life stages and there are documented nesting sites along the entire river corridor. While the Barrow's Goldeneyes use the corridor for nesting in mature trees and use the main channel of the river in the spring and fall for feeding. There is also a documented population of Barrow Goldeneye's that overwinters just below Skilak Lake on the Kenai River. Bald Eagles and river otter frequent the area and utilize the undisturbed habitat on the parcel. In addition, Common Loons and Cormorants have been known to use the Kenai River corridor as a migration route.

Protection of the Beeson property will assist in efforts to restore and maintain healthy numbers of salmon in the Kenai River watershed, which is important for sustaining recreational and commercial fisheries of Cook Inlet. The property is located within the lower 20 miles of the Kenai River; since 1981, approximately 45% of the total annual sport harvest of salmon in the Kenai River has occurred in this section of the river.

In recent years, the Kenai River Chinook salmon fishery has barely met minimum escapement goals and now it is even more imperative to protect Chinook salmon habitat. In addition, as Chinook salmon numbers decline, Injured Services such as recreation and commercial fisheries have become more dependent on other salmon fisheries. Therefore, it is critical to ensure that Kenai River habitat is protected for all salmon species.

The property is contiguous with two parcels located to the south that were acquired by the Trustee Council in 1998 (Carter parcels OSL 1237). With nearly 700 feet of river frontage, the acquisition of the Beeson parcel would complement the Trustee Council actions to protect important wetland and riparian habitats along the lower Kenai River. Although the Beeson parcel is only 4.59 acres compared to the 27 2 acres contained within the Carter parcels, the extremely low purchase price provides for a very high cost-benefit ratio for habitat protection.

Potential Threats: The current owners have expressed a willingness to sell the property. The owners retain parcels to the east of this property. The development along the Kenai River has been extensive and has resulted in problems with non-point runoff and habitat degradation. The Mental Health Trust owns the subsurface estate. Mineral and residential development potential for the Beeson parcel is unknown; however, road access is only 0.1 miles away, and there are a limited number of properties like this remaining in the lower Kenai River.

Proposed Management: The current owners have indicated a preference that the DPOR manage the parcel, if acquired, subject to a conservation easement to protect the parcel from development in perpetuity and will be recommended for inclusion to the Kenai River Special Management Area

The Carter parcels to the south, previously acquired by the Trustee Council, are within the Kenai River Special Management Area, managed by the DPOR. ADF&G also has a Management Right Assignment (ADL 228192). DPOR may consider entering into Cooperative Agreements with ADF&G for both the Beeson parcel and the Carter parcels.

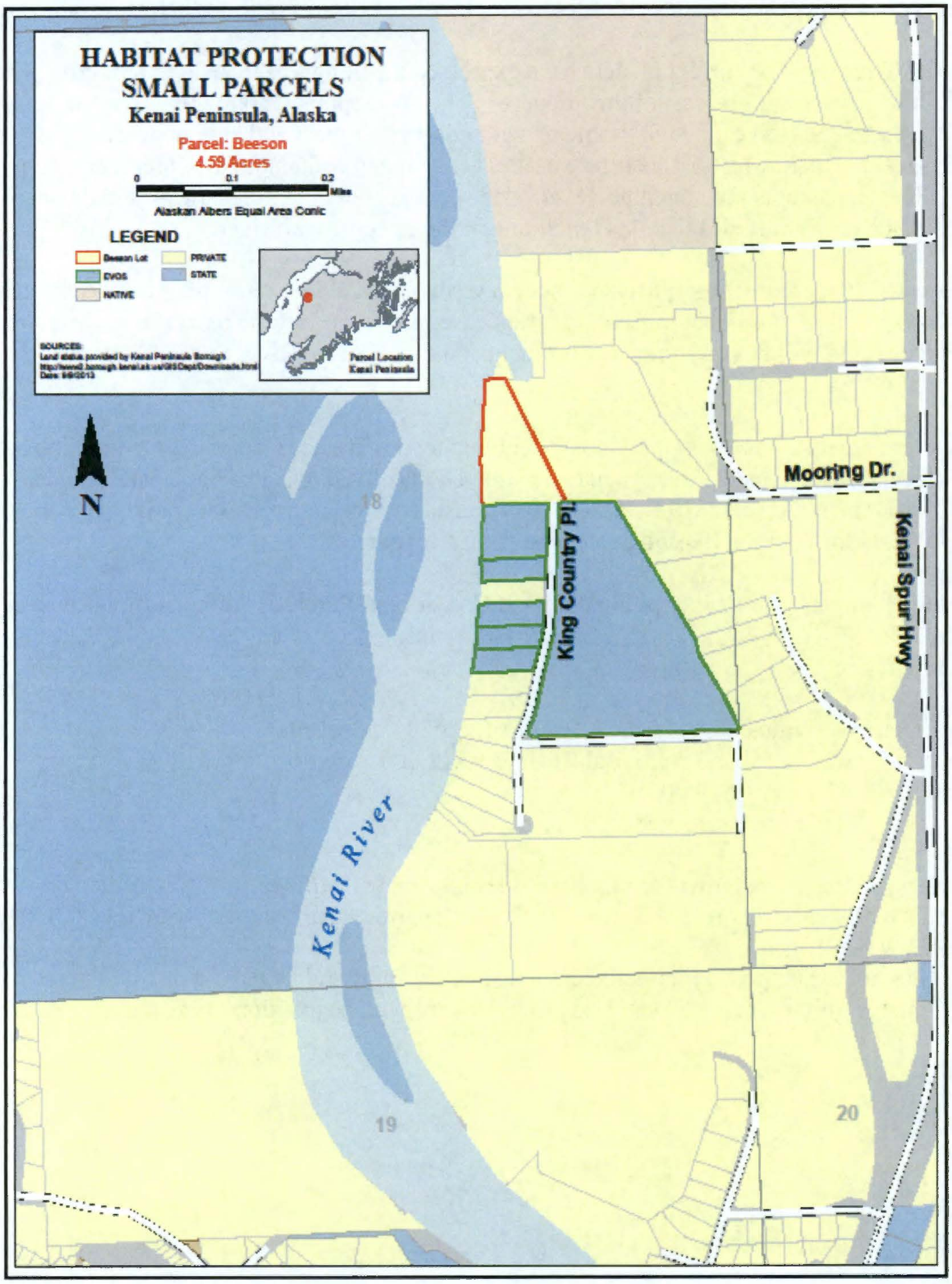
Funding Request: Due Diligence Funding and Conditional-Purchase Authorization Request

Total funding request = $36,160

Due Diligence activities: $24,000 + $2,160 GA (@ 9%) = $26,160
Appraisal and Appraisal Review = $12,000
Hazmat = $10,000
Title Insurance = $2,000

Conditional-Purchase: approval to purchase Beeson parcel at $10,000 if:

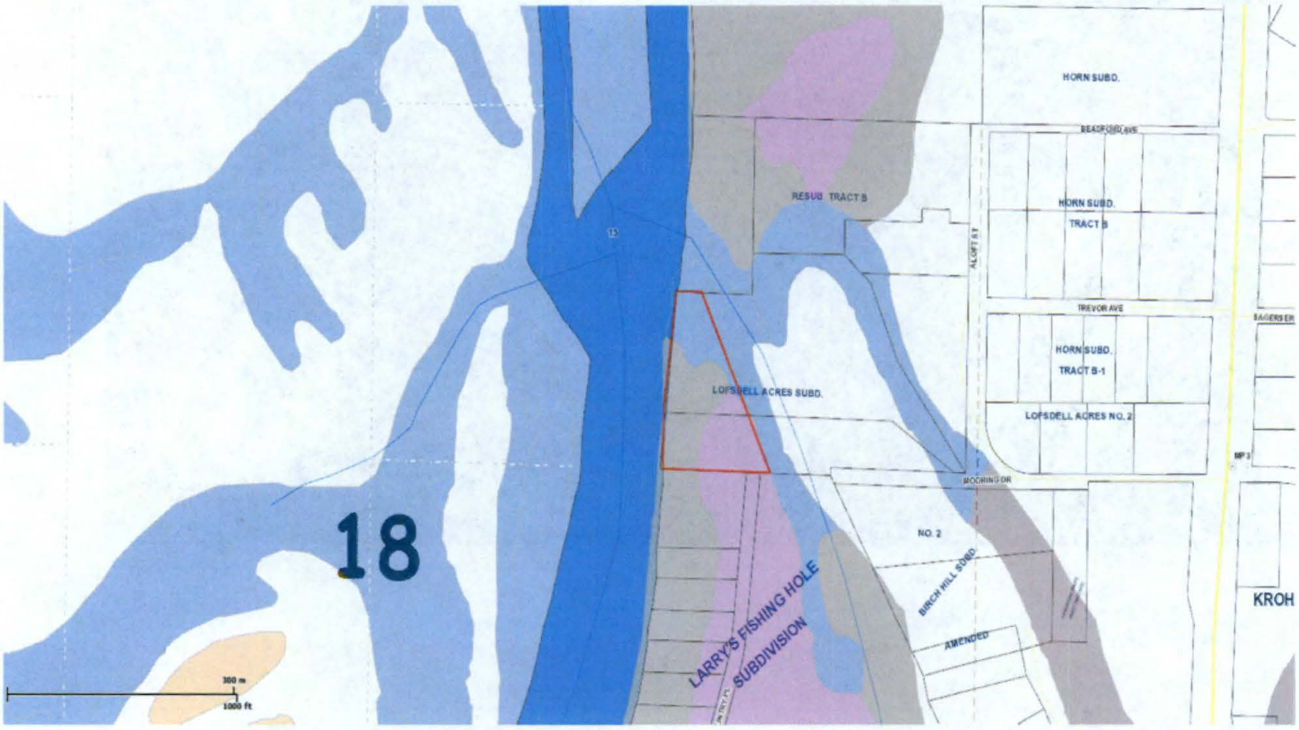
1. Due diligence reports are acceptable to the Departments of Natural Resources (DNR) and Law (DOL); and
2. Provided that the Council's Executive Director, DNR and DOL find that it is in the best interest of the Trustee Council to move forward with acquisition of the parcel.


HABITAT PROTECTION
SMALL PARCELS
Kenai Peninsula, Alaska
Parcel: Beeson
4.59 Acres
Alaskan Albers Equal Area Conic
LEGEND
PRIVATE
STATE
EVOS
NATIVE
Parcel Location
Kenai Peninsula
N
Mooring Dr.
King Country Pl
Kenai Spur Hwy
Kenai River
18
19
20

Fri Sep 6 2013 01:59:19 PM

KPB Parcel Viewer

KPB Wetlands Map



KENAI RIVER SPORTFISHING
ASSOCIATION

October 11, 2013

Exxon Valdez Oil Spill Council
c/o Elise Hsieh, Executive Director
4210 University Drive
Anchorage, AK 99508-4626

Dear EVOS Council members;

Kenai River Sportfishing Association (KRSA) supports the nomination of the Beeson property on the Kenai River to EVOS for purchase.

We support the property owners' desire to conserve this land in perpetuity and that it not be developed. Thus we ask for your consideration to accept the proposal that the Exxon Valdez Oil Spill Trust Council purchase this property, that a Conservation Easement be attached, and that the property be placed under the management of the Alaska State Department of Natural Resources.

KRSA supports fishery conservation for Kenai River wetlands and habitat. The Beeson property contains wetlands that we feel are important for the health of salmon habitat.

Thank you for your time and consideration of this request.

Sincerely,

Ricky Gease

KRSA Executive Director
224 Kenai Avenue, Suite 102
Soldotna, AK 99669

ALASKA STATE LEGISLATURE

REPRESENTATIVE KURT OLSON

- Chair: Labor and Commerce
- Vice Chair: Rules
- Member: Resources, Community & Regional Affairs, Economic Development Trade & Tourism, Fisheries, Legislative Budget & Audit

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State Capitol, Room 24
Juneau, AK 99801-1182
Phone: 907-465-2693
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Interim: May - December
145 Main Street Loop, Ste. 221
Kenai, AK 99611
Phone: 907-283-2690
Fax: 907-283-2763

Official Business

October 2, 2013

Ms. Elise Hsieh, Executive Director
Exxon Valdez Oil Spill Trustee Council
4210 University Drive
Anchorage, Alaska
99508-4626

RE: Nomination of the Beeson Property

Dear Ms. Hsieh,

I am writing to encourage Exxon Valdez Oil Spill Trustee Council to favorably consider the nomination of the 4.59 acres parcel (KPB Parcel #05764044) jointly owned by the Beeson and Mundell families. This property has some 674 feet of river frontage and is adjacent to other EVOS properties on the Kenai River.

I strongly support the protection and preservation of the property mentioned above.

Sincerely,

Kurt Olson
Representative
District 29

cc: Samantha Carroll

Email: rep.kurt.olson@akleg.gov

ALASKA STATE LEGISLATURE

SESSION ADDRESS:
Alaska State Capitol, Rm. 125
Juneau, Alaska 99801-1182
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Fax: (907) 465-4779
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Kenai, AK 99611
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270 W. Pioneer Ave.
Homer, AK 99603
Phone: (907) 235-0690

SENATOR PETER A. MICCICHE

DISTRICT O

Anchor Point
Clam Gulch
Cohoe
Diamond Ridge
Fox River
Fritz Creek
Funny River
Halibut Cove
Happy Valley
Homer
Kachemak City
Kachemak Selo
Kalifornsky
Kasilof
Kenai
Nikolaevsk
Ninilchik
Razdolna
Ridgeway
Seldovia
Soldotna
Voznesenka

October 3, 2013

Exxon Valdez Oil Spill Trustee Council
c/o Executive Director, Elise Hsieh
4210 University Drive
Anchorage, AK 99508-4626

Dear Ms. Hsieh:

I am writing in support of the nomination of Kenai River property jointly owned by my constituents, Steve and Cheryl Beeson, and Earl Mundell, for purchase by the Exxon Valdez Oil Spill Trustee Council. This property of 4.59 acres has 674 feet of frontage on the Kenai River and is located in the Kenai River Special Management Area adjacent on the south end to other Exxon Valdez Oil Spill Trust Council properties managed by the Alaska Department of Natural Resources (DNR). It is also adjacent on the north end to Honeymoon Cove. It is my understanding a nomination for purchase of this parcel was made during spring and that it will be considered by the Council when it meets later this month.

With the protection and preservation of Kenai River wetlands and salmon habitat as their goal, the Beesons and Mr. Mundell wish to conserve this land in perpetuity. They believe the purchase of this land by the Exxon Valdez Oil Spill Trustee Council and management by DNR will achieve this goal.

I appreciate the Beesons and Mr. Mundell bringing this proposal forward and encourage your serious consideration of their request.

Sincerely,

P.A. Micciche

Senator Peter A. Micciche

cc: Samantha Carroll, Large Project Coordinator
Alaska Department of Natural Resources

RECEIVED
OCT 17 2013
EXXON VALDEZ OIL SPILL
TRUSTEE Council

Long-Term Herring

Herring Research and Monitoring semi-annual report

a) *Project Number: 12120111*
b) *Project Title: Herring Research and Monitoring*
c) *Team Lead Name(s):* W. Scott Pegau
d) *Time Period Covered by the Report*: Feb 1-July 31, 2013
e) *Date of Report* – August 30th, 2013
f) *Project Website* – http://pwssc.org/research/fish/
g) *Summary of Work Performed* –

Work on the program continues as originally proposed. Four of the projects are nearing completion and they are providing valuable insights to means for testing the maturation model used in the age-structure-analysis (ASA) model used for forecasting the spawning biomass (addresses program objective 1). Digitizing and measuring a portion of the Alaska Department of Fish and Game's (ADF&G) herring scale library. This is providing a glimpse into the growth of herring back through the 1980's (addresses program objective 2). Fatty acid analysis is being used to determine if we can detect immigration of fish into a bay (addresses program objective 3). And adult herring have been implanted with acoustic tags allowing them to be detected by listening arrays near the spawning grounds and at the entrances of Prince William Sound (addresses program objective 4). The ASA model has been transitioned to another framework that allows it to be used to provide Bayesian estimates of population. This model also helps to tie different program components together.

Several other projects have made the transition from the PWS Herring Survey program to the Herring Research and Monitoring (HRM) program and are just now beginning to address the project and program objectives. A short description of the progress of each project is provided below. For a couple of the most mature project we are able to provide preliminary results.

Validation of acoustic surveys – Bishop

The valves on the trawl winch were replaced and the system tested in March. The tests were successful. Additional modifications are planned to ensure safe deployment and retrieval before the November sampling cruise. In April collection of fish occurred using jigs and gill nets in support of the acoustic surveys of adult biomass. Data about the fish have been entered into a database.

Tracking seasonal movements – Bishop

A large acoustic tracking array was placed at the entrances to Prince William Sound in March. A smaller temporary array of nine acoustic receivers was also installed near the spawning grounds in Port Gravina. Sixty nine herring were collected and tagged in early April in the Port Gravina area. The fish were released in three batches back into areas with large schools of herring. The temporary acoustic array in Port Gravina was retrieved in May. One receiver was lost when the acoustic release failed. Of the 69 tagged fish, 56 were detected at least eight times. Most of the detections occurred during three distinct periods: 7-9, 15-16, and 20-26 April (Figure 1). The majority of the tagged

approve

Herring Research and Monitoring semi-annual report

a) *Project Number 12120111*
b) *Project Title Herring Research and Monitoring*
c) *Team Lead Name(s)* W. Scott Pegau
d) *Time Period Covered by the Report*: Feb 1-July 31, 2013
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Due to the timing of the placement of the acoustic array in the entrances of Prince William Sound and the fact that we found we could consistently collect fish of an appropriate size during the spawning season, but not in the fall, we delayed the schedule of this project some. We still will be retrieving data from the acoustic array either this fall or in late winter to determine if and when fish left and returned to PWS.

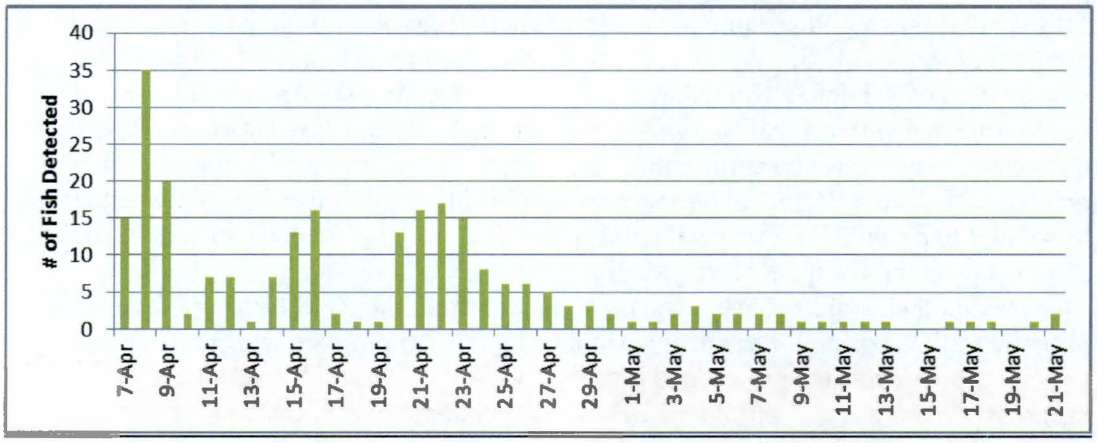

Figure 1. The number of tagged herring detected by an acoustic array near the spawning grounds near Red Head in Port Gravina. The array was installed two days after the fish tagging was completed.

Data management support – Bochenek

Data is being archived on the Workspace by investigators in the program. This work is coordinated with the effort led by the National Center for Ecological Analysis and Synthesis in the LTM program, which is collecting other historical datasets from the region. The ocean workspace has been rolled out to PIs and their user and group profiles have been created. Several training seminars have been held via webinars and PIs are beginning to use the system to organize and consolidate their project level data. Software engineers at Axiom have also been working to support workspace, resolving bugs and implementing new functionality in response to user feedback. Considerable progress has been made on the development of the Herring Portal.

Non-lethal sampling – Boswell, Pegau

Sea trials of the remotely operated vehicle occurred. The contract between PWSSC and Florida International University was set up.

Population dynamics modeling – Branch

The project took on Melissa Muradian from the QERM program at the University of Washington as a MS student. She has converted the ASA model into the statistical programming language AD Model Builder, and is changing the model from one that minimizes simple sums of squares to a Bayesian model. She has been attending classes and stock assessment conferences.

Expanded adult herring surveys – Buckhorn

Hydroacoustic surveys of adult herring schools were conducted March 27- April 5, 2013 and covered 629 nautical miles within Prince William Sound. Surveys were started in Port Gravina and Fidalgo, which have historically been surveyed by the previous hydroacoustic projects, then moved south and northwest to cover areas not previously covered.

We believe that the very cold water in the spring caused the adult herring to delay spawning so there may have been a mismatch between the cruise timing and the herring aggregating in spawning schools. We are reexamining the cruise timing to ensure it matches with expected spawn timing at various locations. The major additional spawn event in 2013 occurred at Kayak Island. Issues with boat licenses and spawn timing prevented us from being able to survey that spawning stock by boat. We were able to observe the spawn from an aircraft and land to collect samples for the genetics analysis.

Juvenile herring abundance index – Buckhorn

Post processing of raw acoustic data and analysis of data collected in November 2012 continued through this period.

Intensive surveys of juvenile herring - Buckhorn

This project is scheduled to begin surveys in October 2013 so no activity occurred during this reporting period.

Fatty acid analysis –Heintz and Vollenweider

Completed sample acquisition and participation in annual PI meeting. Lipid extraction and fatty acid sample preparation and analysis from lab study and fieldwork are ongoing. Due to limited sample availability from the high temporal and spatial resolution study in 2012, and the March 2013 herring collections for the Research and Monitoring program, sample sources from herring collections in PWS in support of the Herring Survey program were identified and analysis of these samples is ongoing.

Age at first spawning – Vollenweider and Heintz

Laboratory tests to determine if histology could detect fish that had not previously spawned were completed. Histology can identify fish that have not previously spawned and we are examining if growth indicated by the scales can be used as a marker of when a fish begins to spawn. Spawning herring were collected from spawning aggregations by

ADF&G and frozen for age/growth analysis. Herring samples were shipped to the NOAA lab in Juneau and age and growth analysis is underway. This work supports a means for determining the maturation function used by the age-structure-analysis model and addresses the first objective of the HRM program.

Herring disease project – Hershberger

This project is still transitioning from the PWS Herring Survey program to the HRM program so activities bridge the two programs. The spring herring disease surveillance collections were completed in PWS and Sitka Sound and analyzed so the data can be incorporated into the ASA model.

A new cohort of pathogen free herring are currently being reared for future laboratory experiments.

Laboratory efforts have focused on improving the detection capabilities for VEN. A cPCR for VEN has been developed and is in the final stages of validation. Other laboratory work included finishing the processing of samples from the 2nd VHSV temperature study.

A manuscript summarizing and synthesizing the past seven years of *Ichthyophonus* surveillances in herring from the NE Pacific is in preparation. Five other publications have either been published or submitted.

Wilson, A. E., T. L. Goldberg, S. V. Marquenski, W. J. Olson, R. F. Goetz, P. K. Hershberger, K. L. Toohey-Kurth. *Submitted.* Development and evaluation of a blocking enzyme-linked immunosorbent assay and virus neutralization assay to detect viral hemorrhagic septicemia antibodies. Journal of Clinical Microbiology.

Emmenegger, E.J., C.H. Moon, P.K. Hershberger, G. Kurath. *Submitted.* Virulence Assessment of viral hemorrhagic septicemia virus (VHSV) genotypes Ia, IVa, IVb, and IVc in salmonid, cyprinid, clupeid, and percid fishes. Diseases of Aquatic Organisms.

Lovy, J., P. Piesik, P.K. Hershberger, K. A. Garver. 2013. Experimental infection studies demonstrating Atlantic salmon as a host and reservoir of viral hemorrhagic septicemia virus type IVa with insights into pathology and host immunity. Veterinary Microbiology 166: 91-101.

Kocan, R, S. LaPatra, P. Hershberger. 2013. Evidence for an amoeba-like infectious stage of *Ichthyophonus* sp. and description of a circulating blood stage: a probable mechanism for dispersal within the fish host. Journal of Parasitology 99: 235-240.

Hershberger, P.K., M. K. Purcell, L.M. Hart, J.L. Gregg, R.L. Thompson, K.A. Garver, J.R. Winton. 2013. Influence of temperature on viral hemorrhagic septicemia (Genogroup IVa) in Pacific herring, *Clupea pallasii* Valenciennes. Journal of Experimental Marine Biology and Ecology 444: 81-86.

Herring condition monitoring – Kline and Heintz

Collection of samples in March was completed as scheduled. Processing of the fish to determine the energetic content and RNA/DNA has begun. The November samples should be completed later this fall and the March samples by December.

The databases containing the condition information at PWSSC have been combined into a single spreadsheet for easier sharing and access by others.

A setback to the project occurred when one of the principal investigators (Dr. Thomas Kline) left the Prince William Sound Science Center in June 2013. The Science Center is currently seeking a replacement for Dr. Kline and Dr. Pegau has taken responsibility for the project until a suitable replacement can be found. The gap in personnel may impact the completion of the analysis of this project, however Dr. Pegau worked with Dr. Kline to ensure a smooth transition of materials and is in a position to rapidly bring a new person up to speed or complete the deliverables if needed.

Juvenile herring intensive monitoring – Kline and Heintz

The milestones of sample collection and processing for this project were completed as scheduled. During late winter the numbers of samples were limited as the fish became more difficult to locate. All fish have been processed for energetic condition variables and the analysis phase is in progress. The RNA/DNA processing and analysis remain underway. Preliminary analysis shows the juvenile herring reaching peak energetic density in November with a steady decline from then until sometime around March when feeding was able to begin to restore energetic reserves. This project is addressing the program's third objective by demonstrating that we are sampling at the correct times of the year to observe the peak and minimum in condition.

A setback to the project occurred when one of the principal investigators (Dr. Thomas Kline) left the Prince William Sound Science Center in June 2013. The Science Center is currently seeking a replacement for Dr. Kline and Dr. Pegau has taken responsibility for the project until a suitable replacement can be found. The gap in personnel may impact the completion of the analysis of this project, however Dr. Pegau worked with Dr. Kline to ensure a smooth transition of materials and is in a position to rapidly bring a new person up to speed or complete the deliverables if needed.

Scales as growth history records – Moffitt

Since 1 February, Pacific herring scales from the Alaska Department of Fish and Game archive have been randomly selected, scanned to a digital image, and growth increments measured with image analysis software. About 6,000 scales from spring collections in 1985–2012 were scanned and 4,793 were selected for growth increment measurements (Table 1). Scales were selected from those that were originally interpreted as age 4, 5, or 6. Through 5 August 2013, the growth increments for 1,784 scales were measured.

Documentation of scale collections is not as good in years prior to 1985. Hand written labels on slides that do not include file names has slowed the process of matching scales and age data.

A preliminary examination of the first year growth of age 6 fish indicates that growth is unlikely to be dependent on a single factor in an individual year. That is, no single factor is likely to explain the differences in growth among years. For example, the preliminary data indicate the largest average growth in the first year of age-6 fish occurred in 1993 (Figure 2). ADF&G's age structured models indicate that the herring biomass declined significantly in the winter of 1992/1993, so there would have been less competition for food resources, but 1993 was also a year with below average zooplankton production. The growth in the first year is not a good predictor of future recruitment although it might be a good indicator of survival.

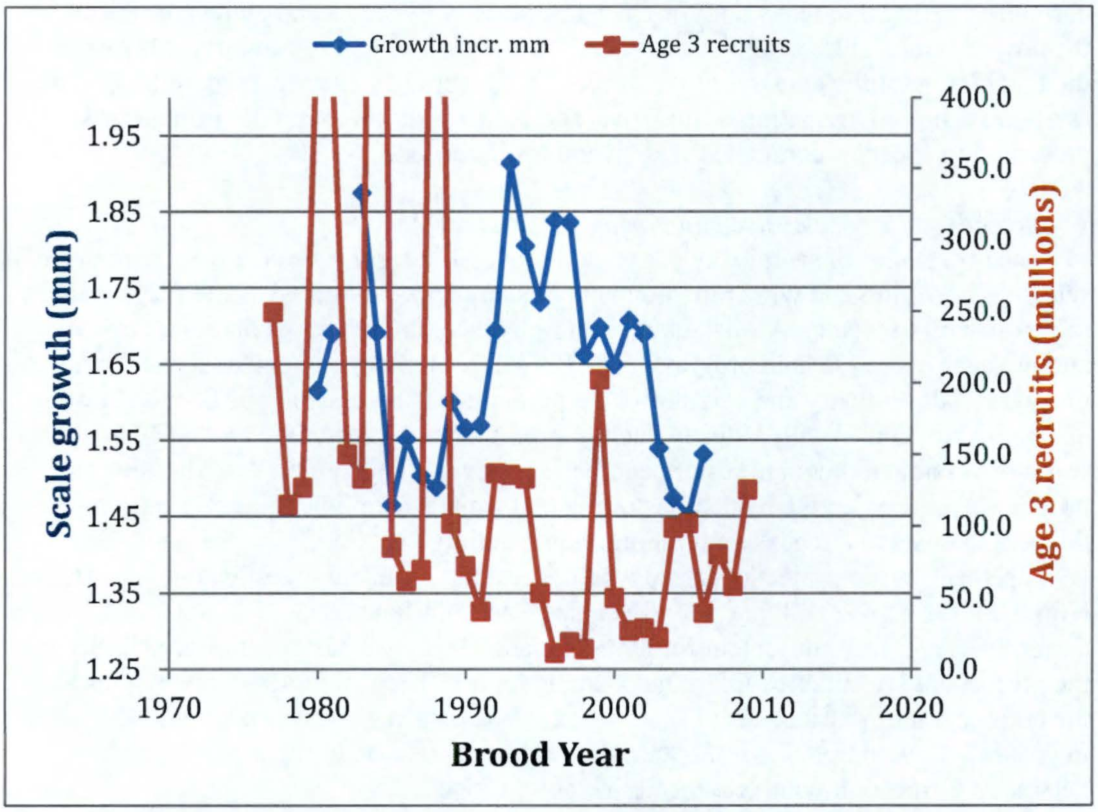

Figure 2. The blue line shows the mean growth increment of scales during the first year of life. The red line is the subsequent recruitment of age-3 fish from that brood year.

Coordination and logistics - Pegau

Three Cordova District Fishermen United vessels were contracted for juvenile herring sampling in March. The fall sampling sites were resampled and samples collected at two additional locations. The juvenile fish collected in March were stored on ice until their return to Cordova. This allowed some of them to be damaged. We have since purchased portable freezers for the fishermen to ensure the samples remain intact. Vessels were also contracted for the expanded adult herring survey and the fish tracking project.

The several meetings between the investigators in this program and the PWS herring survey program occurred through the winter with the final meeting occurring in March.

Samples were collected from Kayak Island for the herring genetics project. We worked with the forage fish project of the LTM program to provide aerial observations of forage fish while they sampled the schools to validate size and composition.

We were asked by a spotter pilot if herring spawn could be observed in satellite imagery. The information was requested to help guide when and where to send a plane to document spawn. The request was also prompted by a large spawn event at Kayak Island, which is outside the normal survey region. We determined that under certain circumstances that spawn can be observed in the visible wavelengths of satellites operating in the area (Figure 3). The region must have clear skies, the satellite needs to be close to overhead, and the spawn event must be fairly large since the pixel size of the satellite being used is 250m. The broad shelf at Kayak Island produces large areas of spawn that make it easier to be detected by the satellites, although it does suffer from cloud cover. These images are made available within a couple hours through the Geographic Information Network of Alaska at the University of Alaska Fairbanks. The pilot was able to follow the imagery and detect a second spawn event at Kayak Island and fly out that day to document it. The satellite has been operating for several years, but only the data since 2010 is available on the GINA website. Reviewing what was available we were able to see spawn at Kayak Island one other year and could see some major spawn events within PWS, but most were too small to be observed. Cloud cover is also an extremely limiting factor for the use of this tool. We continue to look for other satellites that can fill in gaps in the temporal coverage, greater historical data records, and systems with higher spatial resolution that may observe smaller spawn events. We anticipate this information to be useful in identifying other spawning areas and the timing of spawn events that are needed in the expanded adult surveys and genetics sampling projects.

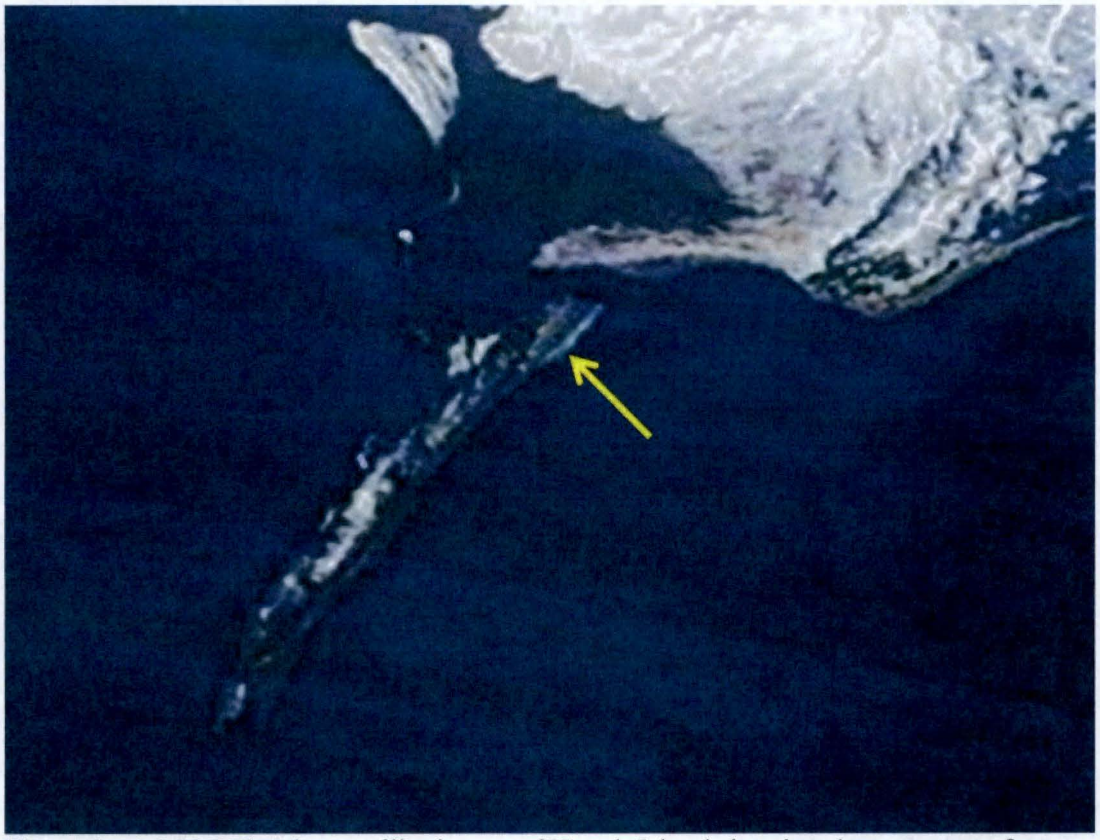

Figure 3. A MODIS color satellite image of Kayak Island showing the presence of herring spawn (yellow line points to the area of spawn).

Outreach - Butters

All outreach deliverables have been met. The outreach project transitioned the herring research webpages to the new PWSSC website. The transition allowed us to better organize the available outreach products. The new website can be accessed at http://pwssc.org/research/fish/pacific-herring/. Project profiles, Field Notes radio program, and school programs have been developed and delivered. The herring program was highlighted at the Ocean Fest public science events in Cordova and Valdez. Individual investigators presented on their research at forums, such as the Alaska Marine Science Symposium.

h) *Summary of Future Work to be Performed* –

Work in this program is still progressing along as originally proposed. The one change in schedule of importance is in the tracking seasonal movements project. In that project the tagging period was shifted from the fall to the spring to take advantage of a larger receiving array that was deployed in March 2013 and we found it better to collect fish near the spawning grounds than during the fall as originally proposed. Project specific work descriptions follow.

Validation of acoustic surveys – Bishop
There are several cruises for the juvenile intensive survey and the juvenile abundance index survey projects that will be supported during the upcoming period. We continue to make adjustments to the deployment method for the trawl to ensure it can be deployed in a safe and rapid manner. It is expected that the trawl will be the primary method of fish capture for acoustic validation and for providing fish to the condition monitoring and disease programs. We will still have gill nets and cast nets if they are needed to provide fish for those projects.

Tracking seasonal movements – Bishop
Data analysis from the tag detections in Port Gravina remains an ongoing task. This fall or winter we will be uploading data from the Ocean Tracking Network receivers. That data will provide information on if and when herring leave and return to PWS.

Data management support – Bochenek
Data from the past two field seasons will be ingested into the data management system. We will continue to refine and expand the information available through the Herring data portal.

Non-lethal sampling – Boswell, Pegau
Initial tests of the combined remotely operated vehicle and Didson sonar units will occur in October or November. These tests will be used to determine if any changes in the deployment system are needed prior to the spring herring survey period.

Population dynamics modeling – Branch
The student will complete all required coursework by fall 2013. We will begin working on a manuscript on the revised ASA model and present results at the Alaska Marine Science Symposium.

Expanded adult herring surveys – Buckhorn
Analysis of data collected in 2013 will be completed. We will examine historic records of spawn, adult concentrations, and bird and mammal observations to identify the most likely times and locations for additional surveys.

Juvenile herring abundance index – Buckhorn

In November eight bays in PWS will be surveyed using a 120 kHz split-beam hydroacoustic unit in a stratified systematic survey design. The eight bays will include the four SEA bays to maintain continuity with previous sampling efforts. Bays will be stratified as MOUTH, MIDDLE, and HEAD The areal extent of each strata will be based upon the variance of mean densities from previous surveys in order to reduce overall variance in abundance estimates. A midwater trawl will be used to sample randomized transects within each strata (See Bishop) and will be directed to size and species composition.

Intensive surveys of juvenile herring - Buckhorn

A series of four cruises will start in October 2014 and extend to the first week of December. We propose to conduct the surveys in two bays sufficiently adjacent to cover each bay each night, such as Simpson Bay and Windy Bay. The surveys in October will be spaced about two weeks apart. The last cruise will be in December with the juvenile herring abundance index cruise in November. Each of the two bays will be surveys 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. 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.

Fatty acid analysis –Heintz and Vollenweider

Analysis of fatty acid samples will continue and is expected to be completed by September 2013. We anticipate being able to address objectives 1 and 2 as proposed, while our ability to address objectives 3 – 5 will be limited due to fish not being caught at the necessary spatial scales in both fall and spring. Preliminary results are to be presented at the AK Marine Science Symposium, Anchorage, AK in January 2014, and future meetings of PI's for the Herring Research and Monitoring program.

Age at first spawning – Vollenweider and Heintz

We anticipate completing the age and growth analysis of scales from the spring spawning aggregation. Preliminary results are to be presented at the AK Marine Science Symposium, Anchorage, AK in January 2014, and future meetings of PI's for the Herring Research and Monitoring program.

Herring disease project – Hershberger

This project is still transitioning from the PWS Herring Survey program to the HRM and has not received funding as part of the HRM program yet. Laboratory studies of factors involved in the detection and transmission mechanisms of the primary herring pathogens remain underway.

Herring condition monitoring – Pegau and Heintz

Future work focuses on the continued collection and analysis of juvenile herring. We are not anticipating any variance from the originally proposed activities of a collection cruise in November. Sample processing will be emphasized through the fall period and we expect the existing samples from November 2012 and March 2013 will be processed during the upcoming period. With spatially-matching fall and spring collections available in only one bay in 2012-2013, most data analysis will likely involve PWS-wide pooling of samples. Data analysis and reporting findings is planned after completion of analysis of all samples in fall 2013. We are examining ways of using the same fish for processing by both portions of this project. This is important when the number of fish collected at a single location is limited.

We expect a new Primary Investigator will be named to oversee the component at the Prince William Sound Science Center.

Juvenile herring intensive monitoring – Pegau and Heintz

We expect to continue the work as originally proposed. Processing of the samples for RNA/DNA analysis will be completed. Future work is focused on the analysis of condition data collected in 2011-2012.

We expect a new Primary Investigator will be named to oversee the component at the Prince William Sound Science Center.

Scales as growth history records – Moffitt

We expect to finish measurements of scale growth increments on the scales that have been digitized.

Coordination and logistics - Pegau

Vessel contracts will be established for the November herring survey and the acoustic intensive project that begin in October. We expect to test the non-lethal sampling system this fall. We are also am exploring the opportunity to present results of the program as a whole at the Alaska Fisheries Society meeting. Coordination between the HRM and Gulfwatch Alaska (GWA) programs will occur at the November GWA PI meeting.

Outreach - Butters

Project work will proceed according to the original proposal. We will continue to update the new herring research website. In addition, the three *Field Notes* programs will be finished by December 2013 to complete this milestone for FY13.

FY14 PROGRAM PROPOSAL FORM

Program Title: PWS Herring Research and Monitoring

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

Team Lead(s): W. Scott Pegau, Prince William Sound Science Center, Box 705 Cordova, AK 99574 ph: 907-424-5800 x222 email wspegau@pwssc.org

Abstract:

The goal of the Herring Research and Monitoring program is to improve the predictive models of herring stocks through observations and research. The program is designed around a twenty year time frame with changes in emphasis of the process studies every five years. During this period we have four objectives to help us move towards our goal. They are: *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model. Inform the required synthesis effort. Address assumptions in the current measurements. Develop new approaches to monitoring.*

A combination of monitoring and process studies will be used to address these objectives. The monitoring projects follow changing conditions and provide inputs to modeling efforts. The process studies are designed to be much shorter and to answer a very specific question.

The monitoring components include tracking the prevalence of disease, increased adult biomass surveys, and juvenile condition and biomass surveys. All of the monitoring components address the first objective.

There are seventeen studies that range in length of one to five years designed to address the different objectives. To address the first objective we are examining the age that fish join the spawning stock, the genetic structure, and examining the approaches available to model herring stocks. To address the second objective we are working on gathering relevant datasets and providing visualization, conducting an analysis using the herring scale library owned by ADF&G, and providing coordination between projects to examine the connectivity. To address the third objective there are intensive studies of juvenile condition and acoustic estimates of juvenile populations, trying to determine if immigration may impact our surveys, providing validation to the acoustic surveys, and conducting laboratory studies of disease. We are looking to herring tagging, disease forecasting, and non-lethal acoustic validation to address the last objective.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
1,027,225	1,264,786	1,358,431	1,294,916	1,241,527	6,186,885

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date:
August 30, 2013

A. Summary of work performed to date

Some of the projects in this program are nearing their end, while others are just starting. We were able to work with the PWS Herring Survey program that proceeded the HRM program to ensure we maintained the scientific schedule even though there was a shift in the funding dates. During the development of the synthesis for the herring survey program there were several meetings where investigators from both programs were invited to ensure everyone was aware of what people had done and what was planned. We anticipate being able to build off the synthesis that was completed in 2013 in our synthesis due in 2014

Sampling for the Juvenile Herring Intensive and Fatty Acid Analysis projects occurred in 2011 and 2012 and those fish have now been processed and the data being analyzed. The Juvenile Herring Abundance Index project sampled seven bays in November 2012 and fish were collected by the Validation project for the disease and herring condition projects. Fishermen from Cordova then sampled the same locations in March of 2013. The Expanded Adult Surveys were conducted as scheduled in April 2013. Fortunate circumstances allowed us to collect a rare sample of herring spawning at Kayak Island in April 2013. This sample was turned over to ADF&G for their age-sex-length analysis and will then be sent to NOAA for inclusion in the genetics study that is about to start.

Fish were collected for the Age At First Spawning project and the laboratory tests to determine if histology could detect fish that had not previously spawned were completed. Histology can identify fish that have not previously spawned and we are examining if growth indicated by the scales can be used as a marker of when a fish begins to spawn. The Scales As Growth History Records scanned a portion of the ADF&G herring scale library and begun making the measurements of growth over time. Early results indicate that growth in the first year of life has experienced pronounced changes over time and is not a good predictor of recruitment (Figure 1). The Age At First Spawning project will use the data from Scales As Growth History Records project to examine if the age at first spawn can be determined by changes in growth rate.

Adult herring were implanted with acoustic tags in April 2012 and 2013. A temporary array of receivers was installed near the spawning grounds in Port Gravina was installed two days after the fish were tagged.Of the sixty nine fish tagged in 2013 fifty six were detected by a receiving array near the spawning grounds. Detections peaked three times in April and some fish were still being detected into May when the spawning ground array was retrieved (Figure 2) Behavior of the detections in May were consistent with live fish and not tags that were lost or fish consumed by predators. We are still awaiting data from the receiving arrays that are installed in the entrances to determine if the fish left Prince William Sound.

The modeling program selected a student to work on the project and she has transitioned the age-structure-analysis model used by ADF&G to ADModel framework to allow for Bayesian predictions and testing the importance of different pieces of information being provided to the model.

The outreach project transitioned the herring research webpages to the new PWSSC website. The transition allowed us to better organize the available outreach products. The new website can be accessed at http://pwssc.org/research/fish/pacific-herring/. Project profiles, Field Notes radio program, and school programs have been developed and delivered. The herring program was highlighted at the

Ocean Fest public science events in Cordova and Valdez. Individual investigators presented on their research at forums, such as the Alaska Marine Science Symposium.

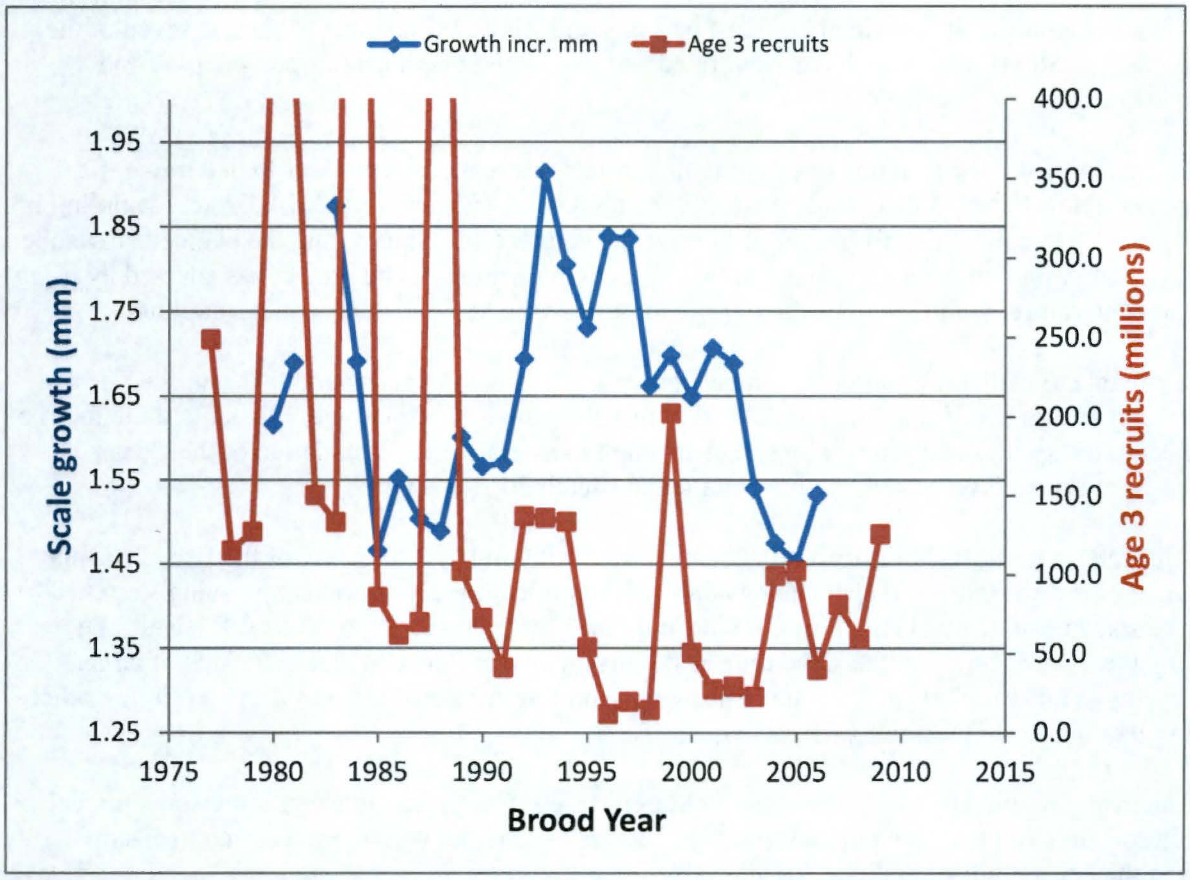

Figure 1. The blue line shows the mean growth increment of scales during the first year of life. The red line is the subsequent recruitment of age-3 fish from that brood year.

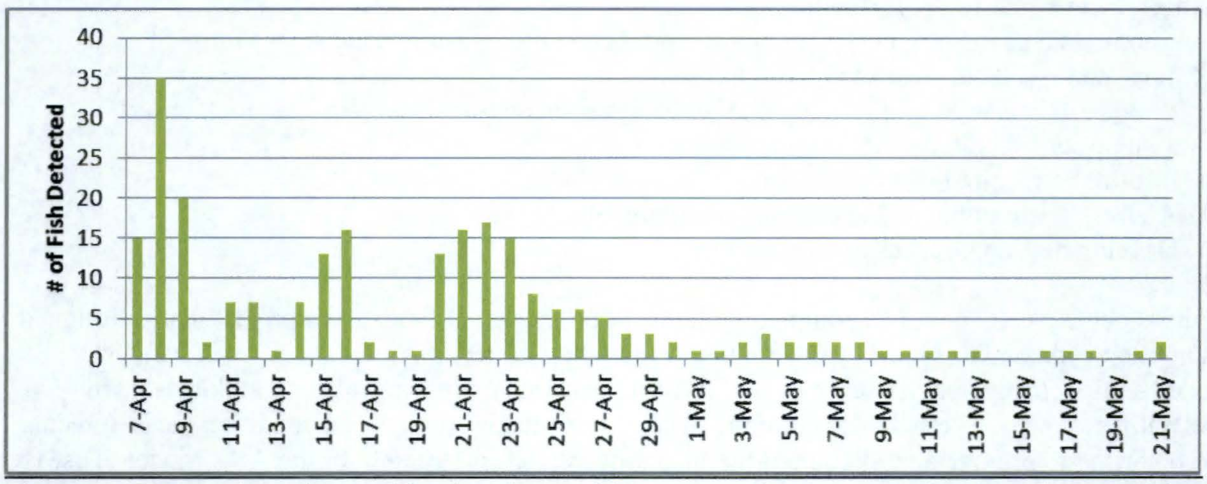

Figure 2. The number of tagged herring detected by an acoustic array near the spawning grounds at Red Head. The array was installed two days after the fish tagging was completed.

The program has experienced some setbacks. A new trawl system for collection of fish was purchased just prior to the November 2012 cruise. The valves on the trawl winch were undersized and the system could not be used so we used gill nets and cast nets as we had in the past for sampling during this cruise. Diagnosing the issues with the winch also cost us a day and we were only able to sample seven of the planned eight locations. The winch has been fixed and confirmed that it can properly deploy and retrieve the net.

The fatty acid project was designed to examine fish from several nearby locations to determine if a difference could be detected that would be useful for tracking movement of the fish. A test sampling in August was able to collect fish from four of the five desired locations, but during the planned November and March sampling fish were only found at two of the five locations. The project has adapted by using more fish from sampling the previous three years to provide the best possible spatial sampling.

We were unable to gather herring in November for the tagging project and found that sampling during the spawning season resulted in quicker collection of fish of an appropriate size. We shifted the focus of the project to the spring, which also allowed us to adapt to a delay in the installation of the Ocean Tracking Network receiver array that was installed in March 2013.

Very cold water temperatures in April 2013 delayed spawning in PWS for many of the fish. This may have made it very difficult for the expanded adult survey project to identify other spawning stocks. The only large spawn event outside the Port Gravina and Port Fildago regions was at Kayak Island. The spawning at Kayak occurred at the same time as the first spawn at Port Gravina. The lack of larger spawn events in other regions may create issues with sampling for genetics as well as identifying other spawning biomasses for the adult surveys to quantify.

Juvenile herring sampled by local fishermen in March were stored on ice and degrading some prior to being returned to Cordova. We purchased travel freezers to send out with the fishermen to ensure the fish are in the best possible condition for analysis.

B. Summary of work to be performed

The long-term goal of the program is to improve predictive models of herring stocks through observations and research. The objectives are:

1) Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model.
2) Inform the required synthesis effort.
3) Address assumptions in the current measurements
4) Develop new approaches to monitoring.

To address objective 1 we will be completing the work on the age at first spawn project that is designed to determine the parameters used by the maturation function of the ASA model. We will conduct expanded adult herring biomass surveys to provide information on herring spawning biomasses in Prince William Sound. We will also continue to conduct acoustic surveys and condition measurements of age-0 herring to provide a prediction of the incoming year class strength for the ASA model. Disease prevalence sampling will be conducted to provide information used by the ASA model. We will conduct simulations to test which data sources are most important in assessing the population estimate derived by the ASA. We will begin sampling different spawning populations to determine if there are genetic differences that may suggest multiple stocks within the region.

The required synthesis referred to in objective 2 will be prepared during this year It will benefit from the completion of the scales as growth history records project that will provide an opportunity to examine how growth rates have changed through the last three decades and how that may tie to different oceanographic conditions. Improvements in the herring portal and other aspects of the data management system scheduled to be completed by the data management support project.

To address objective 3 we will be completing the fatty acid analysis project designed to look at the issue of immigration affecting the juvenile herring surveys. We will also be continuing the intensive surveys of juvenile herring that will begin in October 2013. These surveys are designed to determine the repeatability of our estimates through time. The intensive monitoring of juvenile herring condition will be wrapping up the analysis phase and provide the information necessary to determine if our sampling periods are appropriate for the questions being asked about the changes in overwinter condition. We will continue to collect samples to validate the interpretation of the acoustic survey measurements.

Addressing objective 4 we will be completing the analysis of the acoustic tracking of adult herring. This method may greatly expand our understanding of the movements of adult herring. We will continue to our testing of non-lethal approaches to validating the acoustic measurements using cameras and imaging sonar. That effort will be starting in the fall of 2013.

The coordination and logistic efforts will ensure coordination within the program, coordination with the Gulfwatch Alaska program, logistics for the various components, and be responsible for the synthesis. The outreach and education component will continue to provide materials and delivery of outreach to reach a broader audience than is normally reached by a scientific program.

The milestones listed in the original program proposal are provided below. More detailed deliverables can be found in the project proposals.

FY14 2nd Quarter

March	Complete histology study, complete acoustic intensive
March	Conduct spring juvenile collection
Winter	EVOS sponsored workshop with Herring and Long-term monitoring programs (This has been rescheduled for the following year)

FY14 3rd Quarter

April	Conduct extended adult biomass cruise, collect samples for genetics, submit fatty acid report
May	Conduct annual PI meeting, complete written outreach materials
June	Submit FY15 work plan for review (This now occurs at the end of August)

FY14 4th Quarter

August	Submit annual report
September	Complete acoustic tagging project, Complete non-lethal sample testing
September	Complete annual outreach efforts

FY15 1st Quarter (October 1, 14 to December 31, 14)

October	Assess data submitted to data management
November	Conduct juvenile index survey, validation and sampling for energetics and disease
November	Submit synthesis report to EVOS (This was rescheduled from an earlier date.)

C. Budget changes from prior years

All budget changes in FY14 from the original proposal are a result of changes made in the FY13 proposal to allow funding to match the research deliverables. The reductions in budgets described below are because the funds were received in FY13

Pegau – Coordination and Logistics

FY14 Subtract $40,070 for Boswell subcontract
Subtract $15,600 for boat days
Subtract $12,180 for indirect

Buckhorn – Juvenile Herring Intensive Monitoring

FY14 Subtract $21,000 personnel
Subtract $6,300 indirect

D. Completed budget spreadsheet (attached).

The detailed budgets for all projects and summaries by organization can be found in the attached workbook. The overview showing the totals each year is provided below. This budget includes the Herring Population Dynamics modeling project that was approved as an addition to the original HRM proposal.

Budget Category:	FY 12	Proposed FY 13	Proposed FY 14	Proposed FY 15	Proposed FY 16	TOTAL PROPOSED		Original FY 14	Difference FY 14
Personnel	$201,500	$377,300	$535,700	$524,200	$518,000	$2,156,700		$556,700	($21,000)
Travel	$26,800	$31,500	$47,000	$49,700	$46,600	$201,600		$47,000	$0
Contractual	$336,960	$544,799	$406,188	$367,616	$362,757	$2,018,320		$461,858	($55,670)
Commodities	$81,600	$33,700	$104,100	$100,300	$67,100	$386,800		$104,100	$0
Equipment	$187,200	$0	$0	$0	$0	$187,200		$0	$0
Indirect Costs (*will vary by proposer*)	$108,500	$173,030	$153,200	$146,100	$144,370	$725,200		$171,680	($18,480)
SUBTOTAL	$942,560	$1,160,329	$1,246,188	$1,187,916	$1,138,827	$5,675,820		$1,341,338	($95,150)
General Administration (9% of subtotal)	$84,665	$104,489	$112,291	$106,991	$102,656	$511,093		$114,700	($2,409)
PROJECT TOTAL	$1,027,225	$1,264,818	$1,358,479	$1,294,907	$1,241,483	$6,186,913		$1,456,038	($97,559)
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		$0.0	$0

E. Proposals from each individual project contained within the program.

Attached are project proposal forms from the fourteen projects that are requesting funding in FY14.

Attachments:

Program Project Proposal Form
Budget Form

FY14 PROGRAM PROJECT
PROPOSAL FORM

Project Title: PWS Herring Research and Monitoring Validation of Acoustic Surveys for Pacific Herring Using Direct Capture

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

Primary Investigator(s): Mary Anne Bishop, Ph.D., Prince William Sound Science Center, Cordova
mbishop@pwssc.org

Abstract:
Acoustic surveys provide a relatively low-cost, remote sensing tool to estimate species-specific fish biomass and abundance. Interpreting acoustic data requires accurate ground truthing of acoustic backscatter to confirm species and length frequency of insonified targets. Since November 2012, juvenile and adult herring acoustic surveys have been conducted in November and late March, respectively. Pelagic trawls are the recommended method for validating species composition and for obtaining relatively unbiased information on length frequency distribution, age, and other biological information. Here we propose to use a low-resistance, light-weight midwater sweeper trawl capable of towing speeds (up to 3 knots) as a method to ground truth acoustic surveys for juvenile herring. Our pelagic trawl surveys will take place in conjunction with and onboard the same vessel as three studies in the *PWS Herring Research and Monitoring* program: a) *Juvenile Herring Abundance Index* (years 2-5); b) *Acoustic Consistency: Intensive Surveys of Juvenile Herring* (year 3). Because of concerns of the Alaska Department of Fish and Game, for the March *Expanded Adult Herring Surveys* (years 2-5) we are being required to use gillnets and jigging for validation. Our project will provide data on species composition and length frequency to aid in the interpretation of current and historical acoustic surveys. In addition it will provide adult herring samples to Alaska Department of Fish and Game for the adult herring age-structure-analyses model and will provide juvenile herring samples to researchers investigating juvenile herring fitness and disease. Our trawls will also provide fishery-independent surveys for non-herring species, thus increasing our knowledge of pelagic fishes in Prince William Sound.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
68,000	90,600	148,000	141,100	145,300	593,000

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: August 30, 2013

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the *Exxon Valdez* Oil Spill (EVOS) occurred. In the EVOS settlement, herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival. Described here is one project of a multi-project program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. The long-term goal of the overall multi-project program is to improve predictive models of herring stocks through observations and research.

We recognize that a major deficit in the existing *PWS Herring Survey* program is the lack of an effective means of validating the acoustic signal. Fortunately, if we can establish through direct capture of insonified fish that certain patterns in echograms can be interpreted as different year classes of herring, then we may be able to reanalyze historical acoustic measurements to better understand changes in juvenile herring populations.

From November 2007 through March 2012, juvenile herring acoustic surveys were conducted at the beginning (November) and end (March) of each winter. A variety of methods were used with limited success to ground truth these surveys. Small mid-water trawls used during fall 2007 and fall 2009 cruises failed to catch fish. In most cases, these trawls were towed 1 day after the acoustic survey and always from a different vessel. Trawling speeds were typically 2-3 knots, producing a high level of net avoidance by the targeted fish. Variable mesh gill nets have also been used to validate acoustic surveys; however, gillnets select for faster swimming fish (Thorne et al. 1983) and in PWS, gillnet deployments have resulted in very small catch rates of juvenile herring.

Pelagic trawls are the recommended *in situ* method for validating species composition and for obtaining relatively unbiased information on length frequency distribution, age, and other biological information (Simmonds et al. 1992, McClatchie et al 2000, Adams et al. 2006, NOAA 2009). In the proposed program we plan to use a low-resistance, light-weight mid-water sweeper trawl capable of towing speeds of 2-3 knots designed specifically to capture juvenile forge fish as a direct capture method for collecting the number of fish necessary to provide validation. These surveys will take place as part of two studies in the *PWS Herring Research and Monitoring*: These include: a) *Juvenile Herring Abundance Index* (years 2-5), b) *Acoustic Consistency Intensive Surveys of Juvenile Herring* (year 3). A third study, *Expanded Adult Herring Surveys* (years 2-5) will use gillnets and cast nets to ground truth insonified fish, due to overfishing concerns of Alaska Department of Fish & Game.. Principal Investigators for these three studies are Buckhorn and Thorne. In addition to ground truthing acoustic surveys, in year 1 we will use the trawl along with cast nets to collect juvenile herring during the 9-month intensive A *High-Temporal & Spatial Resolution Study to Validate the Separate Herring Condition Monitoring Programs* (Principal Investigators Kline and Heintz).

B. Summary of Project to Date (if applicable)

All milestones are on track and scheduled to be completed by November 2015 (1 milestone), or in 2016 (4 milestones). The first direct capture study, *HRM. A High Temporal and Spatial Resolution Study to Validate the Separate Herring Condition Monitoring Program* (PI's Kline and Heintz) began in August

2011 (pre-award) and was completed in June 2012. Personnel from this study assisted with the monthly direct capture on several occasions, under the direction of HRM project leader Scott Pegau.
Our first multi-project direct capture effort was scheduled for November 2012 in conjunction with the *HRM study Juvenile Herring Abundance Index*. Prior to that juvenile herring survey and to ensure that our validation methods would be appropriate for our study area and goals, Megan McKinzie, the project's fisheries biologist, participated in the EVOS Gulfwatch study: *Monitoring long-term changes in forage fish distribution, abundance, and body condition in Prince William Sound* (USGS Alaska Science Center, PI's Piatt and Armitsu). From July 20-26, 2012 McKinzie was onboard the *R/V* Alaskan Gyre with other scientists assisting with data collection. In addition to acquiring experience fishing the mid-water trawl, McKinzie acquired critical information to determine the appropriate net and mesh size required for our herring validation surveys.

When we wrote the original proposal for this project we planned to use a trawl that was part of the PWS Science Center's inventory. Unfortunately, this trawl was lost during field work on another project, forcing us to purchase a new trawl. Due to hydraulic compatibility issues between our reel/winches and the charter vessel during the initial November 2012 survey we were unable to obtain sufficient power to successfully deploy and haul our mid-water sweeper trawl, despite several attempts at system modifications and replumbing. Therefore, within each survey bay variable mesh adult and juvenile herring gillnets were deployed and allowed to soak overnight in areas of high acoustic signature as an alternative validation method. To provide samples to the juvenile herring and disease projects conducted concurrently with the acoustic surveys we supplemented our validation efforts with a small mesh gillnet and cast nets. All fish captured were identified to species, separated and measured for total length and weight.

The first expanded adult herring acoustic survey began late March through early April 2013 aboard the *R/V Auklet* We collected fish for Herring and Research Monitoring acoustic validation and genetics studies primarily using jigs and gillnets, and to a lesser extent castnets. We did not utilize the mid-water trawl for the adult survey validation component because of ADFG concerns that too many adult herring would be captured.

To prepare for the upcoming fall 2013 juvenile herring survey, we made equipment adjustments to our trawl winches and our hydraulics. On 15 March 2013 we successfully tested the trawl to ensure it is fully functional and that we have the necessary power to deploy and retrieve the net. From October 2013-December 2013 we participate in the biweekly *Juvenile Herring Intensive Acoustic & Validation Surveys*. In addition, in November 2013 we will conduct the validation surveys for the annual *Juvenile herring abundance index* acoustic surveys.

II. PROJECT DESIGN

A. Objectives

This study, *Validation of Acoustic Surveys for Pacific Herring Using Direct Capture*, is a process study that addresses objective 3 of the *PWS Herring Research and Monitoring: **to address assumptions in the current measurements*** Our study will provide the ability to rapidly improve our understanding of the herring population in PWS. This effort will allow the design of the most accurate and efficient monitoring program.

Objectives specific to the *Direct Capture* study include:

1) Improve capture methods used for ground truthing acoustic surveys.

2) Increase the sample size for identification, quantification, and measurement of juvenile (0+, 1+, 2+) and adult (3+ and older) herring schools as well as other fish schools in survey areas.

3) Provide data on species composition and length frequency to aid in the interpretation of current and historical acoustic surveys.

4) Provide adult herring samples to Alaska Department of Fish and Game for the adult herring age-structure-analyses model.

5) Provide juvenile herring samples to researchers investigating juvenile herring fitness and disease.

In addition, to providing better information on acoustic targets. this study will bolster the current understanding of pelagic species composition and abundance in PWS.

B. Procedural and Scientific Methods

Field Collections and Laboratory Methods

To provide accurate data on insonified fish, the trawl will be towed simultaneous with acoustic surveys for juvenile herring and from the same research vessel. Based on our sampling objectives, desired species and age classes it was determined that a mid-water sweeper trawl would be the most effective net design. The net has an approximately 154 m^2 mouth (14 m x 11m) and is 22 m long. Mesh size diminishes from 38 mm at the mouth to 12 mm at the cod end (Innovative Net Systems, Inc.). The net is held open by two 0.4 m^2, series 2000 steel mid-water trawl doors (Nor 'Eastern, Inc.); each weighing approximately 76 lbs. The net and doors are deployed via dual winches with enough 3/8" dynema line to fish to a maximum depth of about 70 m. Target depth for juvenile herring capture is 15-25 m. Until a trawl master can be obtained, trawl depth and water temperature will be recorded every second using a DST centi-TD temperature depth recorder (Star-Oddi). To analyzed trawl performance and net orientation the trawl will also be equipped with as DST-tilt sensor (Star-Oddi). Data will be downloaded and reviewed between trawls. Average trawling speeds will be 2-3 kts.

Validation of acoustic echograms relies on ground trothing acoustic backscatter to confirm species composition and length frequency distribution of insonified fish (McClatchie et al. 2000). In each survey bay, we will conduct three 1-km tows in areas and depths with the strongest acoustic signature, as designated by the lead acoustician. For each haul, all catch items will be collected, broken down by species, then weighed and measured. In the case of large hauls, a random sub-sample of the catch will be collected and measured. For all non-herring species, 60 individuals/species will be randomly selected along with 200 herring for the collection of morphometric data.

Species composition and length frequency will be characterized by identifying all fish to species and measuring individual total length, fork length, standard length and weight. Juvenile herring of age 0+ and 1+ can be reliably aged based on length (Norcross et al. 2000, Kline unpubl. data), however, herring >150 mm will be aged using scale conventions developed by Alaska Department of Fish and Game (ADF&G). Adult herring captured during expanded spring surveys will be measured, sexed, aged, and assessed for spawning condition. Adult herring samples will be processed in collaboration with the Cordova office of ADF&G so that data can be incorporated into the ADFG herring age-structure-analysis model. All herring scales will be archived with ADF&G.

C. Data Analysis and Statistical Methods

Acoustic-based estimates of fish abundance rely on unique target strengths obtained for each fish species according to fishes' behaviors, physiologies, anatomies and morphologies, in addition to physical characteristics of the surveyed environment (Hazen and Horne, 2003). In most cases, the target strength obtained from hydroacoustic surveys is best described by the equation:

$$TS = m \log L + b + \varepsilon$$

where TS is the target strength, m and b are species specific coefficients, ε is an error term and L is the mean fish length for the school (McClatchie et al., 1996, Stokesbury et al. 2000). Thus in order to validate acoustic signals, the aforementioned trawls will provide requisite species and length data necessary to obtain values of m, b and L. Trawl data will be compiled for such validation analysis by Dr. Buckhorn. See Buckhorn and Thorne proposal for details on echo integration and acoustic surveys. In addition to facilitating the validation of acoustic survey data, the proposed trawls will provide valuable fishery independent data on non-herring species and size composition (length and weight) for multiple bays throughout Prince William Sound. For a subset of non-herring species, otoliths will be collected, providing additional age data. These data will improve upon a scarce body of knowledge of pelagic fishes and populations, providing novel baseline data.

D. Description of Study Area

The study area includes all of Prince William Sound. However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 1). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

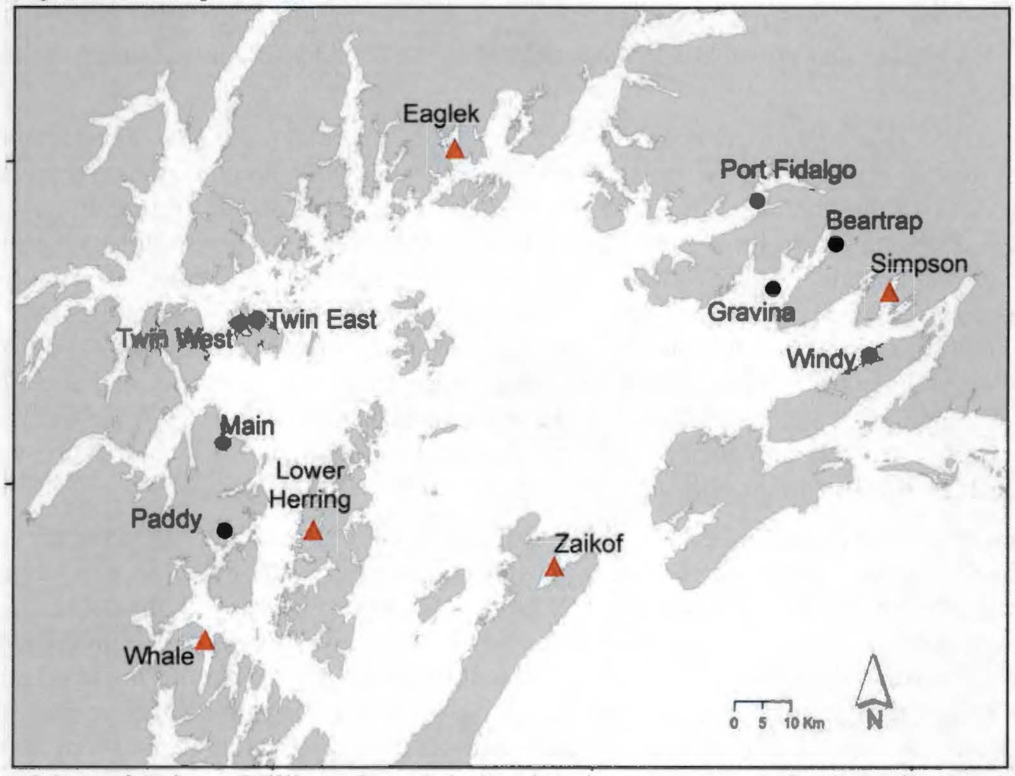

Figure 1. Map of Prince William Sound indicating bays surveyed for juvenile herring between November 2009 and March 2012. Primary bays indicated with red triangles.

E. Coordination and Collaboration with the Program

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 *Gulfwatch Long-Term Monitoring* proposal submitted by the Alaska Ocean Observing System. This proposal is structured to be a collaborative effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program. He will also be responsible for outreach and public input efforts.

Dr. Pegau currently is the coordinator of the existing EVOSTC funding PWS Herring Survey program. This program consists of ten individual projects that provide a coordinated examination of juvenile herring in Prince William Sound. This proposal is heavily influenced by the early findings from that effort. Dr. Pegau also serves as the Research Program Manager for the Oil Spill Recovery Institute (OSRI). In that capacity he is responsible for developing annual work plans, ensuring proper reporting, making reports available, developing partnerships to leverage funding, and to ensure outreach of OSRI activities. All activities that provide experience delivering the team leader duties outline in the request for proposals.

One of his duties is to ensure proper scientific oversight of the research programs. To accomplish this we will be setting up a four-person scientific oversight panel that will help guide the program and ensure the research is relevant to the long-term goal. The team will consist of people representing Alaska Department of Fish and Game, the National Oceanic and Atmospheric Administration, academia, and the local fishing community. There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities. This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermens United (CDFU), and others. Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydroacoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations. We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

Dr. Mary Anne Bishop (PWSSC) will lead the direct capture efforts needed for validation of hydroacoustic measurements and disease and condition studies. Bishop will oversee the project and coordinate with other studies that are part of the *PWS Herring Research & Monitoring* program. Specifically, the *Validation of Acoustic Surveys for Pacific Herring Using Direct Capture* project will be providing samples for projects by Drs. Kline and Heintz (herring condition) Dr. Hershberger (herring disease), Moffitt (herring scales), and Drs. Buckhorn and Thorne (juvenile herring index and intensive surveys; expanded adult herring surveys). In addition, Bishop will have primary responsibility for field work (fish capture), data integration, and completion of final products for *PWS Herring Research & Monitoring* synthesis. She will supervise her research assistant. Megan McKinzie. She will be responsible for project design, statistical analyses and data interpretation and preparation of a manuscript and contributing to the *PWS Herring Research & Monitoring* synthesis.

III. CV's/RESUMES

Curriculum Vitae

MARY ANNE BISHOP, Ph.D.
Research Ecologist,
Prince William Sound Science Center
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Cordova, Alaska 99574
907-424-5800 x 228; mbishop@pwssc.org

EDUCATION

Ph.D. Department of Wildlife and Range Sciences, University of Florida, Gainesville, 1988.
M.S. Wildlife and Fisheries Sciences, Department of Wildlife and Fisheries Sciences, Texas A & M University, College Station, 1984.
B.B.A. School of Business, University of Wisconsin, Madison, 1974.

RECENT PROFESSIONAL EXPERIENCE

Research Ecologist, Prince William Sound Science Center, Cordova, Alaska, Jun 1999-present
Research Wildlife Biologist, Copper River Delta Institute, Pacific Northwest Research Station, U.S. Forest Service, Cordova, Alaska, 1990-1994 and 1997- May1999
Research Wildlife Biologist, Center for Streamside Studies and Dept. Fisheries, University of Washington, assigned to Copper River Delta Institute, Cordova, Alaska, 1994-1997
Acting Manager, Copper River Delta Institute, Pacific Northwest Research Station, U.S. Forest Service, Cordova, Alaska, 1992-1993.

SELECTED SCIENTIFIC PUBLICATIONS (10 of 53)

*= publication resulting from herring research

*__Bishop, M.A.__, J.T. Watson, K. Kuletz, T. Morgan. Pacific herring consumption by marine birds during winter in Prince William Sound, Alaska. *Fisheries Oceanography*. (accepted pending revisions).

Bishop, M.A., B.F. Reynolds, S.P. Powers. 2010. An *in situ*, individual-based approach to quantify connectivity of marine fish: ontogenetic movements and residency of lingcod. *PLoS ONE* 5(12): e14267

*__Bishop, M.A.__ and S.P. Green. 2001. Predation on Pacific herring (*Clupea pallasi*) spawn by birds in Prince William Sound, Alaska. *Fisheries Oceanography* 10 (1): 149-158.

*Cooney, R.T., J.R. Allen, **M.A. Bishop**, D.L. Eslinger, T. Kline, B.L. Norcross, *et al.* 2001. Ecosystem control of pink salmon (*Oncorhynchus gorbuscha*) and Pacific herring (*Clupea pallasi*) populations in Prince William Sound. *Fisheries Oceanography* 10(1): 1-13.

*Dawson, N.M., **M.A. Bishop**, K.J. Kuletz, A.F. Zuur.. Using ships of opportunity to assess winter habitat associations of seabirds in subarctic coastal Alaska. *Arctic. (accepted pending revisions).*

Powers, S.P., **M.A. Bishop**, S. Moffitt, and G.H. Reeves. 2007 Variability in Freshwater, Estuarine and Marine Residence of Sockeye Salmon (*Oncorhynchus nerka*) within the Copper and Bering River Deltas, Alaska. Pages 87-99 in C. A. Woody (ed) *Sockeye salmon evolution, ecology and management*. American Fisheries Society, Symposium 54, Bethesda, MD.

Powers, S.P., M.A. Bishop, J.H. Grabowski, and C.H. Peterson. 2002. Intertidal benthic resources of the Copper River Delta, Alaska, USA. *Journal Sea Research* 47: 13-23.
Reynolds, B.F., S.P. Powers, M.A. Bishop. 2010 Application of Acoustic Biotelemetry to Assess Quality of Created Habitats for Rockfish and Lingcod in Prince William Sound, Alaska. *PLoS One* 5(8): e12130.
*Watson, J.T., M.A. Bishop, and S.P. Powers. Pacific cod predation on pacific herring during winter in Prince William Sound. *Fisheries Oceanography*. (in press).
*Zuur, A.F., N. Dawson, M.A. Bishop, K. Kuletz, A.A Saveliev and E.N. Ieno. 2012. Two-stage GAMM applied on zero inflated Common Murre density data. Pages 155-188 *in* A.F. Zuur, A.A.Saveliev, E.N. Ieno (eds). *Zero Inflated and Generalized Linear Mixed Models with R* Highland Statistics Ltd, Newburgh, United Kingdom.

PROFESSIONAL COLLABORATIONS

M. Buckhorn (PWSSC), K. Carpenter (CRWP), N. Dawson (PWSSC), J. Eiler (NOAA), R. Federer (PWSSC), R. Heintz (NOAA), N. Hill (MIT), E.N. Ieno (Highland Statistics), K. Kuletz (USFWS), A. Lang (Memorial Univ.), F. Li (Intl. Crane Foundation), J. Moran (NOAA), T. Morgan (PWSSC), E. Nol (Trent Univ.), W.S. Pegau (OSRI), S. Powers (U. S. Alabama), B. Reynolds (PWSSC), G. Robertson (CA), D. Roby (OSU), J. Runstadler (MIT), A Saveliev (Highland Statistics), S. Senner (Audubon), Y. Suzuki (OSU), A. Taylor (UAA), R. Thorne (PWSSC), D. Tsamchu (Tibet Plateau Institute of Biology, PR China), J. Vollenweider (NOAA), J. Watson (PWSSC), M. Wille (Memorial Univ.), Z. Zuur (Highland Statistics)

IV. SCHEDULE

A. Project Milestones

Objective 1. Improve capture methods used for ground truthing acoustic surveys.
Field work completed April 2016 Synthesis evaluating techniques, August 2016.

Objective 2. Increase the sample size for identification, quantification, and measurement of juvenile (0+, 1+, 2+) and adult (3+ and older) herring schools as well as other fish schools in survey areas.
Completed April 2016

Objective 3. Provide data on species composition and length frequency to aid in the interpretation of current and historical acoustic surveys.
Sampling completed April 2016. Data synthesis completed August 2016.

Objective 4. Provide adult herring samples to Alaska Department of Fish and Game for the adult herring age-structure-analyses model.
Completed April 2016

Objective 5. Provide juvenile herring samples to researchers investigating juvenile herring fitness and disease.
Completed November 2015

B. Measurable Project Tasks

FY 14, 1st quarter (Feb 1 – Apr 30, 2014)

Feb-Mar	Biweekly Field Cruises: *Juvenile Herring Intensive Acoustic & Validation Surveys*
late Mar	Field cruise: *Expanded Adult Herring Survey* with hydroacoustic & validation surveys

FY 14, 2nd quarter (May 1, 2014-Jul 31, 2014)

May-Jul	Process fish & analyze data
Jul	Prepare mid-year report & FY15 work plan

FY 14, 3rd quarter (Aug 1, 2014- Oct 31, 2014)

Aug	Submit report & FY 15 work plan
Aug-Oct	Analyze data

FY 14, 4th quarter (Nov 1, 2014 – January 31, 2015)

Nov	Field cruise: *Juvenile herring abundance index* with hydroacoustic & validation surveys; disease & energetics collections
Dec	Process fish samples
Jan	Alaska Marine Symposium

V. BUDGET

Budget Form (Attached)

FY14 PROGRAM PROJECT
PROPOSAL FORM

Project Title: PWS Herring Research and Monitoring Tracking Seasonal Movements of Adult Pacific Herring in Prince William Sound

Project Period: February 1 2014 – January 31, 2015

Primary Investigator(s):
Dr. Mary Anne Bishop, Prince William Sound Science Center, Cordova , mbishop@pwssc.org
Collaborators:
Dr. Sean Powers, University of South Alabama & Dauphin Island Sea Lab, spowers@disl.org
John Eiler, NMFS, Ted Stevens Marine Research Institute, john.eiler@noaa.gov

Abstract:

Knowledge of fish movements and migrations are critical to understanding fish population dynamics. In Prince William Sound (PWS) adult herring disperse after spawning, however their movement patterns are poorly understood. Currently the only information on adult herring movements are a small number of observations from fishers that suggest PWS herring are regularly migrating out of PWS and onto the shelf. This proposal focuses on verifying adult Pacific herring movements using detections of tagged fish. The Herring Marking Workshop sponsored by EVOS in December 2008, reviewed all potential marking methods for herring and conditionally endorsed acoustic tagging as a method for determining herring movements. This pilot project will acoustic tag wild adult herring for the first time. Herring will be sampled from around Port Gravina, a spring spawning area. We will examine detections from acoustic arrays to determine seasonal movement patterns in and out of Prince William Sound. The proposed project builds on our previous and current research on acoustic-tagged fishes. This project will synergize with efforts of the Ocean Tracking Network (OTN). The ability to track herring is critical to answer many questions including those about stock structure, migration habits, and the occurrence of skip-spawning. Determining the capabilities of this technology will help guide our choice of future research emphasis.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
70,700	17,500	17,400	0	0	105,600

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: August 31, 2013

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the *Exxon Valdez* Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival. Described here is one project of a multi-project program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. The long-term goal of the overall multi-project program is to improve predictive models of herring stocks through observations and research.

Adult Pacific herring (*Clupea pallasii*) along the eastern Pacific Ocean often overwinter close to spawning areas and in nearshore channels (Hay and McCarter 1997). This behavior has also been observed in PWS herring populations, where historically large schools both overwintered and spawned around northern Montague and Green Islands. More recently however, the major biomass of adult herring during winter has shifted to the northeast and southwest areas of PWS. Currently the largest concentration of adult herring overwinters and spawns around Port Gravina and Port Fidalgo (R. Thorne, PWS Science Center, pers. comm.). Some spring spawning aggregations are not located near known overwintering areas suggesting that: (a) some adult herring populations are overwintering outside of PWS; (b) not all PWS overwintering populations are being detected; or, (c) overwintering schools such as those in northeast PWS break into smaller schools in spring with some schools moving away from their overwintering area to spawn.

Post-spawning behavior of adult PWS herring is poorly understood. Elsewhere, it is common for large herring populations to migrate from nearshore spawning areas to coastal shelf areas for summer feeding habitat (Hay and McCarter 1997, Hay et al. 2008). To date, our only information on adult PWS herring movements comes from a study by Brown et al. (2002) that compiled local and traditional knowledge. In that study, fishers reported herring moving in fall north through Montague Strait prior to the fall bait fishery while whose observations suggest others reported herring moving into PWS in spring through Hinchinbrook Entrance, Montague Strait and the southwest passages of Erlington and LaTouche. These observations suggest that PWS herring are regularly migrating out of PWS and onto the shelf.

Acoustic transmitters make it possible to monitor fish movements both across large distances (Heupel et al. 2006) and in structurally complex habitats like those found in nearshore areas (Bishop et al. 2010). Acoustic tags offer many additional advantages, including: 1) the potential for multiple data points over time and space for each individual fish; 2) minimal handling - fish are captured and handled only once; 3) transmitters can be implanted quickly, with low mortality and with low tag expulsion; 4) transmitters are programmed for individual identification; and 5) the capability to use portable receivers to monitor spawning schools or large wintering schools of herring regardless of the location (Bishop 2008).

Previous efforts to acoustic tag and monitor fish in Prince William Sound over more than a one year period have been proven successful. In October 2008 the Pacific Ocean Shelf Tracking Project (POST), PWS Science Center (M.A. Bishop, Co-PI), University of South Alabama (S. Powers, Co-PI) and the PWS Oil Spill Recovery Institute installed across the mouth of Port Gravina the first long-term, large-scale hydroacoustic array in Prince William Sound, as well as eight portable receivers at pinnacles near the POST array. In September 2010 an array was installed at the mouth of Zaikof Bay near Hinchinbrook Entrance consisting of six portable receivers. Acoustic-tagged lingcod (*Ophiodon elongatus*) were then successfully monitored at Zaikof and Port Gravina through February and May 2012, respectively (Bishop et al. 2010; Fig. 1).

Following several years of planning and negotiations, in March 2013, PWS Science Center collaborated with Canada's Ocean Tracking Network (OTN) to install two, large-scale arrays including one across the mouth of Hinchinbrook Entrance and one across Montague Strait, and four small arrays at the southwest PWS passages of Erlington, LaTouche, Bainbridge, and Prince of Whales (Fig. 1). These arrays will allow for detections of acoustic-tagged herring moving into and out of Prince William Sound.

B. Summary of Project to Date (if applicable)

All milestones are on track and scheduled to be completed by July 2014 and September 2014.

Our first tagging effort took place from 18-22 November 2011 in conjunction with the Alaska Department of Fish and Game (ADFG) herring bait surveys. Field efforts by ADFG to purse seine were stymied by poor weather conditions (exceptionally cold, or high winds), whales in and around herring schools, and herring schools remaining deeper than the seine. We were provided samples from their final set for tagging. Fish ranged in age from 2.5 to 3+, and were smaller than our pre-determined size restriction for tagging and release, however, we were able to practice our surgical procedures on 20 herring before sacrificing these fish.

Our second tagging cruise coincided with herring spawn aggregations and took place from 8-11 April 2012 in Port Gravina. Compared with November, fish were much larger and were of sufficient size to hold an acoustic tag. We practiced tagging pre-spawning adults and based on our observations and experienced gained on pre-spawners, on our final day (11 April) we jigged 38 adult herring >19 cm TL. We surgically implanted 25 adult herring with coded acoustic transmitters (V9-2L/2H, 69kHz). While a few fish appeared to have spawned, most fish had not yet spawned. The 25 tagged fish and 13 controls (untagged fish) were released simultaneously near the capture site in 25 m of water at ~ 1600h on 11 April (Figs. 1, 2). A singleVR2W receiver (60.68885, -146.39118) was retrieved from 17 m of water on 19 May 2012 to upload the detection data.

This was the first time that wild herring have been tagged with acoustic transmitters. The VR2W receiver near our point of release detected 23 (92%) of the tagged individuals multiple times (≤ 227 detections) on one or more days (≤ 5 d) post release at (Fig. 3). Only 1 of the 25 herring was never detected. Final detections of tagged fish by 15 April coincided with a cessation of spawning in the immediate area suggesting that fish departed from Port Gravina and did not return.

Our third tagging cruise also coincided with spawn aggregations in Port Gravina. Between 6-7 April 2013 we surgically implanted coded acoustic transmitters (Model V9-2L/2H, 69kHz) into 69 adult herring from 3 separate schools (24, 20 and 25 tagged). All but one herring had not yet spawned. We used the same methodology as in April 2012, including releasing tagged fish and controls (untagged fish) simultaneously and near a herring school. Due to recent technological changes, the VR3 acoustic receiver array at Port Gravina cannot detect the new generation of transmitters. Therefore, we installed a temporary acoustic array from 7 April – 21 May 2013. Of the 69 tagged individuals, 56 (81 %) were detected multiple times (≥8 detections) on one or more days. Most detections occurred over three distinct periods: 7-9, 15-16 and 20-26 April, possibly indicating periods of increased spawning activity

Determining whether or not herring depart from Prince William Sound has been dependent on the installation of acoustic arrays across the major entrances and passages between the Sound and the Gulf of Alaska. When this project was planned, arrays across the entrances and passages were scheduled to be deployed in fall 2011. However due to a series of delays, the equipment did not arrive from Canada until late December 2012, after the transmitters on herring tagged in April 2012 had expired. In March 2013, the Ocean Tracking Network (OTN) arrays were deployed and acoustic arrays are now installed across Hinchinbrook Entrance, Montague Strait, and four major passages in southwest Prince William Sound.

II. PROJECT DESIGN

A. Objectives

1) Field test the application of recent advances in acoustic telemetry on wild adult herring.

(2) Elucidate herring movement patterns between overwinter and spawning sites.

(3) Utilize the PWS acoustic arrays to monitor herring migration into and out of PWS.

This project will use the preferred marking method for herring. The Herring Marking Workshop sponsored by EVOS in December 2008, reviewed all potential marking methods for herring and stated with regards to acoustic tagging:

> A specific recommendation is the conditional endorsement of acoustic tagging, with the caveat that the initial involvement should be limited Arrays of acoustic receivers have been installed in PWS and there may be opportunities to leverage costs with other organizations, so the present time is an excellent opportunity to pursue this approach . It seems probable that useful information on herring ecology and migratory movements could be revealed by acoustic tagging (source draft Integrated Herring Restoration Plan 2010, page 134)

B. Procedural and Scientific Methods

Here we propose to synergize with efforts of the Ocean Tracking Network by undertaking a pilot study to mark adult Pacific herring with acoustic tags. Our tagging efforts will coincide with Alaska Department of Fish & Game (ADFG) surveys for adult herring (known as bait surveys) in November 2011. Our spring 2012 and spring 2013 efforts will coincide with the beginning of spawn in the Port Gravina area. For November efforts, we will use a dipnet to collect herring captured by ADFG purse-seines. For spring 2012 and 2013, we will jig adult herring. Healthy individuals will be transferred to a 40 gallon aquarium containing aerated, ambient seawater aboard our research vessel. Surgical protocol will follow procedures used for implanting acoustic transmitters into age 2 and 3 Pacific herring (average size 180 mm) and similar sized Pacific salmon smolts (Welch et al. 2007; Seitz et al. 2010). Prior to surgery, individual herring will be transferred to a small, aerated bath containing ambient seawater and buffered tricaine methanesulfonate (MS-222; 60 mg/L), an anesthetic. Following sedation, the fish will be weighed, measured for standard and fork length, then placed on a V-shaped surgery board lined with a disposable surgical mat. During surgery the opercular cavity will be gently irrigated with ambient seawater.

For transmitter insertion, we will make a small incision (11-12 mm) along the ventral midline anterior to the pelvic fins. A Vemco series V9-2L/2H acoustic transmitter (Vemco, Halifax, Nova Scotia) programmed to transmit an individually-encoded signal at 40-60 s (high power) and 60-150 s (low power) random intervals will be inserted into the abdominal cavity. Each transmitter measures 24 x 9 mm and weighs 3.6 g, and has an estimated battery life of ~260 d. The incision will be closed with two sutures then swabbed with a broad spectrum antibiotic ointment. The surgical procedure will take less than 2 min per fish. Following surgery, fish will be held for recovery in an aquarium aerated with ambient seawater until equilibrium (upright swimming) and active swimming are observed. Post recovery we will release fish at the capture site. We will tag up to 100 herring around Port Gravina and Port Fidalgo. In spring 2012 and 2013, VR2W acoustic receivers will be temporarily installed to monitor for tagged fish in Port Gravina from April through mid-May. Data from Ocean Tracking

Network arrays at the entrances to Prince William Sound will be uploaded in late February/early March 2014.

C. Data Analysis and Statistical Methods

Prior to analyses, we will assume a fish was detected only when there are at least two detections of a transmitter at an array during a 24h period. In order to test whether herring are detected more frequently based on size, month of capture, or location, we will calculate the detectability of each herring following a methodology similar to that outlined by Andrews et al. (2010). With this method, we will divide the number of days a herring was detected by the life span of the tag. We will then use detectability as the dependent variable in a linear mixed model.

We will consider a herring as having departed from the Sound if it is detected at one of the arrays at the PWS entrances or passages. Similarly, if that fish is later detected at one of these arrays, it will be considered having returned to PWS. Detections occurring in Port Gravina will be examined to determine the amount of time spent in an area.

D. Description of Study Area

While herring can potentially move throughout the Sound, acoustic receivers will be located in Port Gravina, and across Hinchinbrook Entrance, Montague Strait, and in the four southwest passages of Bainbridge, Prince of Whales, Erlington, and LaTouche.

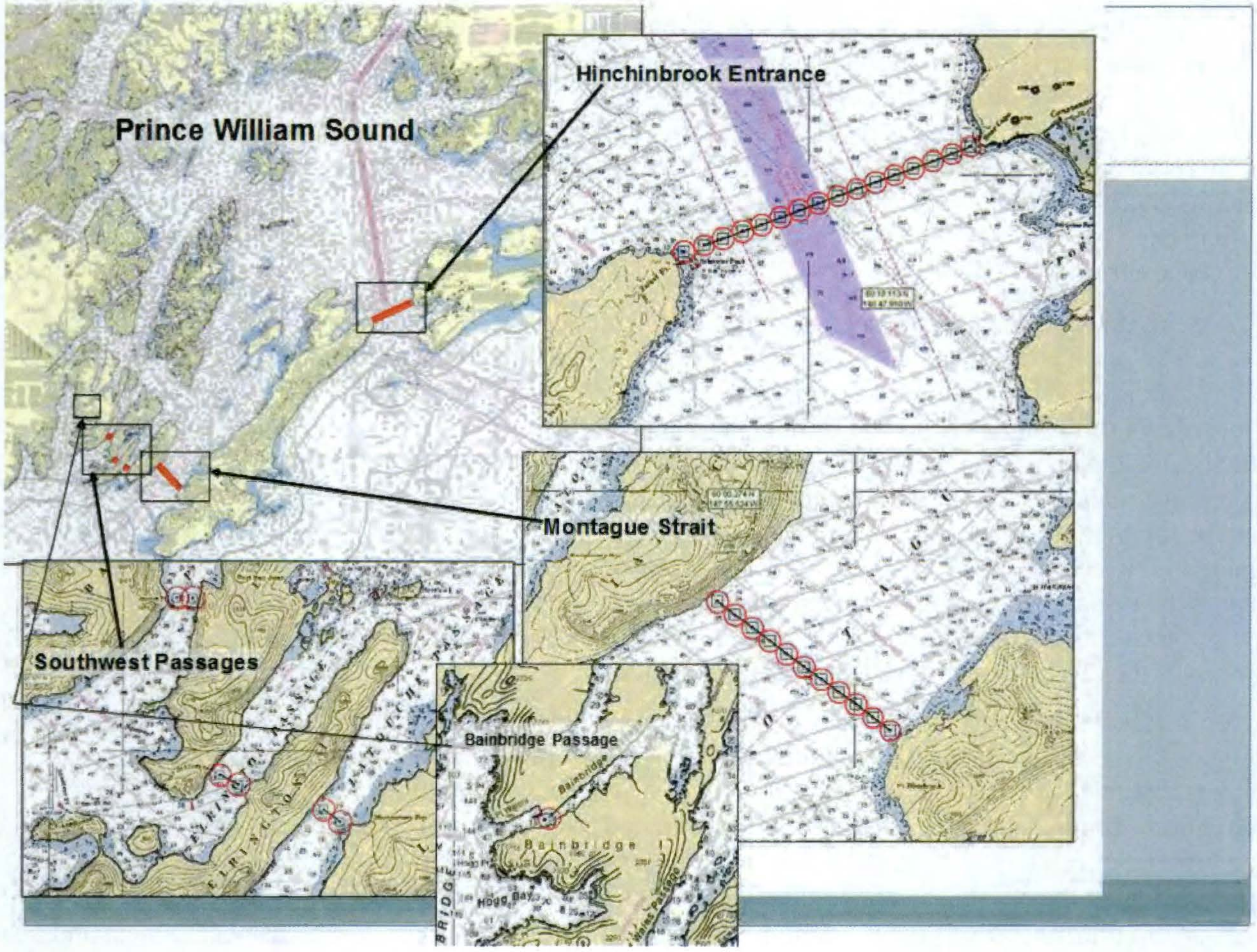

Fig. 1. Location of Ocean Tracking Network acoustic arrays, installed in Prince William Sound in March 2013.

E. Coordination and Collaboration with the Program
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 Gulfwatch Long-Term Monitoring program. This proposal is structured to be a collaborative effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program. He will also be responsible for outreach and public input efforts.

Dr. Pegau currently is the coordinator of the existing EVOSTC funding PWS Herring Survey program. This program consists of ten individual projects that provide a coordinated examination of juvenile herring in Prince William Sound. This proposal is heavily influenced by the early findings from that effort. Dr. Pegau also serves as the Research Program Manager for the Oil Spill Recovery Institute (OSRI). In that capacity he is responsible for developing annual work plans, ensuring proper reporting, making reports available, developing partnerships to leverage funding, and to ensure outreach of OSRI activities. All activities that provide experience delivering the team leader duties outline in the request for proposals.

One of his duties is to ensure proper scientific oversight of the research programs. To accomplish this we will be setting up a four-person scientific oversight panel that will help guide the program and ensure the research is relevant to the long-term goal. The team will consist of people representing Alaska Department of Fish and Game, the National Oceanic and Atmospheric Administration, academia, and the local fishing community. There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities. This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermens United (CDFU), and others. Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydroacoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations. We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

Other important programs for coordinating with are the existing PWS herring survey program and existing ADF&G herring research. This program has been developed with input from both of these programs and the focus of this proposal is extending the interpretation of the data from those two programs. The Herring Survey program will still be operating in FY12 and FY13. There are field observations scheduled in FY12 and in FY13 funds are strictly for analysis and report writing. Included in the report writing is a synthesis of previous and current research. This report will be finished in FY13 and be the basis for the synthesis required under this request for proposals.

Dr. Mary Anne Bishop (PWSSC) will oversee the seasonal movements study and will coordinate with other studies that are part of the *PWS Herring Research & Monitoring* program as well as our collaborators. She will have primary responsibility for field work (fish tagging) data integration, preparation of a manuscript and completion of final products for *PWS Herring Research & Monitoring* synthesis. Initially a PI on this project, Dr. Sean Powers (University of South Alabama) is now a collaborator on this project due to unforeseen circumstances relating to the obligations relating to investigating impacts of the Deep Water Horizon oil spill. John Eiler, of NOAA Ted Stevens Marine Research Institute is also a collaborator on this project. This project will rely on obtaining data from the Ocean Tracking Network arrays proposed that were installed at major entrances to Prince William Sound in March 2013. We collaborated with Alaska Department of Fish and Game for our November 2011 tagging efforts that coincided with their fall herring bait surveys.

III. CV's/RESUMES

MARY ANNE BISHOP, Ph.D.
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EDUCATION

Ph.D. Department of Wildlife and Range Sciences, University of Florida, Gainesville, 1988.
M.S. Wildlife and Fisheries Sciences, Department of Wildlife and Fisheries Sciences, Texas A & M University, College Station, 1984.
B.B.A. School of Business, University of Wisconsin, Madison, 1974.

RECENT PROFESSIONAL EXPERIENCE

Research Ecologist, Prince William Sound Science Center, Cordova, Alaska, Jun 1999-present
Research Wildlife Biologist, Copper River Delta Institute, Pacific Northwest Research Station, U.S. Forest Service, Cordova, Alaska, 1990-1994 and 1997- May1999
Research Wildlife Biologist, Center for Streamside Studies and Dept. Fisheries, University of Washington, assigned to Copper River Delta Institute, Cordova, Alaska, 1994-1997
Acting Manager, Copper River Delta Institute, Pacific Northwest Research Station, U.S. Forest Service, Cordova, Alaska, 1992-1993.

SELECTED SCIENTIFIC PUBLICATIONS (10 of 53)

- = publication resulting from either acoustic or radio telemetry study (13 total)

***Bishop, M.A.**, B.F. Reynolds, S.P. Powers. 2010. An *in situ*, individual-based approach to quantify connectivity of marine fish: ontogenetic movements and residency of lingcod. *PLoS ONE* 5(12): e14267
***Bishop, M.A.**, N. Warnock, and J. Takekawa. 2004. Differential spring migration of male and female Western Sandpipers at interior and coastal stopover sites. *Ardea* 92: 185-196.
***Bishop, M.A.**, N. Warnock, and J.Y. Takekawa. 2006 Spring Migration Patterns in Western Sandpipers *Calidris mauri* Pages 545-550 in G.C. Boere, C.A. Galbraith, and D.A. Stroud (eds.) *Waterbirds around the world.* The Stationery Office, Edinburgh, U.K.
Bishop, M.A. and S.P. Green. 2001. Predation on Pacific herring (*Clupea pallasi*) spawn by birds in Prince William Sound, Alaska. *Fisheries Oceanography* 10 (1): 149-158.
***Bishop, M.A.** and N. Warnock. 1998. Migration of Western Sandpipers: links between their Alaskan stopover areas and breeding grounds. *Wilson Bulletin* 110: 457-462.
Powers, S.P., **M.A. Bishop**, S. Moffitt, and G.H. Reeves. 2007 Variability in Freshwater, Estuarine and Marine Residence of Sockeye Salmon (*Oncorhynchus nerka*) within the Copper and Bering River Deltas, Alaska. Pages 87-99 in C. A. Woody (ed) *Sockeye salmon evolution, ecology and management.* American Fisheries Society, Symposium 54, Bethesda, MD.
Powers, S.P., **M.A. Bishop**, J.H. Grabowski, and C.H. Peterson. 2002. Intertidal benthic resources of the Copper River Delta, Alaska, USA. *Journal Sea Research* 47: 13-23.

*Reynolds, B.F., S.P. Powers, **M.A. Bishop.** 2010. Application of Acoustic Biotelemetry to Assess Quality of Created Habitats for Rockfish and Lingcod in Prince William Sound, Alaska. *PLoS One* 5(8): e12130.

Watson, J.T., **M.A. Bishop**, and S.P. Powers. Pacific cod predation on pacific herring during winter in Prince William Sound. *Fisheries Oceanography*. (in press).

Zuur, A.F., N. Dawson, **M.A. Bishop**, K. Kuletz, A.A Saveliev and E.N. Ieno. 2012. Two-stage GAMM applied on zero inflated Common Murre density data. Pages 155-188 *in* A.F. Zuur, A.A.Saveliev, E.N. Ieno (eds). *Zero Inflated and Generalized Linear Mixed Models with R* Highland Statistics Ltd, Newburgh, United Kingdom.

PROFESSIONAL COLLABORATIONS

M. Buckhorn (PWSSC), K. Carpenter (CRWP), N. Dawson (PWSSC), J. Eiler (NOAA), R. Heintz (NOAA), N. Hill (MIT), E.N. Ieno (Highland Statistics), K. Kuletz (USFWS), A. Lang (Memorial Univ.), F. Li (Intl. Crane Foundation), J. Moran (NOAA), T. Morgan (PWSSC), E. Nol (Trent Univ.), W.S. Pegau (OSRI), S. Powers (U. S. Alabama), B. Reynolds (PWSSC), G. Robertson (CA), D. Roby (OSU), J. Runstadler (MIT), A Saveliev (Highland Statistics), S. Senner (Audubon), Y. Suzuki (OSU), A. Taylor (UAA), R. Thorne (PWSSC), D. Tsamchu (Tibet Plateau Institute of Biology, PR China), J. Vollenweider (NOAA), J. Watson (PWSSC), M. Wille (Memorial Univ.), A. Zuur (Highland Statistics)

IV. SCHEDULE

A. Project Milestones

1) Field test the application of recent advances in acoustic telemetry on wild adult herring. ***To be completed July 2014.***

(2) Utilize the PWS acoustic arrays to monitor herring migration into and out of PWS. ***To be completed July 2014.***

(3) Elucidate herring movement patterns between overwinter and spawning sites. ***To be completed September 2014.***

B. Measurable Project Tasks

FY 14, 1st quarter (February 1 – May 31, 2014)

February, 2014	*Project funding available*
late Feb/early Mar	*Upload data from Ocean Tracking Network array*
Mar-May	*Process and analyze data*

FY 14, 2nd quarter (June 1, 2014-August 30, 2014)

Jun-Aug	*Process and analyze data, prepare final report*

FY 14, 3rd quarter (September 1, 2014-November 30, 2014)

September 30	*Submit final report*

FY 14, 4th quarter (December 1, 2015 – January 31, 2015)

V. BUDGET

Budget Form (Attached)

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

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: Data Management Support for the EVOSTC Long Term Monitoring Program

Project Period: Feb 1st 2014 to Jan 31st 2015

Primary Investigator(s): Rob Bochenek, Axiom Consulting & Design

Abstract: This project supplies the EVOS Long Term Monitoring (LTM) effort with critical data management support to assist study teams in efficiently meeting their objectives and ensuring data produced or consolidated through the effort is organized, documented and available to be utilized by a wide array of technical and non technical users. This effort leverages, coordinates and cost shares with a series of existing data management projects which are parallel in scope to the data management needs of the long term monitoring program. In the first two years, this project would focus on providing informatics support to streamline the transfer of information between various study teams and isolate and standardize historic data sets in the general spill affected area for use in retrospective analysis, synthesis and model development. These efforts would continue into year three through five but efforts would also focus on developing management and outreach applications for the data and data products produced from the LTM program.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
130,800	130,800	22,500	23,300	24,000	331,400

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: August 6th 2013

(THIS SUMMARY PAGE NOT TO EXCEED ONE PAGE)

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the *Exxon Valdez* Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

Described here is the data management component of the PWS Herring Research and Monitoring Program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. **The long-term goal of the program is to improve predictive models of herring stocks through observations and research.** While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

Managing oceanographic data is particularly challenging due to the variety of data collection protocols and the vast range of oceanographic variables studied. Data may derive from automated real-time sensors, remote sensing satellite/observational platforms, field/cruise observations, model outputs, and various other sources. Variables can range from mesoscale ocean dynamics to microscale zooplankton counts. The resulting datasets are packaged and stored in advanced formats, and describe a wide spectrum of scientific observations and metrics. Due to the complexity of the data, developing data management strategies to securely organize and disseminate information is also technically challenging. Distilling the underlying information into usable products for various user groups requires a cohesive, end-to-end approach in addition to a fundamental understanding of the needs and requirements of the user groups and stakeholders.

Data management activities for oceanographic information occur in isolated, physically distributed agencies, leading to low cross-agency utilization of data. Technical barriers, complex data formats, a lack of standardization and missing metadata have limited access to data and made the utilization of available scientific information cumbersome and daunting. As a consequence, existing data is underutilized and often has not undergone quality assurance.

B. Summary of Project to Date (if applicable)

During the first few months of the EVOS PWS Herring Program Data Management project investigators have been focused on establishing protocols for data transfer, metadata requirements and initiating the data salvage effort. Investigators have been meeting and planning with Matt Jones to coordinate future activities. PIs have participated in several PI meetings and are coordinating activities between the Herring and LTM programs. In addition, the AOOS ocean workspace has been rolled out to PIs and their user and group profiles have been created Several training seminars have been held via webinars and PIs are beginning to use the system to organize and consolidate their project level data. Software engineers at Axiom have also been working to support workspace, resolving bugs and implementing new functionality in response to user feedback. The PWS Herring Portal has been updated with available herring data from ADF&G and expanded with additional regional datasets of relevance to the PWS Herring Program.

II. PROJECT DESIGN

A. Objectives

1) Provide data management oversight and services for EVOS IHRP project team data centric activities which include data structure optimization, metadata generation, and transfer of data between project teams.
2) Consolidate, standardize and provide access to study area data sets that are critical for retrospective analysis, synthesis and model development.
3) Integrate all data, metadata and information products produced from this effort into the AOOS data management system for long term storage and public use.

The specific objectives of this proposed effort will directly support the overall objectives of the combined PWS Herring Research and Monitoring proposal which are listed below.

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008). The proposed monitoring efforts are designed to address this objective by either expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events.
2) *Inform the required synthesis effort* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers.
3) *Address assumptions in the current measurements.* Many of the existing studies are based on historical or logistical constraints We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program.
4) *Develop new approaches to monitoring* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

Providing a framework for efficiently managing data produced or consolidated by this effort will enable the information to be used to improve the ASA model, inform and facilitate the planned synthesis efforts, address assumptions in the current measurements and develop new approaches to monitoring. Data management activities are critical for the overall success of the IHRP program in addition to the integration of data sets and information transfer between study groups and research team leads.

B. Procedural and Scientific Methods

Objective 1. Provide data management oversight and services for EVOS IHRP project team data centric activities which include data structure optimization, metadata generation, and transfer of data between project teams.

AOOS data management staff will work with EVOS IHRP investigators to assess the types of data which will be collected during sampling efforts, assess Standard Operating Procedures (SOPs) for data collection to create metadata templates in addition to gauging general data management needs of PIs This assessment is critical to identify the data management needs and the types of tools needed by researchers to increase their abilities to manage their data in an automated, standard fashion.

The AOOS data management group is currently developing a web base platform for PIs to manage project level data sets and author metadata System development is currently supported through internal AOOS funds in additional to dedicated funding from the Prince William Sound Science Center The AOOS Ocean Workspace will provide a web based platform for PIs to post and share data sets and rapidly author metadata The system will be enabled with security authentication in order to limit access to IHRP investigators, project managers and administrators The system will also provide PIs with tools to generate metadata profiles which comply with national standards. Initially, this system will focus on authoring FGDC metadata formats including tools for authoring the biological extension for taxonomic classifications and measurements The software development phase of this application was initiated in March 2011 An initial beta release/testing of this system will commence in August 2011 with a planned release date of October 1st, 2011 This platform will provide IHRP investigators and project managers with a transparent view of data collection and metadata authoring progress in addition to providing a framework for data integration It is envisioned that this platform will function as the primary vehicle to facilitate data transfer, metadata generation and archiving for the entire IHRP project data management lifecycle This proposed effort will provide a user base and focused environment for the expansion and refinement of this project level data management tool

Objective 2. Consolidate, standardize and provide access to study area data sets that are critical for retrospective analysis, synthesis and model development.

This task will involve isolating and standardizing historic data sets deemed necessary for retrospective analysis by EVOS IHRP synthesis efforts. Early in the effort the EVOS IHRP researcher team will be engaged to prioritize sources of relevant data deemed of high value for the synthesis effort. Data will be prioritized by several metrics including length of time series, scientific importance, and quality and precision of the data storage format. All data acquired through efforts of this project will be merged into the AOOS data system for long term archival and access. Many herring related data sets not easily accessible to restoration researchers and managers have been standardized and made available through the actions of the PWS Herring Portal (EVOS Project 070822, 080822 and 090822). This proposed project would expand the geographic and programmatic scope of this work to include datasets in Lower Cook Inlet and potentially Kodiak regions.

Building upon results of the PWS Herring Portal Project, investigators will expand their efforts to additional project level data sets, long term time series produced from sensor platforms, remote sensing/satellite imagery data products, oceanographic/atmospheric/ecological model outputs and relevant GIS data layers. The AOOS data system currently has the capacity to manage all of these data types except for project level data. AOOS will be deploying a project level data management system in the fall of 2011 to address this need. This is the same system referenced in methods of objective 1 Data analysts preparing and salvaging historic project level datasets will leverage this system to consolidate, centralize and document data resources so that IHRP investigators can access these data as they are discovered, processed and made available for use.

Additionally, data management staff will leverage existing data management efforts and data sets currently under the stewardship of AOOS in this activity. These resources and efforts are detailed more fully in the "Coordination and Collaboration with Other Efforts" section of this proposal. These existing data resources include a wide array of physical and biological data sets in the general spill affected areas. These resources can be reviewer at http://data.aoos.org.

Potential Data Sources for this Effort

Lower Cook Inlet
The Alaska Department of Fish and Game in Homer (ADF&G-Homer) has flown aerial surveys to assess Pacific herring abundance trends in Lower Cook Inlet (LCI) since 1978 (Otis et al. 1998). An uninterrupted time series (1978-2008) of aerial survey data is available for the Kamishak and Southern (i.e., Kachemak Bay) districts and discontinuous data sets are available for the Outer and Eastern districts. The Outer/Eastern districts are oceanographically downstream of PWS. Embayments along the outer coast of the Kenai Peninsula may function as juvenile rearing areas for herring larvae advected from PWS via Montague Strait. Lower Cook Inlet's most comprehensive herring data set is for Kamishak Bay, where commercial sac-roe herring harvests occurred from 1974-1979, and from 1985-1998. The fishery is currently closed while the stock rebuilds, but ADF&G continues to fly aerial surveys and conduct vessel surveys to assess herring abundance and ASL composition of the spawning biomass. Through a previous NOAA grant funded project (Otis and Spahn 2003), the great majority of the Kamishak herring data set has already been digitized into a spatial database (ADF&G 2002), which can be readily ingested into the data management system for this project. However, herring survey and ASL data for the Southern, Outer, and Eastern districts of LCI remain spatially disabled and would require staff time to digitize and spatially reference them. Table 1 documents the type and current status of available herring data from LCI.

Kodiak
The Alaska Department of Fish and Game in Kodiak (ADF&G-Kodiak) has been monitoring herring population and fishery parameters since the 1930's. Herring distribution and abundance trends have been assessed using a combination of aerial and acoustic surveys periodically since the mid-1980's. Spawn observations have been documented consistently since the 1970's and herring age, sex, length (ASL) data have been collected annually since 1967. Fishery performance and harvest data have been maintained since the 1970's and early fishery observations exist back to the 1930's. Marine mammal sightings and herring disease data are also available for recent years. Most of these valuable, historical data sets exist only in hard copy format and need to be digitized and spatially enabled to realize their full worth. Table 2 documents the type and current status of available herring related data from the Kodiak region.

PWS-ADF&G
The Alaska Department of Fish and Game in Cordova (ADF&G-Cordova) has flown aerial surveys in Prince William Sound since 1973. Population trends were initially monitored with aerial surveys to estimate biomass and the linear extent of beach used for spawning (Brady 1987), and have continued almost without interruption. Age, sex, and size data h as been collected from most fisheries and spawning aggregations since 1973 (e.g., Baker et al. 1991; Biggs et al. 1992). Dive surveys to estimate spawning biomass began with feasibility studies in 1983 and 1984 and continued in 1988-1992 and

1994-1997 (e.g., Willette et al. 1999). In 1993, ADF&G in cooperation with the Prince William Sound Science Center began fall acoustics surveys. Spring (March/April) acoustics surveys have been conducted during 1995-2009. Age structured models have been used since 1993 to estimate historical population parameters and project future biomass, recruitment, and abundance (Funk 1994). Disease assessments (1993-2002) indicate viral hemorrhagic septicemia virus (VHSV) and associated ulcers were related to population declines in 1993/1994 and 1998; and *Ichthyophonus hoferi* was related to a population decline in 2001 (Marty et al. 2004). Additional disease sampling to index the prevalence of VHSV and *I hoferi* (2003-2006) and measure the prevalence (2006-2009) have been funded by the Department of Fish and Game and the EVOS Trustee Council. Previous funding by the EVOS Trustee Council has allowed the digitizing and publishing of the majority of the aerial survey linear extent of spawn and biomass data; and age, sex, and size in addition to the commercial harvest data. (http://dev.axiomalaska.com/pwsherringportal/) and digitizing most of the commercial harvest and spawn deposition survey data. Table 3 documents the type and current status of available herring related data from the PWS region.

PWS-PWSSC

The Prince William Sound Science Center (PWSSC) has been collecting biological and physical measurements in Prince William Sound which are critical to understanding herring population dynamics back to the early 1990s. The data includes herring acoustic data (e.g., Thomas and Thorne 2003), herring nursery bay and larger PWS oceanographic conditions, zooplankton abundance, herring energetic, and seabird predation datasets for juvenile and adult herring. The data at PWSSC must be standardized, documented and up scaled into a geospatial database. Table 4 documents the type and current status of available herring related data from the PWS region stewarded by the Prince William Sound Science Center.

Objective 3. Integrate all data, metadata and information products produced from this effort into the AOOS data management system for long term storage and public use.

The ultimate goal of this project is to provide services to assist in the organization, documentation and structuring of data collected and made available via EVOS IHRP project activities so that it can be transferred efficiently to long term data archive and storage centers and made available for future use by researchers and other user groups. This task will leverage the AOOS cyber infrastructure, long term funding and other active data management projects being undertaken by that organization. Data sets produced from the integrated research effort will be served to users by extending existing data access, analysis and visualization interfaces currently supported and under development by the AOOS data management team.

Figure 1 below provides screen captures of existing AOOS data portals which provide access to data management systems that manage sensors, models/remote sensing and GIS data layers. These portals can be accessed off the AOOS website at http://data.aoos.org/.

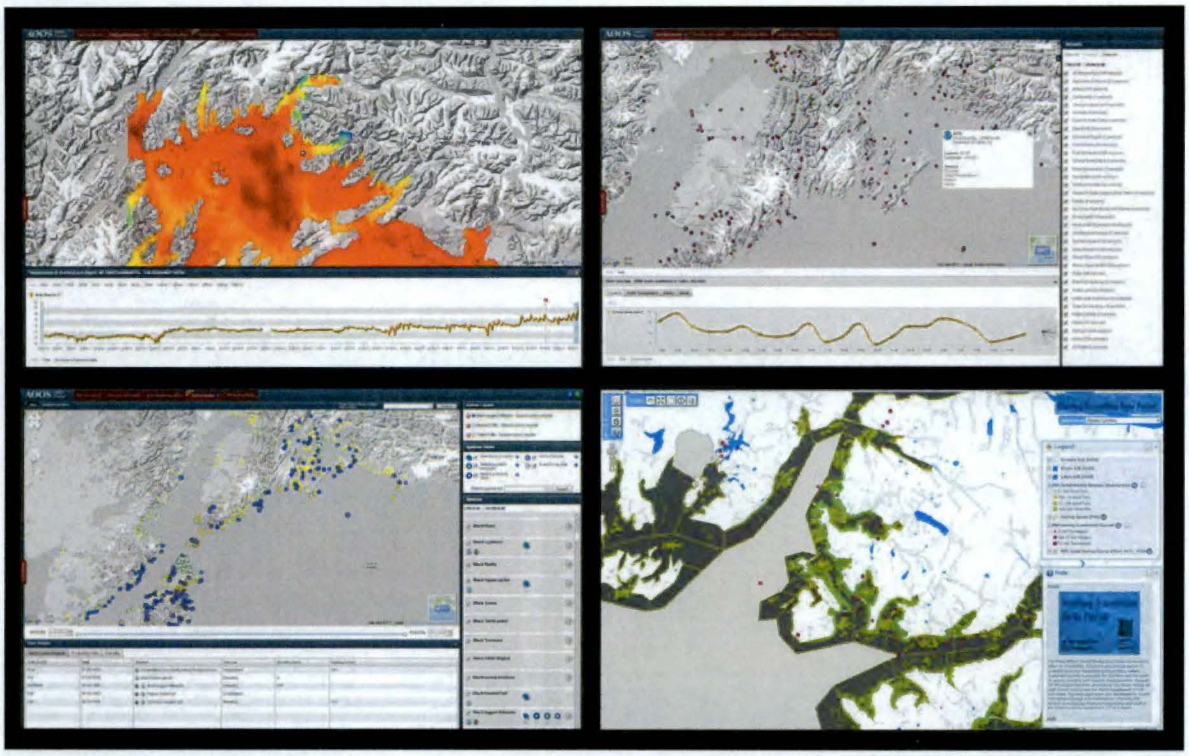

Figure 1. Screenshots of existing AOOS data management and visualization systems which are available at http://data.aoos.org. At the top left is a screenshot of the AOOS model explorer displaying a ROMS circulation model of Prince William Sound and an ocean temperature point source time series extraction near Port Fidalgo. On the top right of the figure is a screen capture of the AOOS real time sensor portal. On the bottom of the figure from the left to right are screenshots of the North Pacific Seabird Portal and the PWS Herring Portal.

C. Data Analysis and Statistical Methods

The overarching strategic plan for the AOOS data system involves implementing an end-to-end technological solution which allows data and information to be channeled and distilled into user-friendly products while simultaneously enabling the underlying data to be assimilated and used by the emerging external data assembly systems. The following diagram (Figure 2) details the four logical technical tiers of the approach. At the base (Tier 1) of the pyramid lie the source data produced by researchers, instruments, models, and remote sensing platforms which are stored as files or loaded within geospatial databases. Interoperability systems (Tier 2), such as Web Map Services (WMS) and Web Coverage Services (WCS), are then implemented and connected to these underlying data sources. The asset catalogue (Tier 3) connects to internal interoperability systems in addition to known external sources of interoperable data and populates a database describing the dimensional characteristics (space, time, measured parameter, and taxonomy) of each data resource. Also in this third tier are web services which provide access to the descriptive information contained in the asset catalogue database so that applications can more easily utilize data from multiple sources, formats, and types. The final technical level (Tier 4) is composed of the web based applications and tools which provide users access to data and products. Users sit at the top of the pyramid with all underlying systems working together to create a powerful and intuitive user experience. The intended result is the facilitation of rapid data discovery, improved data access, understanding, and the development of knowledge about the physical and biological marine environment.

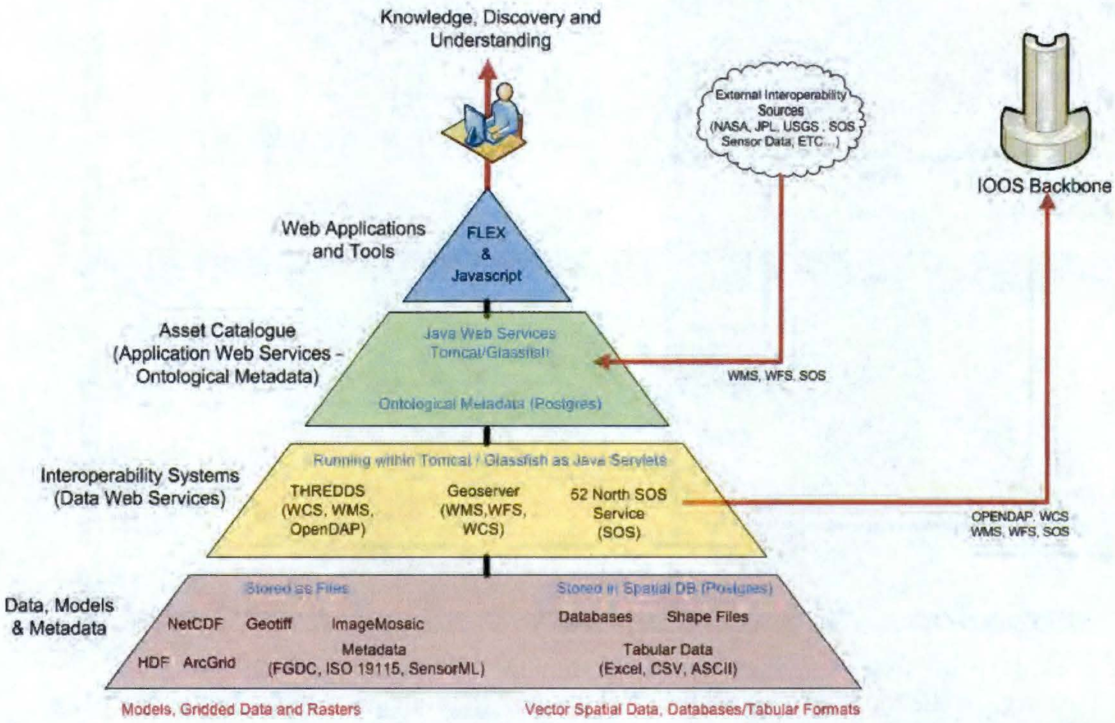

Figure 2. Data knowledge pyramid detailing the flow of data through logical technology tiers so that it can be consumed by users to enable discovery and understanding about the ocean environment.

Tiers are discussed in technical detail below.

- **Tier 1 (Data, Models and Metadata)** – At the base of the proposed data management framework are the datasets, metadata, and model outputs that provide the foundation for applications and user tools. These resources can be stored either in native formats or spatially enabled databases. The decision to choose one method over the other is dictated by the requirements of the interoperability system which will be serving the data. Data which has a tabular or vector form (Shapefiles, databases, Excel spreadsheets, comma separated values (CSV) text files, etc.) will be loaded into a PostgreSQL database and spatially indexed. GeoServer, an open source geospatial data server, will then connect to the PostgreSQL database and serve the data via WFS and WMS protocols. Imagery, raster, and model data will be stored in a file server in their native file formats. THREDDS and/or ncWMS will be used to serve NetCDF and HDF files which may contain two, three, four or higher dimensional gridded datasets. GeoServer or other OGC compliant mapping servers will be utilized to serve GeoTIFF, ArcGrid, ImageMosaic and other two dimensional imagery/raster data.

- **Tier 2 (Interoperability Systems)** – Various interoperability servers (GeoServer, THREDDS, ncWMS, 52 North SOS, etc.) will be implemented on top of source data. By design, these servers will expose a powerful set of interfaces for other computing systems and humans to extract, query, and visualize the underlying source data. These systems will facilitate all aspects of data delivery to users in addition to providing the muscle for the machine-to-machine data transfer to national data assembly systems as required. Because these systems have been developed using the Java programming language, they will run within a servlet container such as Tomcat or Glassfish.

- **Tier 3 (Asset Catalogue, Ontological Metadata and Services)** – The asset catalogue provides a description of known internal and external available data resources, access protocols for these resources (interoperability services, raw file download, etc), and directives on how to ultimately utilize these data resources in applications Because documentation and access methods vary widely between data sources, a system which catalogs data sources and reconciles these inconsistencies must be implemented if the data are to be used in an efficient manner

  In addition to managing information about data availability and access methods, the asset catalogue will also contain an ontology that maps source data descriptions and metadata to a common set of internally stored terms with strict definitions. This mapping will allow users to easily locate related sets of information without having explicit knowledge of the internal naming conventions of each data-providing agency. The development of an internal ontology will also enable future endeavors to connect the asset catalogue to global ontologies in the semantic web. The following dimensions are to be stored in the database for mapping the heterogeneous characteristics of source data to common metrics:

  - **Source** – Service URLs and methods of interaction for these services
  - **Data formats and return types** – Data format returned by the service and how data can be equated between various formats
  - **Space (x, y, z)** – Spatial dimensions of dataset (1D, 2D, 3D). Upper and lower spatial bounds (bounding box or cube) stored in common projection (EPSG 4326).
  - **Time (t)** – For data resources with a time component. document time span, whether time corresponds to a single moment or if it is representative of a time period. If data is in discrete periods, document individual available periods.
  - **Taxonomy** – Taxonomic data mapped to International Taxonomic Information System (ITIS) codes.
  - **Parameter** – Parameter(s) and units in the data resource and how they map to internally defined universal terms. For example. Datasets SST, AVHRR, and Sea_Surface all contain parameters that map to internal universal term Sea Surface Temperature

  Web services written in the Java programming language will be developed to connect to the asset catalogue and provide applications with access to the underlying descriptions of all known data sources Because the asset catalogue contains a structured ontological definition of data sources and maps all known data sources to a common definition, applications can be developed which connect users to vast arrays of data through simple but powerful interfaces. The following is a list of example functionality that is possible utilizing this methodology.

  - Users can load multiple data layers (potentially existing in different physical locations and being served by different systems) onto a single web based map. Users can also filter all layers simultaneously by time or request spatial and temporal subsamples of data that can be pulled from multiple sources and automatically packaged into a single download.
  - All real time sensor feeds can be accessed and visualized on a single uniform user interface by parameter even though the sources of the sensor feeds may exist in a wide array of formats and service protocols.
  - Users can query the asset catalogue to discover which data is available for an area, time period, parameter, and species.

- **Tier 4 (User Applications)** – Users interface with web based applications that bring together combinations of underlying data and allow users to make discoveries, improve understanding, and develop knowledge through visualization and data access. These types of applications would most likely be interactive map based data portals Applications will also be developed which provide specific targeted functionality. These focused applications could include marine spatial planning tools, emergency response applications, and educational/outreach portals Developed tools are designed to meet user needs and thus require user input into their initial design and periodic feedback to direct functional improvements for future design iterations.

D. Description of Study Area

The majority of this project will involve consolidating existing data, metadata, and other electronic resources related to herring in Spill Affected Area. Specific areas of focus include those areas in PWS, Lower Cook Inlet, and Kodiak where herring fisheries currently do, or historically did occur. The north, east, south, and west bounding coordinates of this area are 59.767, -145.837, 61.834, and -154.334

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. This project is also highly coupled with the proposed data management component of the EVOS Long Term Monitoring program.

AOOS brings a significant level of leveraged resources, infrastructure, regional data management projects and partnerships to this proposed effort. The data management effort for the LTM and herring projects could not be accomplished for the budgeted amount by a team without these leveraged resources.

1. AOOS – (500k to AOOS DM) Alaska oceanographic data management effort. Supports open source, standards based data system that serves up and archives real-time sensor feeds, models & remote sensing applications, GIS data layers, and historical datasets. Data system developed on interoperability concepts and meets NOAA Integrated Ocean Observing System standards and protocols for streaming data feeds to national data assimilation sensors. Data Management Committee chaired by Dr. Phil Mundy provides ongoing advice, prioritization and direction to the team at Axiom Consulting & Design. AOOS board is made up of federal and state agencies, and major marine research institutions in the state that have committed to data sharing. The AOOS board has committed to supporting a statewide data system for as long as AOOS exists. Federal funding is stable, although we would like to see it increase. In the event AOOS was to end, all data and data products would be transferred to the University of Alaska.
2. PWSSC – PWSSC Data Management Project ($50K to AOOS DM).– Project involves the creation of a prototype data management system for use by PWSSC staff to manage, track, document via metadata and visualize oceanographic and biological data being collected at the center. Project will utilize a stack of open source technologies and protocols with the overall goal of creating a packaged solution for research organizations to better manage and document their data resources. This project is to function as the pilot application for the AOOS project level data management system.

3. Northern Forum/USFWS Seabird Data System – ($50K)Project involves the creation and population of a series of new seabird metric databases (diet and productivity) and integrating these new databases with legacy seabird databases (species distribution and abundance at seabird colonies, pelagic species distribution and abundance, USGS seabird monitoring databases and NPRB's North Pacific Seabird Diet Database). Modern spatially explicit, web based data entry interfaces have and continue to be developed to assist researchers existing in distributed agencies to contribute their historic and current seabird metric data into standard data structures. Project will result in vastly increasing the amount and quality of seabird species distribution, diet and other seabird data available for use in retrospective analysis and management. Though data includes areas around all of Alaska, most available data is located in GOA and PWS.
4. AOOS – 3-year funded partnership (~$200K to ADF&G) with ADF&G Division of Commercial Fisheries to develop data sharing and transfer to make commercial fisheries data more accessible, and to allow ADF&G researchers greater access to oceanographic data. Project builds upon an effort funded by the Moore foundation to develop improved data management capacity and salmon fishery management tools for the PWS fisheries.
5. AOOS – collaborator with Alaska Data Integration Working Group – an initiative with the Alaska Climate Change Executive Roundtable – to develop protocols for serving up project data to increase data sharing among federal and state agencies.
6. AOOS and NOAA – initiatives to develop data sharing agreements with private sector, including oil & gas companies.
7. Cook Inlet Regional Citizens Advisory Council (27K) – contract with Axiom to develop a data management system for their oceanographic and contaminants data in Cook Inlet.

III. CV's/RESUMES

CV — Robert Bochenek

Position and Address
Information Architect
Axiom Consulting and Design, 523 W. 8th Ave, Anchorage, AK 99501, USA

Professional Preparation
University of Michigan, Aerospace Engineering, B.S.E , 2001

Appointments

2010 – Present	Technical Lead, Alaska Ocean Observing System, Anchorage, AK
2006 – Present	Information Architect, Axiom Consulting and Design, Anchorage, AK
2003 – 2006	Data Systems Manager, Exxon Valdez Oil Spill Trustee Council (EVOSTC), Anchorage AK, 99504
2001 – 2002	Analyst Programmer, Alaska Department of Fish & Game, Anchorage, AK

Publications
None

Synergistic Activities

2012 – Present	Funded under the NOAA High Performance Computing program for exploratory research in applying HPC concepts to serving and visualizing gridded multidimensional models and observational data sets
2011 – Present	Member of the IOOS Sensor Observation Service standardization Committee
2010 – Present	Member of the Alaska Data integration Working Group (ADIWG) focused on developing frameworks for interchange of scientific information across Alaskan Agencies.
2009 - Present	Development of the Prince William Sound Data Portal, A tool for scientists, educators and the public to visualize four dimensional fisheries data

Collaborators and Co-Editors

Broderson, Dayne	Geographic Information Network of Alaska (GINA), Fairbanks, AK
Howard, Katherine	Alaska Department of Fish and Game, Anchorage, AK
Jones, Matt	National Center for Ecological Analysis and Synthesis, Santa Barbara, CA
Krueger, Charles	Great lakes Fishery Council, Ann Arbor, MI
Moffit, Steve	Alaska Department of Fish and Game, Anchorage, AK
Moss, Jamal	Alaska Fisheries Science Center, Juneau, AK
Mueter, Franz	University of Alaska, Juneau, AK
Mundy, Phillip	Alaska Fisheries Science Center, Juneau, AK
Pegau, Scott	Oil Spill Recovery Institute, Cordova, AK
Saupe, Susan	Cook Inlet Citizen's Advisory Council, Anchorage, AK
Smith, Stan	United states geological Survey, Anchorage, AK
Snowden, Derrick	Integrated Ocean Observing System, Silver Springs, MD
Svoboda, Michael	Environment Canada, Whitehorse, Canada
Wiese, Francis	North pacific Research Board, Anchorage, AK

CV — Shane R. StClair

Position and Address
Senior Software Engineer
Axiom Consulting and Design, 523 W. 8th Ave, Anchorage, AK 99501, USA

Professional Preparation
University of Alaska Anchorage, Biological Sciences, B.S., 2002

Appointments

2008 – Present	Senior Software Engineer, Axiom Consulting and Design, Anchorage, AK
2006 – 2008	Analyst Programmer, Exxon Valdez Oil Spill Trustee Council, Anchorage, AK
2002 – 2006	Research Analyst, Alaska Department of Fish & Game, Anchorage, AK

Publications

Brannian, L. K., K. R. Kamletz, H. A. Krenz, S. StClair, and C. Lawn. 2006. Development of the Arctic-Yukon-Kuskokwim salmon database management system through June 30, 2006. Alaska Department of Fish and Game, Special Publication No. 06-21, Anchorage.

Hamner, H. H., S. St Clair, and H. Moore. 2004. An inventory of age, sex and length data for Norton Sound, Kotzebue, and Kuskokwim chum salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A04-06, Anchorage.

Estensen J. L., S. St Clair. 2003. Pacific herring stocks and fisheries in the Arctic-Yukon-Kuskokwim region of the Bering Sea, Alaska, 2003 and outlook for 2004. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-37, Anchorage.

Hamner H., S. Karpovich, S. StClair. 2003. Development Of A Shared AYK Salmon Database. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-23, Anchorage.

Hamner, H. H., S. Karpovich, S. St. Clair. 2003. Norton Sound salmon information database file inventory and problem review. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-01, Anchorage.

Synergistic Activities

2011 - Present	Member of the IOOS Sensor Observation Service standardization committee
2011 - Present	Developer of IOOS customizations of 52North SOS software and significant contributor to main codebase
2011 - Present	Maintainer of GeoServer (open source geospatial data server) Excel WFS output plugin
2010 - Present	Maintainer of Redmine/ChiliProject (open source project management software) Recaptcha anti-spam plugin
2009 - Present	Contributor to several widely used open source projects including jTDS, OpenScales, Maven Shade, GeoTools
2009 - 2012	Developed spatially enabled online data management application for Alaska Dept. of Fish & Game aerial surveys and transferred software to client systems and programmers
2008 - Present	Developer for global seabird abundance, population health, and diet database in conjunction with USFWS, World Seabird Union, Pacific Seabird Group, and others

Collaborators

Aime, Andrea	GeoSolutions, Reggiolo, Italy
Bridger, Eric	Gulf of Maine Research Institute, Portland, ME
Chaouchi, Mohamed	Center for Operational Oceanographic Products and Services, Silver Spring, MD
Deoliveira, Justin	OpenGeo, New York, NY
Dickinson, Ian	Epimorphics, Bristol, UK
Garcia, Mike	National Data Buoy Center, John C. Stennis Space Center, MS
Hollmann, Carsten	52North Initiative for Geospatial Open Source Software, Muenster, Germany

Irons, David	U.S. Fish and WIldlife Service, Anchorage, AK
Jones, Kathleen	Alaska Department of Fish and Game, Juneau, AK
Kaler, Robb	U.S Fish and WIldlife Service, Anchorage, AK
Kellon, Cathy	Ecotrust, Portland, OR
Kimball, Heath	Alaska Department of Fish and Game, Anchorage, AK
Mayorga, Emilio	Northwest Association of Networked Ocean Observing Systems, Seattle, WA
Moffit, Steve	Alaska Department of Fish and Game, Cordova, AK
Snowden, Derrick	Integrated Ocean Observing System, Silver Springs, MD
Walton, Kelly	Alaska Natural Heritage Program, Anchorage, AK
Welch, Tim	Ecotrust, Portland, OR
Wilcox, Kyle	Applied Science Associates, South Kingstown, RI

IV. SCHEDULE

A. Project Milestones

Objective 1. Provide data management oversight and services for EVOS IHRP project team data centric activities which include data structure optimization, metadata generation, and transfer of data between project teams.

This objective will be addressed throughout the entire span of the project and will follow the annual cycle of field data collection and analysis by principal investigators Investigators will be engaged before each field season to ensure that preparations have been made to stage data collected by the project so that other members of the IHRP project can access the data produced by project participants.

Objective 2. Consolidate, standardize and provide access to study area data sets that are critical for retrospective analysis, synthesis and model development.

This objective will be met by the fourth quarter of year two of the effort (January 2014)

Objective 3. Integrate all data, metadata and information products produced from this effort into the AOOS data management system for long term storage and public use.

This objective will be addressed throughout the entire span of the project The AOOS data system is to serve as the vessel to capture all project level data produced through this effort in addition to those datasets salvaged to inform the historic synthesis effort This task will be ongoing as long as the program is producing or acquiring additional data

B. Measurable Project Tasks

Y3 1st Quarter (February 1, 14 to April 30, 14)

Winter	EVOS workshop with Herring and Long-term monitoring programs
February	Submit annual report
February	Submit annual financial report

Y3 2nd Quarter (May 1, 14 to July 31, 14)

May	Participate in annual PI meeting

Y3 3rd Quarter (August 1, 14 to October 31, 14)

August	Submit semi-annual report and year 4 work plan
September	Oversee transfer of field year 3 data
October	Assess year 3 datasets and metadata submitted through Ocean Workspace

Y3 4th Quarter (November 1, 14 to January 31, 15)

January	Annual Marine Science Symposium

V. BUDGET

Budget Form (Attached)

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

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: Non lethal sampling: In situ estimation of juvenile herring sizes

Project Period: (Please use the fiscal year of February 1 – January 31)

Primary Investigator(s): Kevin M. Boswell; Florida International University, North Miami, FL, 33029

Abstract: A common source of bias in acoustic surveys is proper partitioning of size classes and their respective contribution to biomass estimates (see Simmonds and MacLennan 2005). This is particularly evident when considering the probability of encountering multiple size classes (or age classes) within a given survey region, or even within a large school. Several approaches have been successful in estimating in situ size distributions, though many require appropriate light fields to determine target sizes (Foote and Traynor 1988; Gauthier and Rose 2001; Kloser and Horne 2003). Recent application of imaging sonars have proven useful for acquiring high-resolution measurements of target-length distribution, without the need for ambient or external light sources, thereby reducing the potential of behaviorally mediated bias in length estimation. Further, automated analysis software has been refined to rapidly provide length estimates and target tracking parameters, even for tightly schooling fishes.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
0	43,676	51,263	0	0	94,939

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: 8/30/2013

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I. NEED FOR THE PROJECT
A. Statement of Problem
A common source of bias in acoustic surveys is proper partitioning of size classes and their respective contribution to biomass estimates (see Simmonds and MacLennan 2005). This is particularly evident when considering the probability of encountering multiple size classes (or age classes) within a given survey region, or even within a large school. Several approaches have been successful in estimating in situ size distributions, though many require appropriate

light fields to determine target sizes (Foote and Traynor 1988; Gauthier and Rose 2001; Kloser and Horne 2003). Recent application of imaging sonars have proven useful for acquiring high-resolution measurements of target-length distribution, without the need for ambient or external light sources, thereby reducing the potential of behaviorally mediated bias in length estimation. Further, automated analysis software has been refined to rapidly provide length estimates and target tracking parameters, even for tightly schooling fishes.

Recent work by Boswell and others in Southeast Alaska (Lynn Canal) has resulted in the development and successful integration of an imaging sonar and fishery echosounder system to directly compare estimates of biomass derived from traditional echo integration techniques. These traditional measures have been adopted and continue to be used as the baseline for estimating fish biomass, though have no real capacity for determining fish length distributions and their contribution to estimated biomass of PWS herring, as is the need for this research effort. A compelling result from the work conducted in Lynn Canal (Boswell et al., unpub.) was the large variability in estimated biomass from the traditional echo integration techniques as compared to the more direct approach with the imaging sonar. Interestingly, M. Jech (NOAA NEFSC) independently observed the same result with respect to variability in biomass estimates from echo integration and imaging sonar observations from Atlantic herring. Thus in addition to achieving in situ size estimates from the imaging sonar, the simultaneous integration of both sonar systems may enhance resolution of herring biomass estimates as well.

B. Summary of Project to Date (if applicable)

Agreements have recently been arranged between PWSSC and FIU to initiate the contract process.`

II. PROJECT DESIGN

A. Objectives

Objective 1-Apply non-invasive techniques to estimate the in situ distribution (size, abundance, behavior and orientation) of herring.

Objective 2- Directly compare the abundance, size, and density estimates of herring derived from direct capture methods, fisheries echosounder data and in situ measurements.

Objective 3- Use data from in situ methods to evaluate biases with direct collection methods and estimates of abundance derived from traditional fisheries echosounder data.

Given that the condition of the herring population is of great concern the ability to estimate the in situ abundance, density and length distributions of herring is paramount. Moreover, by developing a method to acquire these metrics in a non-invasive manner, we will be better able to interpret the fisheries acoustic data collected and move beyond relying on intensive direct capture techniques

B. Procedural and Scientific Methods

A multibeam imaging sonar and an ROV will be used to derive in situ estimates of herring size, abundance, behavior, and orientation to compare with direct capture methods and traditional fisheries echosounder data. We propose to augment surveys using traditional fisheries echosounder equipment (e.g., Simrad Ek60 Split-beam 38 and 120 kHz), with a vane or ROV deployment approach to opportunistically acquire both in situ length and density estimates, while simultaneously validating species composition (ROV). The imaging sonar (DIDSON or ARIS; www.soundmetrics.com) has a down-range resolution of <1cm, depending on range, offering the ability to discriminate among size classes in real time and will serve to quantify differences in length-frequencies among seasons and bay systems. This high-resolution sonar can be mounted onto a vane and deployed at depth or integrated into a towable-ROV conceived by Boswell and Seamor Marine with 1200ft fiber optic tether, capable of towing at depth up to 5kts (Figure 1). Depending on vessel capabilities, size and power options, either the vane deployment method or ROV can be utilized. As illustrated in Figure 1, a transducer can be attached to the vane to allow for in situ measures of target strength to compliment echo integration techniques and density estimation; this is not unlike the work previously conducted by Thomas and Thorne in concept However, in contrast to their work, we would integrate the more contemporary technology by making use of the position and compensation methods offered with split-beam transducers. Ultimately, this would provide an in situ estimate of fish length (via imaging sonar) and target strength (via echosounder) to derive two independent indices of herring size and abundance, while also acquiring information about in situ behavior which can greatly influence acoustic estimates of fish biomass from traditional echo integration techniques

C. Data Analysis and Statistical Methods

Acoustic data will be processed in both Echoview and Matlab (Boswell et al. 2008; Handegard and Williams 2008), for which algorithms have previously been developed for target identification, tracking, enumeration, and biomass estimation. Length frequency distributions derived from the sonar systems will be compared from direct collection methods (e.g., seines, gill nets, trawls) and offer insight into potential biases among different gear types used to target herring. Additionally, estimates of density and abundance derived form in situ methods will be compared with those derived by both direct capture and fisheries echosounder techniques. Specifically, the metrics derived from the imaging sonar (length, abundance, density) will be compared with the echointegrated estimate of density and abundance indices derived from the fisheries echosounder and direct capture methods, respectively. In addition, length-frequency estimates will be derived from all techniques and the distributions will be compared to identify potential sampling biases among gear types. Finally, these distributions will be available for use as a complimentary tool to enhance current modeling and assessment methods implemented by the ADFG for estimating spawning biomass, juvenile survivorship, and potentially even emigration from coastal bays. The primary product will be to ground-truth juvenile herring length distributions in the core bays sampled in the monitoring program using a high-resolution imaging sonar. Thus, in situ target-length (imaging sonar) and target strength (echo-sounder) distributions will be derived. We will estimate proportional biomass contributions of herring size classes based on in situ length and abundance distributions. Additionally, we will evaluate size-based bias in collection methods (e.g., gill nets, trawls, seines, etc.) and extending those biases within the context of population level biomass estimates. An important, yet indirect product will be the estimation of herring sizes targeted by humpback whales during cruises with J. Moran (similar to previous work in Lynn Canal). Following each survey, data will be assimilated and processed to derive aforementioned metrics and facilitate comparisons among gear types. Results and analyses will be provided to PWSSC researchers for integration into analysis and modeling components and to meet reporting requirements.

D. Description of Study Area

As this is a complimentary component to other proposed projects (listed below), the time frame for this proposed work will be dependent upon the finalized sampling program schedule developed throughout the first few fiscal years.

Juvenile Herring Abundance Index
Expanded Adult Herring Surveys
Acoustic Consistency: Intensive Surveys of Juvenile Herring
Use of concurrent trawls to validate acoustic surveys for Pacific Herring

E. Coordination and Collaboration with the Program
This component will collaboratively and opportunistically compliment work of other investigators (e.g., MA Bishop, R Thorne, M. Buckhorn, J. Moran) involved by providing estimates of juvenile herring size distributions for which several other projects are dependent, and by making more efficient use of ship time and adding new observations at various spatial and temporal resolutions (e.g. seasonal estimates of herring size, behavior in response to predation, variability among different bays). Further, we will be able to address other relevant process-related questions using this approach (e.g., predation or mortality rates imposed by humpback whales).

III. CV's/RESUMES

Kevin M. Boswell

Florida International University
Marine Sciences Program
Department of Biological Sciences
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North Miami, FL 33181, USA

Office: 305-919-4009
Fax 305-919-4030
Email: kevin boswell@fiu.edu
Web· http·//www2.fiu.edu/~kmboswel/

(a). Professional Preparation
2006 PhD, Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, LA. Minor- Experimental Statistics
1998 BS, Marine Fisheries, Texas A&M University, Galveston, TX

(b). Appointments
2011-Present Assistant Professor, Marine Science Program, Department of Biological Sciences, Florida International University
2012- Present Assistant Professor- Adjunct, Department of Oceanography and Coastal Sciences, Louisiana State University
2010- 2011 Assistant Professor- Research, Department of Oceanography and Coastal Sciences, Louisiana State University

(c). Products
Five most relevant products
Grabowski, TB, **KM Boswell**, BJ McAdam, RJD Wells, G Marteinsdottir. *2012* Characterization of Atlantic cod spawning habitat and behavior in Icelandic coastal waters. *PLoS ONE, 7(12).* doi:10.1371/journal.pone.0051321

Handegard, NO, **KM Boswell**, C.C. Ioannou, S.P LeBlanc, D B Tjostheim and I.D. Couzin. *2012* The dynamics of coordinated group hunting and collective information-transfer among schooling prey. *Current Biology*, 22 1213-1217.

Boswell KM, BM Roth and JH Cowan 2009. Simulating the effects of fish orientation on acoustic biomass calculations *ICES Journal of Marine Science*, 66: 1398-1403

Boswell KM, MP Wilson and JH Cowan 2008. A semi-automated approach to estimating fish size, abundance and behavior from Dual-frequency Identification Sonar (DIDSON) data. *North American Journal of Fisheries Management,* 28:799-807.

Kimball ME, **KM Boswell**, LP Rozas and JH Cowan. 2010. Evaluating the effect of slot size and environmental variables on the passage of estuarine nekton through a water control structure *Journal of Experimental Marine Biology and Ecology, 395 181-190*

Five other products
Campbell MD, KA Rose, **KM Boswell** and JH Cowan. 2011 Individual-Based Modeling of Fish Population Dynamics of an Artificial Reef Community: Effects of Habitat Quantity and Degree of Refuge. *Ecological Modeling,* 222 (2011) 3895– 3909

Boswell KM, RJD Wells, JH Cowan and CA Wilson 2010. Biomass, density, and size distributions of fishes associated with a large-scale artificial reef complex in the Gulf of Mexico *Bulletin of Marine Science*. doi:10.5343/bms.2010.1026

Mueller AM, DL Burwen, **KM Boswell** and T Mulligan. 2010. Tail Beat Patterns in DIDSON Echograms and their Potential Use for Species Identification and Bioenergetics Studies. *Transactions of the American Fisheries Society*, 139:900-910.

Boswell KM, MP Wilson, PSD MacRae, CA Wilson and JH Cowan. 2010. Seasonal estimates of fish biomass and length distributions using acoustics and traditional nets to identify estuarine habitat preferences in Barataria Bay, Louisiana. *Marine and Coastal Fisheries Dynamics, Management, and Ecosystem Science*, 2:83-97.

Boswell KM and CA Wilson. 2008. Side-aspect target strength measurements of bay anchovy (*Anchoa mitchilli*) and Gulf menhaden (*Brevoortia patronus*). *ICES Journal of Marine Science*, 65·1012-1020.

(d). Synergistic Activities

Selected Professional Services, Committees and Outreach

i Founding member· Southeast Acoustics Consortium (seac fiu edu)
ii. US Representative. ICES Working Group on Fisheries Acoustics Science and Technology
iii. Participant: ICES Study Group on Calibration of Acoustic Equipment
iv. Member of the Advisory Committee of the Atlantic Coastal Cooperative Statistics Program
v. Manuscript reviewer for American Fisheries Society Symposium Series, Conservation Biology; Estuarine, Coastal and Shelf Science; J of Experimental Marine Biology and Ecology; Gulf of Mexico Science; ICES J of Marine Science; J of Sea Research; Marine and Coastal Fisheries, Marine Ecology Progress Series; Marine Technology Society Journal; North American J of Fisheries Management; Transactions of the American Fisheries Society

(e). Collaborators and Other Affiliations

Collaborators in past 48 months

Dennis Allen (USC BBML); Hongsheng Bi (UMCES); Iain Couzin (Princeton); James Cowan (LSU), Kim de Mustert (GMU), Alex De Robertis (NOAA), Nils Olav Handegard (IMR), John Hedgepeth (Tenera); Ron Heintz (NOAA); Joe Hightower (NCSU), Mike Jech (NOAA); Matt Kimball (UNF); Chunyan Li (LSU); Brenda Norcross (UAF); Doug Nowacek (Duke); Guillaume Rieucau (IMR), Jay Rooker (TAMU); Jan Straley (UAS); Tracey Sutton (VIMS), Chris Taylor (NOAA); Joel Trexler (FIU); Joe Warren (SUNY), David Wells (TAMU)

Graduate advisors and postdoctoral sponsors

PhD- Dr Charles A Wilson; Gulf of Mexico Research Initiative
Post Doctoral- Dr. James H. Cowan; Louisiana State University

Thesis Advisor and Postgraduate-Scholar Sponsor

Postdoctoral scholar- Dr Marta D'Elia, Postdoctoral advisee, 2013-present
Visiting Scientists- Dr. Guillaume Rieucau, 203
Thesis committee: Mark Barton (PhD, Florida International University); Michael Bush (PhD, Florida International University); Grace Harwell (MS, Louisiana State University); Ashley Melancon (PhD, Louisiana State University); Andrew Repp (PhD, Florida International University); Kirsten Simonsen (PhD, Louisiana State University); Adam Zenone (MS, Florida International University)

IV. SCHEDULE

A. Project Milestones

Objective 1- Apply non-invasive techniques to estimate the in situ distribution (size, abundance, behavior, orientation) of herring.

Data collection and analysis will be completed by January 2015

Objective 2-Directly compare the abundance, size, and density estimates of herring derived from direct capture methods, fisheries echosounder data and in situ measurements.

Statistical analyses completed by March 2015

Objective 3-Use data from in situ methods to evaluate biases with direct collection methods and estimates of abundance derived from traditional fisheries echosounder data.

To be completed by June 2015

B. Measurable Project Tasks

FFY 14, 1st quarter (October 1, 2014-December 31, 2014)

November 15 Final collection and begin analysis for Objective 1

FFY 14, 2nd quarter (January 1, 2015-March 31, 2015)

January 18 Annual Marine Science Symposium

March 31 Completion of analyses of Objective 2

FFY 14, 3rd quarter (April 1, 2015-June 30, 2015)

June 30 Complete analyses for Objective 3

FFY 14, 4rd quarter (July 1, 2015-September 30, 2015)

August 1 Submit final report. This will consist of a draft manuscript for publication to the Trustee Council Office

V. BUDGET

Budget Form (Attached)

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

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: **PWS Herring Research and Monitoring: Expanded Adult Herring Surveys**

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

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

Abstract: Prince William Sound herring stock biomass estimates from hydroacoustic surveys provide a direct measure of the stock abundance and are also a primary input into the age-structured assessment (ASA) model that is the forecasting tool used for managment. Prior to 2001, the hydroacoustic surveys were conducted exclusively by the Prince William Sound Science Center (PWSSC). Since 2001, the effort has been shared between PWSSC and the Cordova office of Alaska Department of Fish and Game (ADF&G). While the ADF&G considers the hydroacoustic surveys to be critical (Steve Moffitt, personal communication) the lack of a commercial herring fishery in PWS since 1998 has reduced management priorities for herring. Thus the PWSSC contribution has become critically important for the long-term, especially if a future fishery appears only a remote possibility. With the level of effort available over the past several years, PWSSC and ADF&G individually have achieved herring biomass estimates with a precision of about ±30%, which is insufficient for management purposes. However, the combined effort currently meets management requirements for precision. Current stock assessment efforts by ADF&G resource managers in PWS focus on the largest spawning aggregations. The objective of this study is to increase the current survey area of adult spawning beyond the Port Gravina and Fidalgo areas to provide a more precise estimate of spawning biomass. We propose to extend the PWSSC acoustic surveys to help identify the relative contributions of additional spawning aggregations over temporal and spatial scales. This will help establish more accurate estimates of the total herring biomass in PWS and provide an alert to changes in biomass in different regions. Beginning in FY2013 and continuing until 2016, hydroacoustic surveys will be conducted in late spring (April-May) to assess adult spawning biomass. ADF&G will continue to conduct direct sampling for age/length/weight. Additional direct capture will be conducted using a midwater trawl at adult spawning sites (See Bishop proposal).

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
6,500	84,400	68,100	90,600	84,400	334,000

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: 30 August 2013

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the *Exxon Valdez* Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

Described here are projects for a program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. **The long-term goal of the program is to improve predictive models of herring stocks through observations and research.** While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

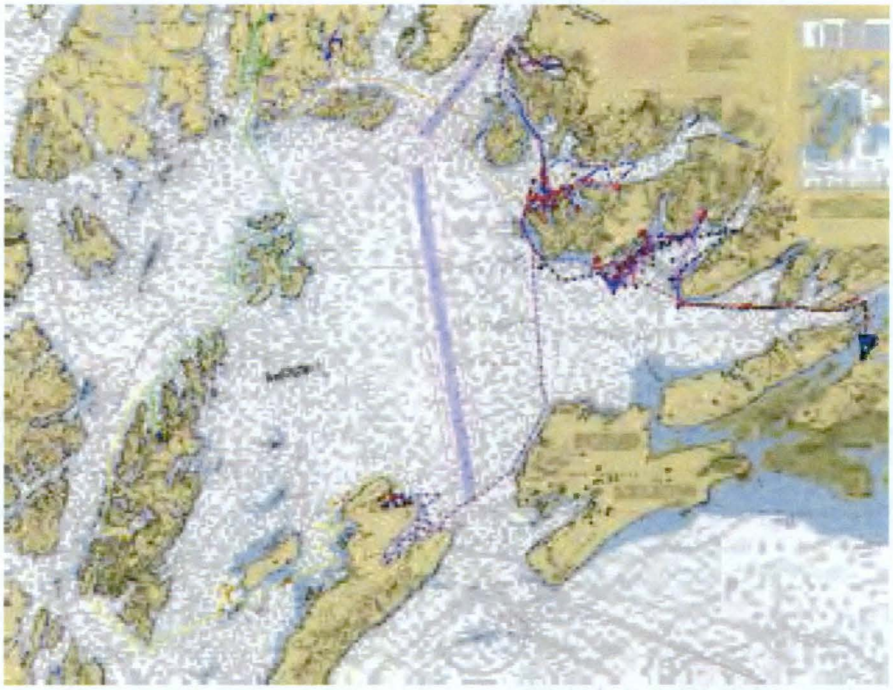
The current management of the Prince William Sound (PWS) herring stock by the Alaska Department of Fish and Game (ADF&G) depends heavily on hydroacoustic surveys. Biomass estimates from these surveys provide a direct measure of the stock abundance and are also a primary input into the age-structured assessment (ASA) model that is the primary forecasting tool. The hydroacoustic surveys were initiated in 1993 when fishers were unable to locate concentrations of herring despite a forecast for high abundance. The high forecast was based on an ASA model that relied on age-structure information alone. The hydroacoustic survey revealed that the population had collapsed. March 2011 will mark the 19th consecutive annual survey using hydroacoustic surveys. Over this time period the hydroacoustic survey has shown to be an early and accurate measure of the herring stock abundance and compares well with the recent ASA model estimates that now incorporate hydroacoustic survey information as well as an index of male spawning abundance.

Prior to 2001, the hydroacoustic surveys were conducted exclusively by the Prince William Sound Science Center (PWSSC). Since 2001, the effort has been shared between PWSSC and the Cordova office of Alaska Department of Fish and Game. Over the past 3 years, the PWSSC effort has been supported by EVOS TC. The cooperative effort has been critical since both PWSSC and ADF&G have limited resources for this effort. While ADF&G considers the hydroacoustic surveys to be critical (Steve Moffitt, personal communication) the lack of a commercial herring fishery in PWS since 1998 has reduced management priorities for herring during a time of overall limited funding for the state agency. Thus the PWSSC contribution has become critically important for the long-term, especially if a future fishery appears only a remote possibility.

With the level of effort available over the past several years, PWSSC has achieved herring biomass estimates with a precision of about ±30%. This level of precision is insufficient for management purposes. The level of effort available to ADF&G is similarly insufficient. However, the combined effort currently meets management requirements for precision. There is concern that some concentrations of fish are not located and surveyed under current levels, in which case the estimate is biased, a factor not incorporated into variance calculations for precision.

B. Summary of Project to Date (if applicable)

a) Hydroacoustic surveys of adult herring schools were conducted March 27- April 5, 2013 and covered 629 nautical miles within Prince William Sound. Surveys were started in Port Gravina and Fidalgo, which have historically been surveyed by the previous hydroacoustic projects, then moved south and northwest to cover areas not previously covered.



Map of Prince William Sound with survey tracks for adult herring surveys.

II. PROJECT DESIGN

A. Objectives

The objective of this study is to increase the current survey area of adult spawning beyond the Port Gravina and Fidalgo areas to provide a more precise estimate of spawning biomass.

B. Procedural and Scientific Methods

Current stock assessment efforts by ADF&G resource managers in PWS focus on the largest spawning aggregations. Additional spawning aggregations exist, but are not regularly surveyed by ADF&G because of funding and personnel limitations; therefore, their relative contributions to the biomass of the PWS metapopulation remain poorly understood. The Prince William Sound Science Center (PWSSC) has also conducted acoustic biomass surveys for the past two decades. We propose to extend the PWSSC acoustic surveys to help identify the relative contributions of these additional spawning aggregations over temporal and spatial scales. This will help establish more accurate estimates of the total herring biomass in PWS and provide an alert to changes in biomass in different regions. The PWSSC survey will overlap with the ADF&G survey to provide a comparative measure between the two studies and to improve the precision of the estimate.

In this proposal for expanded adult herring surveys, we propose an effort level that will meet management needs for precision when combined with the ADF&G effort, and will also reduce current levels of uncertainty with regard to adequate geographic coverage. Beginning in FY2013 and continuing until 2016, hydroacoustic surveys will be conducted in late spring (April-May) to assess adult spawning biomass. Based on an exhaustive review of historic survey coverage, we have determined the effort required to be eight days of vessel survey for PWSSC in addition to that available to ADF&G. ADF&G will continue to conduct direct sampling for age/length/weight, primarily with a 17 FA purse seine, including concentrations located by the PWSSC effort. PWSSC effort will emphasize search for and surveys of concentrations outside the Port Gravina/Port Fidalgo area where the herring have been concentrated during the past several years. Direct capture will be conducted using a midwater trawl at adult spawning sites (See Bishop proposal). As has been the case previously, the search effort will utilize all information available including historical records of sighting of both adults and spawn, reports of marine mammal/bird concentrations and some aerial survey effort as well as high speed vessel surveys.

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**
- Prince William Sound Science Center PO BOX 705, Cordova, AK
- mbuckhorn@pwssc.org
- (907) 424-5800 x 239 fax: (907) 424-5820

- **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.
rthorne@pwssc org
P O Box 705, Cordova, Alaska 99574
(907) 424 -5800 (work), -5820 (fax)

Employment History

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

Gary L. Thomas,
Rosenstiel School of Marine and Atmospheric Sciences
4600 Rickenbacker Causeway
Miami, Florida 33149
gthomas@rsmas.miami.edu

IV. SCHEDULE

A. Project Milestones

Objective 1. The objective of this study is to increase the current survey area of adult spawning beyond the Port Gravina and Fidalgo areas to provide a more precise estimate of spawning biomass. *To be met by April 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.

FY14 1st Quarter	
January	Annual Marine Science Symposium
Winter	EVOS sponsored workshop with Herring and Long-term monitoring programs
FY14 2nd Quarter	
April	Conduct extended adult biomass cruise, collect samples for genetics
May	Attend annual PI meeting
FY14 3rd Quarter	
August	Submit FY15 work plan for review
FY14 4th Quarter	
October- December	Process and analyze data

V. BUDGET

Budget Form (Attached)

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

FY14 PROGRAM PROJECT
PROPOSAL FORM

Project Title: PWS Herring Research and Monitoring: Juvenile Herring Abundance Index

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: Management of the Pacific herring stock in Prince William Sound (PWS), Alaska, is based primarily on an age-structured-assessment (ASA) model. The current model, developed in 2005, incorporates both hydroacoustic estimates of the adult herring biomass and an index of the male spawning, called the "mile-days of spawn". Unfortunately, the forecast is based on measurements from the previous year and does not have a direct measure of future age 3 recruitment. Current knowledge suggests that most mortality occurs during the first winter of life, so the relative recruitment may be fixed by the end of the first year. Consequently, estimates of relative abundance of age 1 and age 2 fish should provide an index of future recruitment. An index of age 0 fish would also provide a forecast of recruitment if additional information were available on the magnitude of the first year mortality. We will conduct annual fall surveys (FY2013-2016) of 8 bays; four of which will be the Sound Ecosystem Assessment (SEA) bays (Cooney et al. 2001). This will maintain a continual database from these locations. The other 4 bays will be selected based upon the survey results of the current EVOSTC FY10 Herring Survey Project (# 10100132). Surveys will be conducted using 120 kHz split-beam hydroacoustic unit in a stratified systematic survey design (Adams et al. 2006). For this study, direct capture will be directed to size and species composition. A midwater trawl will be used to sample randomized transects within each strata.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
90,100	80,100	66,100	84,900	83,000	404,200

(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

Management of the Pacific herring stock in Prince William Sound (PWS), Alaska, is based primarily on an age-structured-assessment (ASA) model. The current model, developed in 2005, incorporates both hydroacoustic estimates of the adult herring biomass and an index of the male spawning, called the "mile-days of spawn". Evidence suggests that the current model performs adequately. Unfortunately, the forecast is based on measurements from the previous year and does not have a direct measure of future recruitment. Since herring are a relatively short-lived fish, this uncertain recruitment can be a substantial component of the forecast abundance.

Herring recruit primarily as age 3. Current knowledge suggests that most mortality occurs during the first winter of life, so the relative recruitment may be fixed by the end of the first year. Consequently, estimates of relative abundance of age 1 and age 2 fish should provide an index of future recruitment. An index of age 0 fish would also provide a forecast of recruitment if additional information were available on the magnitude of the first year mortality.

Hydroacoustic surveys of juvenile herring abundance have been conducted over the past 4 years. These surveys have been conducted in both fall and late winter. The focus has been on age 0 herring, driven by interest in the extent of the critical first overwinter mortality, and has included energetics and disease research as well as research on sources of predation mortality

B. Summary of Project to Date (if applicable)

Hydroacoustic surveys were conducted November 6- 16, 2012. Bays surveyed were the SEA bays: Simpson, Eaglek, Whale, Zaikof plus Lower Herring, Port Fidalgo, and Port Gravina. We were unable to conduct surveys in Windy Bay due to weather and delays due to mechanical failures involving the midwater trawl. Fish capture was accomplished using gillnets and castnets. Acoustic data is currently being processed and analyzed.

II. PROJECT DESIGN

A. Objectives

Project Objectives:

1. Conduct annual surveys of juvenile herring to create an index of future recruitment
2. Validate species and size composition of fish ensonified during acoustic transects (See Bishop proposal).

B. Procedural and Scientific Methods

Objective 1: Conduct annual surveys of juvenile herring to create an index of future recruitment

We will conduct annual fall surveys (FY2013-2016) of 8 bays; four of which will be the Sound Ecosystem Assessment (SEA) bays (Cooney et al. 2001). This will maintain a continual database from these locations. The other 4 bays will be selected based upon the survey results of the current EVOSTC FY10 Herring Survey Project (# 10100132).

Surveys will be conducted using 120 kHz split-beam hydroacoustic unit in a stratified systematic survey design (Adams et al. 2006). Bays will be stratified as MOUTH, MIDDLE, and HEAD. The areal extent of each strata will be based upon the variance of mean densities from previous surveys in order to reduce overall variance in abundance estimates (Simmonds et al. 1992, Adams et al. 2006).

Objective 2: Validate species and size composition of fish ensonified during acoustic transects (See Bishop proposal).

Historically, direct capture has been oriented to maximize age 0 captures in support of disease and energetics research. For this study, direct capture will be directed to size and species composition. Gill nets have been only been moderately effective in catching juvenile herring during previous surveys and tend to select for faster moving fishes (Thorne et al. 1983, McClatchie et al. 2000). A midwater trawl will be used to sample randomized transects within each strata (See Bishop, this proposal).

We propose to sample during fall rather than spring despite uncertainty about overwinter mortality. Previous experience suggests that the fall period provides better assessment conditions: less ice coverage and better weather. It is anticipated that the results of previous research will allow overwinter mortality to be factored into the juvenile index.

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

The study area includes all of Prince William Sound. However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 1) This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

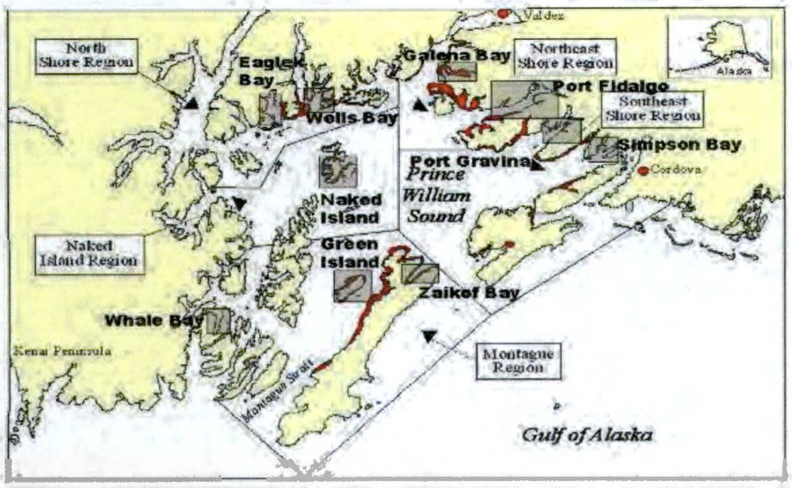


Figure 1. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with the Program

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

Prince William Sound Science Center PO BOX 705, Cordova, AK
mbuckhorn@pwssc.org
(907) 424-5800 x 239 fax: (907) 424-5820

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
Jorge Torre, PhD., Comunidad y Biodiversidad, AC, Mexico
Andrea Saenz, PhD., Comunidad y Biodiversidad, AC, Mexico

CURRICULUM VITAE

Richard E. Thorne, Ph.D.
rthorne@pwssc org
P O Box 705, Cordova, Alaska 99574
(907) 424 -5800 (work), -5820 (fax)

Employment History

Prince William Sound Science Center	Senior Scientist 2000-present
BioSonics, Inc.	Vice President 1996-1999
4027 Leary Way NW	Manager Technical Services 1991-1999
Seattle, WA 98107	Senior Scientist 1988-1999
University of Washington	Affiliate Research Professor 1991-2001
School of Fisheries	Research Professor 1981-1990 (LOA 1988-1990)
Fisheries Research Institute	Research Associate Professor 1976-1981
Seattle, WA	Senior Research Associate 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:
Gary L. Thomas,
Rosenstiel School of Marine and Atmospheric Sciences
4600 Rickenbacker Causeway
Miami, Florida 33149
gthomas@rsmas.miami.edu

IV. SCHEDULE

A. Project Milestones

Objective 1: Conduct annual surveys of juvenile herring to create an index of future recruitment. *To be met by November 2013*

Objective 2: Validate species and size composition of fish ensonified during acoustic transects (See Bishop proposal). *To be met by November 2013*

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.

FY14 1st Quarter

FY14 2nd Quarter

May	Attend annual PI meeting
June	Submit FY15 work plan for review

FY14 3rd Quarter

September	Provide juvenile data for synthesis efforts.

FY14 4th Quarter

November	Conduct juvenile index survey

V. BUDGET

Budget Form (Attached)

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

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 began 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 surveys 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

Prince William Sound Science Center PO BOX 705, Cordova, AK
mbuckhorn@pwssc.org
(907) 424-5800 x 239 fax: (907) 424-5820

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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(907) 424 -5800 (work), -5820 (fax)

Employment History

Prince William Sound Science Center	Senior Scientist 2000-present
BioSonics, Inc.	Vice President 1996-1999
4027 Leary Way NW	Manager Technical Services 1991-1999
Seattle, WA 98107	Senior Scientist 1988-1999
University of Washington	Affiliate Research Professor 1991-2001
School of Fisheries	Research Professor 1981-1990 (LOA 1988-1990)
Fisheries Research Institute	Research Associate Professor 1976-1981
Seattle, WA	Senior Research Associate 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:
Gary L. Thomas,
Rosenstiel School of Marine and Atmospheric Sciences
4600 Rickenbacker Causeway
Miami, Florida 33149
gthomas@rsmas.miami.edu

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
Febrary	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.

FY14 PROGRAM PROJECT
PROPOSAL FORM

Project Title: PWS Herring Research and Monitoring: Outreach & Education

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

Primary Investigator(s): Lindsay Butters, Education Coordinator, PWS Science Center (PWSSC)
lbutters@pwssc.org

Abstract:
The *Outreach & Education* project is designed to enhance the PWS Herring Program research activities by showcasing their relevancy, broadening their applicability and extending their impact to people in the community. PWSSC educators will work with PWS Herring Research and Monitoring principal investigators (PI) and project collaborators to prepare public education materials that communicate the purpose, goals and results of the research program to "non-scientist" audiences and stakeholders in communities in and beyond the spill affected area.

Outreach and education products will extend and transfer Pacific herring and marine ecosystem information to inform the public of local research activities and improve their ecological and ocean science literacy.

The specific objectives of this proposal, which includes the outreach and education components of the PWS Herring Research and Monitoring Program, are to:

1) Disseminate PWS herring research information and lessons learned in this program to individuals, groups, policy makers, resource managers and institutions in PWS, including the effected fishing community.

2) Extend and transfer PWS herring research-based outreach and education products to general audiences in and beyond the spill affected areas of PWS.

3) Integrate community involvement into the planning and sampling programs through citizen science opportunities and public workshops

Estimated Budget: $153,900
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
16,500	30,500	$32,700	36,000	38,300	154,000

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
		0			

Date: August 30, 2013

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the *Exxon Valdez* Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

Described here are projects for a program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. **The long-term goal of the program is to improve predictive models of herring stocks through observations and research.** While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

B. Summary of Project to Date (if applicable)

All written and web-based outreach materials have been produced as proposed, including seven *Project Profiles*, six *Delta Sound Connections* articles/infographics, and three articles in the *Breakwater* newsletter. The herring research webpage is live and we will continue to add content (www. http://pwssc.org/research/fish-2/pacific-herring/). A video of a *Community Lecture* was posted on the *PWSSC YouTube Channel* (http://youtu.be/NlVTcpxLccw) and blog and *Facebook* posts have been made.

Education programs about Pacific herring research have been delivered to school groups in Cordova, and Chenega Bay, and to science campers participating in PWSSC's summer education programs. To date, PWSSC educators have delivered twelve *Discovery Room* programs, one *Outreach Discovery* program and herring-themed lessons in four *Summer Field Programs*. Six *Community Lectures* presented by project PIs have also been held. Three *Field Notes* radio programs were produced and aired on KCHU public radio.

I am behind on two milestones: marketing of herring lesson plans to programs outside of this region (September 2012) and the production of three *Field Notes* programs (May 2013). These delays are the result of my being pregnant and having a baby in January 2013, and setbacks caused by the revision of the Field Notes radio program format by PWSSC. I expect to have the three radio programs completed by December 2013 and the lesson plans prepared for public outreach by May 2014.

II. PROJECT DESIGN

Program Objectives:

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model.* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008). The proposed monitoring efforts are designed to address

this objective by either expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events.

2) *Inform the required synthesis effort* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers.

3) *Address assumptions in the current measurements* Many of the existing studies are based on historical or logistical constraints. We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program.

4) *Develop new approaches to monitoring.* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

Because we are at the beginning of a twenty-year effort, we want to maximize the value of any data collected. The objectives listed above are designed to ensure that research and monitoring efforts within the expected twenty-year program are most effective. The programs addressing the objectives provide the information necessary to evaluate existing efforts while continuing to move towards our long-term goal.

Outreach and Education Project Objectives:
The specific objectives of this proposal, which includes the outreach and education components of the PWS Herring Research and Monitoring Program, are to:

4) Disseminate PWS herring research information and lessons learned in this program to individuals, groups, policy makers, resource managers and institutions in PWS, including the effected fishing community.

5) Extend and transfer PWS herring research-based outreach and education products to general audiences in and beyond the spill affected areas of PWS.

6) Integrate community involvement into the planning and sampling programs through citizen science opportunities and public workshops.

The **Outreach & Education** project is designed to enhance the PWS herring research activities by showcasing their relevancy, broadening their applicability and extending their impact to people in communities in and beyond the spill affected areas of PWS. Outreach products and education activities will extend and transfer herring and ecosystem information to inform the public of local research activities and improve their ecological and ocean science literacy. Both formal and informal approaches to science education are used.

The PWSSC education group has experience developing and implementing a diverse array of public outreach and educational activities through its ***Science of the Sound*** program. Educators will work closely with PWS herring research principal investigators and project collaborators to prepare and distribute public education materials that communicate the purpose, goals and results of the research program to "non-scientist" audiences and stakeholders in communities in and beyond the spill affected area.

B. Procedural and Scientific Methods

Approach: Our iterative approach to addressing the long-term goal of this program "**to improve predictive models of herring stocks through observations and research**" involves testing the relative importance of factors that may be preventing the recovery of PWS herring. The relative importance of these factors will be identified through an integrated set of studies that include monitoring efforts, shorter field-based process studies focusing on particular aspects of the herring life cycle, and controlled laboratory-based studies intended to determine cause-and effect relationships. When combined, this approach is intended to inform more directed herring monitoring and modeling efforts by focusing on important population-limiting factors and providing empirical data for the current ASA model. The work outlined here will be informed by projects outlined in a separate long-term monitoring program, such as monitoring of basic oceanographic conditions, food availability, and predator populations. It also builds upon the existing EVOSTC funded PWS Herring Survey research program. The team lead (W. Scott Pegau) on the proposed work is the same team leader as on the PWS Herring Survey program, which allows the proposed work to be fully integrated with the existing work without unnecessary duplication.

C. Data Analysis and Statistical Methods
Not applicable.

D. Description of Study Area
The *PWS Herring Research and Monitoring* program study area includes all of Prince William Sound. However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 1). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

PWS Herring Research and Monitoring Outreach & Education activities will primarily occur in PWS communities, and some communities outside of the spill affected region.

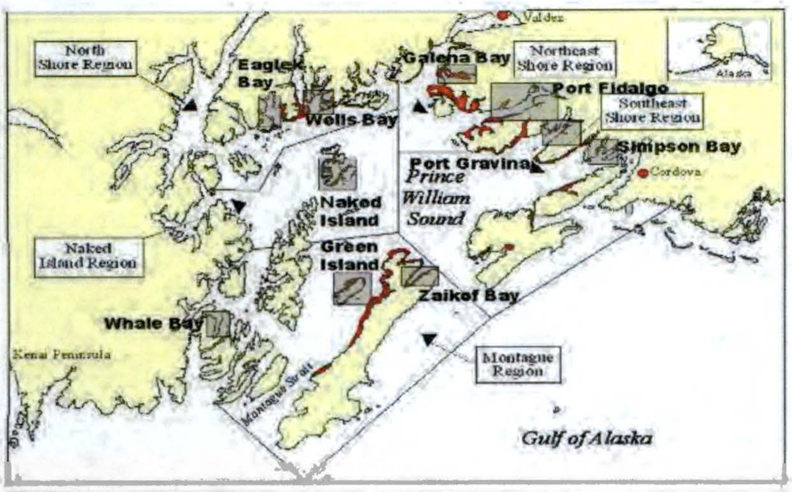

Figure 1. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

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

Lindsay Nan Butters
PO Box 2035
Cordova, AK 99574
Office (907) 424-5900 x 231 Email: lbutters@pwssc.org
Home (907) 424-7830 Fax (907) 424-5820

EDUCATION

Post Baccalaureate, University of Wisconsin, Stevens Point
Fundamentals of Environmental Education, 2006
Applied Environmental Education Program Evaluation, 2007
Strategic Planning and Implementation, 2007

Johnson State College, Johnson, VT, 2004
B.S. Environmental Science-Integrated Science
Graduated Cum Laude

PROFESSIONALEXPERIENCE

PrinceWilliam Sound Science Center, Cordova, AK
A non-profit research and education organization with a focus on ecosystem science in Coastal Alaska
Education Specialist **December 2012-present**

- Produce written, radio and web-based outreach materials to communicate ecosystem research information to the general public.
- Develop/oversee delivery of educational programs that engage students and community members in presentations, hands-on activities and field experiences to learn about ecosystem science research in the Prince William Sound region.

Education Program Coordinator **November 2004-2011**
Education Program Development and Coordination responsibilities:

- Coordinate logistics for summer Science Camps and field courses for youth aged 7-18 and adults. Oversee program advertising and recruitment, registration, scholarships, staff training, field camp, meals, healthcare, adventure activities, educational programming and evaluation.
- Plan and implement standards-based science education programs for students in K-6 grades with an emphasis on place-based, experiential learning. Curriculum compilations include salmon and herring biology, lake and ocean monitoring and oil spill response technology.
- Design and conduct environmental monitoring projects to involve 4-6 grade students in field research techniques and credible data collection. Recent projects focused on salmon habitat, water quality and weather.
- Collaborate with community partners to coordinate community festivals and one-day events to educate participants about the ecosystems of PrinceWilliam Sound and the Copper River Delta. Events include Copper River Delta Shorebird Festival, Copper River Wild! Salmon Festival, Tidepooling for Tots and Community Kayak Day.
- Coordinate Cordova's National Ocean Sciences Bowl program and coach high school students in preparation for the regional competition.

Program Administration responsibilities:

- Prepare grant proposals and project budgets, \$1000-\$135,000.

◦ Submit annual progress reports to funders and education updates to the PWSSC board.
◦ Supervise school-year and summer program education staff members.
◦ Conduct program evaluation and strategic planning activities.

PrinceWilliam Sound Community College, Cordova, AK September-December 2008
Biology Teacher Assistant
◦ Prepared laboratory for student activities, facilitated lab experiments and graded student work.

Harborside Pizza, Cordova, AK June 2006-present
Bookkeeper
Restaurant Management responsibilities
◦ Assist in implementation of the Harborside Pizza Development and Business Plans.
◦ Maintain accounting records and financial documents including balance sheets, profit & loss statements and annual sales projections.

Cambridge Elementary School, Cambridge, VT January-May 2004
Volunteer Program Coordinator
◦ Prepared nature education workshops for second and third graders for the Environmental Learning for the Future (ELF) program. Topics included animal and plant adaptations, nature's designs and earth's systems.

Learning Resource Center, Johnson State College, VT October-May 2003
English and Earth Science Tutor
◦ Tutored students in CollegeWriting and Earth Science courses.
◦ Assisted with test preparation and research skills, proofreading and paper revision techniques.

PROJECT COLLABORATION

Alaska River Expeditions: Geology of the Copper RiverWatershed field course.
Copper River Watershed Project: Discovery Room, Copper River Stewardship Program, community monitoring.
Cordova and Chugach School Districts: Discovery Room, Outreach Discovery, National Ocean Sciences Bowl, monitoring projects
Prince William Sound Science Center research staff: youth science camps, adult workshops, community lectures, student presentations, outreach materials.
Other project partners: Cordova Arts and Pageants, Cordova District Fishermen United, Native Village of Eyak, Prince William Soundkeeper Wrangell Institute of Science and Environment
U.S. Forest Service Cordova Ranger District: Discovery Room, science and wetlands ecology camps

WORKSHOPS ATTENDED

◦ 2006 Project WET activity and curriculum use training
◦ 2006 Alaska Natural Resource and Outdoor Education workshop series
◦ 2007, 2008 Communicating Ocean Science, AK Marine Science Symposium
◦ 2007 Project WILD, ProjectWILD Aquatic and AlaskaWildlife Curriculum training
◦ 2010 Citizen Science for K-12 Teachers, Kachemak Bay Research Reserve
◦ 2012 Adobe software skills workshop, Kristin Link via Copper River Watershed Project
◦ 2012 ServSafe Food Protection Manager Certification Program, Anchorage CHARR

IV. SCHEDULE

A. Project Milestones

Objective 1. Disseminate PWS herring research information and lessons learned in this program to individuals, groups, policy makers, resource managers and institutions in PWS, including the effected fishing community.

Objective 2. Extend and transfer PWS herring research-based outreach and education products to general audiences in and beyond the spill affected areas of PWS.

Objective 3. Integrate community involvement into the planning and sampling programs through citizen science opportunities and public workshops

To meet the objectives outlined above, PWSSC educators will produce the public outreach and education materials/programs identified in Table 1.

Table 1. The informal or formal education approaches (**bold**) used to meet objectives, specific products (*italics*), and schedule and frequency/number of outreach and education products developed/delivered by our staff.

1. Written project profiles and articles for public information and use; appropriate for lay audiences for inclusion in newsletters or other science/education publications.		
Delta Sound Connections	20,000 copies distributed annually to residents and visitors to PWS	Contribution of articles by herring researchers FY12-16. Sponsorship and herring program feature FY13 & FY15
PWSSC Breakwater *newsletter*	Mailed to 325 households/businesses in and outside of Alaska	One herring article per newsletter publication 2-3 time per year FY12-16
Project Profiles	Distribution points: PWSSC, CDFU, Cordova harbor, Chamber of commerce, public locations, Community Education email list-350 subscribers	Three profiles per year developed or updated FY12-16
2. Public presentations to general public audiences.		
Community Lecture Series	(live in Cordova, broadcast to Valdez)	Three presentations delivered by Herring researchers per year FY12-16
Field Notes radio program	(aired and archived KCHU public radio)	Three radio programs produced based on Herring projects per year FY12-16
3. Advertise and involve community members in opportunities to participate in herring research as "citizen scientists."		

Citizen Science Opportunities	Provide and promote opportunities for the public to become involved in research project activities	Citizen science opportunities promoted on web and during community presentations
4. Develop and advertise web-based materials to communicate the basis, goals and results of the herring research project, and provide access to outreach and education products.		
Herring Program webpage: http://www.pwssc.org/herringsurvey	Basic information about each herring project can be found and links to the annual reports on the EVOSTC website.	Continue to use this as a place to make documents associated with the herring program accessible FY12-16
Herring Program Facebook page: http://www.facebook.com/pages/PWS-Juvenile-Herring Research/187859711248910	Project photos, news and updates, administered by PWSSC & CDFU	Continue to use popular social media to outreach information associated with the herring program FY12-16
PWSSC YouTube channel: http://www.youtube.com/user/PWSSC	Podcasts (based on *Field Notes* radio programs) and video clips posted on YouTube	Continue to use popular social media to outreach information associated with the herring program FY12-16
5. Educate targeted groups in the application of research information and sampling methods.		
Discovery Room	5th Grade Oceanography and Herring curriculum	6 2-hour classroom sessions/monitoring field trips delivered Oct-Apr FY12-16
Outreach Discovery	Stand-alone, hands-on herring and ocean science education programs for students in grades 3-12	1 program delivered to school group outside of Cordova per year FY12-16
Summer Field Programs	Field-based, hands-on herring and ocean science activities for participants in science and environmental camps and day programs	1 program delivered in PWSSC or partner summer program per year FY12-16

The first year (FY12) of this project overlaps with the existing PWS Herring Survey Program. PWSSC educators will use the overlap period to focus increasing capacity to expand the impact and geographic scope of outreach and education efforts. The intention is to provide activities that groups outside our delivery area will utilize without direct funding from this program. To increase the geographic impact of the programs, we propose to modify the current oceanography and herring *Discovery Room, Outreach Discovery* and *Summer Education* activities so that the instructional focus is on how a fishery (PWS herring) is affected by changes in the ecosystem. The resultant activities will focus on the ecosystem, which is more transferable, than on a particular fish population. At the same time it will continue to use PWS herring as the central example, which maintains its relevance to this program. The second activity that will take place in the first year is to market the revised programs to other marine education programs in the state. It is important to actively market the activities if we expect them to be utilized by other groups.

B. Measurable Project Tasks

FY 14, 1st quarter (February 1 – May 31, 2014)

May	Evaluate/update oceanography and herring *Discovery Room* program curriculum
	Participate in Principal Investigator update and outreach meeting
	Delivery of *Community Lectures* complete for FY14
	Production of written outreach materials complete for FY14 (*Delta Sound Connections*, *Breakwater* newsletter articles, *Project Profiles*)
	Herring lesson plans ready for public outreach/marketing

FY 14, 2nd quarter (June 1, 2014-August 30, 2014)

August	Delivery of *Field Notes* complete for FY14
August	Deliver *Summer Field Program*
August	Submit Project Annual Report

FY 14, 3rd quarter (September 1, 2014-November 30, 2014)

September	Delivery of *Outreach Discovery* program complete for FY14
October	Begin implementing oceanography and herring *Discovery Room*

FY 14, 4th quarter (December 1, 2015 – January 31, 2015)

December	Develop *Field Notes* radio program based on fall surveys
January	Alaska Marine Science Symposium

V. BUDGET

Budget Form (Attached)

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

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: PWS Herring Research and Monitoring: Herring Disease Program (HDP)

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

Primary Investigator(s):
Paul K. Hershberger
U.S. Geological Survey, Marrowstone Marine Field Station
616 Marrowstone Point Road
Nordland, WA 98358
Telephone: (360) 385-1007, Ext. 225
Email: phershberger@usgs.gov

Abstract:
The *Herring Disease Program (HDP)* is part of a larger integrated effort, Prince William Sound Research and Monitoring (outlined in a separated proposal by Dr. Scott Pegau). Within this integrated effort, the *HDP* is intended to evaluate the impact of infectious and parasitic diseases on the failed recovery of the PWS herring population. The framework for the 2012 – 2016 *HDP* involves a combination of field surveillance efforts, field-based disease process studies, and laboratory-based controlled studies. Field surveillance efforts will provide continued and expanded infection and disease prevalence data for herring populations in Prince William Sound (PWS), Sitka Sound, and Puget Sound. During FY 2014 we will continue the health assessments of adult herring from Prince William Sound and Sitka Sound, we will continue to rear colonies of specific-pathogen-free Pacific herring for controlled studies in the laboratory, and we will develop a chromogenic in situ hybridization assay that will be capable of identifying *Ichthyophonus* in histological tissue sections.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
0	0	$281,900	291,900	298,000	871,800

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
		$42,100			

Includes in-kind salary and benefit contributions (20%) for P. Hershberger ($26,400) and J. Gregg ($15,700)

Date: August 9, 2013

(THIS SUMMARY PAGE NOT TO EXCEED ONE PAGE)

I. NEED FOR THE PROJECT

A. Statement of Problem

A leading hypothesis accounting for the decline and failed recovery of Pacific herring populations in Prince William Sound and other locations throughout the NE Pacific involves chronic and acute mortality from infectious and parasitic diseases including ichthyophoniasis, viral hemorrhagic septicemia (VHS), viral erythrocytic necrosis (VEN), and others (Marty et al, 1998; Marty et al. 2003; Marty et al. 2010). Here, we propose to follow up on earlier EVOS TC-funded herring disease studies by:

1) continuing surveillances of PWS herring populations for prevalence and intensity of the primary pathogens and using newly-developed disease forecasting tools to quantify the potential for future disease epizootics,
2) performing field-based disease process studies in coordination with other components of the PWS Herring Project; these observational studies will begin to address epizootiological factors including temporal and geographical patterns of pathogen exposure and resulting disease-induced mortalities that occur in wild herring populations,
3) performing laboratory-based empirical studies intended to determine cause-and effect disease relationships; these relationships will be used to develop additional disease forecasting tools and understand the fundamental disease processes

B. Summary of Project to Date (if applicable)

FY 2014 will be the first year of a new integrated herring project.

II. PROJECT DESIGN

A. Objectives

- Provision of disease prevalence data necessary for the ASA herring model
- Production of Specific Pathogen-Free Pacific herring intended as laboratory hosts for controlled experiments intended to determine cause-and-effect disease relationships
- Development of a novel diagnostic technique (fluorescent in situ hybridization) intended to provide confirmatory diagnosis of *Ichthyophonus* from histology sections.

B. Procedural and Scientific Methods

Provision of disease prevalence data necessary for the ASA herring model

Disease is now a component in the Age-Structure-Analysis model for Prince William Sound; however, it is not part of the ADF&G sponsored surveys. We will provide the disease information for the ASA model by determining annual prevalence and intensity data for the most virulent pathogens that are currently endemic in the PWS herring populations, including viral hemorrhagic septicemia (VHS), viral erythrocytic necrosis (VEN), and ichthyophoniasis. Monitoring efforts will consist of the annual collection and processing of sixty adult and sixty juvenile herring per site from three sites in PWS to test for disease. Diagnostic techniques for these pathogens will follow standard procedures described in the "Blue Book: Standard procedures for the detection and identification of select fish and shellfish pathogens (American Fisheries Society)." We will also examine efficacy of newly-developed procedures that may forecast the potential for future disease mortalities and simplify the disease surveillance efforts.

Production of Specific Pathogen-Free Pacific herring intended as laboratory hosts for controlled experiments intended to determine cause-and-effect disease relationships
A critical component of both the field surveillance efforts and the empirical disease process studies involves the availability of laboratory host animals with known exposure and disease histories. We have developed techniques to rear specific pathogen-free (SPF) herring and we currently maintain thousands of SPF herring in each of 4 age classes (age 0, 1, and 5 and 6 yr) for use as experimental animals. These laboratory animals are the only SPF herring known to exist and are offered as an in-kind contribution to the proposed project. Additional colonies need to be developed and maintained to satisfy the needs described in this proposal

Colonies of specific pathogen-free (SPF) Pacific herring will be reared at the USGS - Marrowstone Marine Field Station each year, taking special precautions to prevent their exposure to marine pathogens or antigens of marine pathogens through the rearing water or feed. As a source of SPF Pacific herring, naturally deposited herring eggs attached to submerged macrophytes will be collected from locations in Puget Sound, WA. Herring eggs and associated macrophytes will be transported to the USGS, Marrowstone Marine Field Station, where they will be incubated in 260 L tanks supplied with single-pass, processed seawater. Ambient seawater will be processed by double sand-filtration, 100 µm particle filtration, and double UV-irradiation prior to delivery to culture facilities where SPF herring will be reared and live feeds will be produced. Submerged macrophytes will be removed from the tanks after yolk sac larvae have emerged. Early larvae will be fed live rotifers (*Brachionus plicatilis*) and later weaned to *Artemia* nauplii (*Artemia franciscana*, instar 1-2). Live rotifer colonies will be maintained on concentrated algae, (*Isochrysis* sp., *Nannochloropsis* sp.) and Artemia will be hatched daily from chlorine-decapsulated cysts; both live feed items will be enriched with Super Selco® (INVE Aquaculture; Dendermonde, Belgium), Protein HUFA (Salt Creek Inc., Salt Lake City, Utah), or Algamac 3050 (Aquafauna Bio-Marine, Hawthorne, California) for 12 hr prior to use. The enrichments will be rotated daily. Herring larvae will later be weaned onto Cyclop-eeze™, a product of frozen copepods harvested from a freshwater Arctic lake (Argent Laboratories, Redmond, WA).

Development of a novel diagnostic technique (fluorescent in situ hybridization) intended to provide confirmatory diagnosis of Ichthyophonus from histology sections
Fluorescent *in situ* hybridization (FISH) allows specific nucleic acid sequences to be identified in morphologically preserved cells or tissues. FISH is often used for specific identification of a pathogen in host tissues, but has also been used for a wide range other applications, including the identification (using epifluorescence microscopy) or quantification (using flow cytometry) of microbial and fungal communities in aquatic environments (Amann and Fuchs 2008; Jobard, Rasconi et al. 2010). The most common nucleic acid targets are regions within the ribosomal gene complex; this gene region is widely used for phylogenetic analyses. The fluorescently-labeled oligonucleotide probes diffuse into permeabilized cells and hybridize to homologous DNA or RNA sequences. A major drawback of the technique can be low sensitivity due to the ribosome content in the cells or high background due to autofluorescence (Jobard, Rasconi et al. 2010). However, assay sensitivity can be improved using probes labeled with horseradish peroxidase (HRP) which catalyze multiple fluorescent labeled tyramides (Catalyzed reporter deposition (CARD)-FISH) (Schmidt, Chao et al. 1997).

There are currently no FISH assays available for the detection of *Ichthyophonus* but methods have been developed for other members of the Class Mesomycetozoea. ISH has been used to successfully to identify *Rhinosporidium seeberi* in human tissues and lake water (Fredericks, Jolley et al. 2000; Kaluarachchi, Sumathipala et al. 2008) and *Anurofeca richardsi* spores in frog feces (Baker, Beebee et al. 1999), *Ichthyophonus*-specific oligonucleotide probes will be designed to conserved portions of the 18S small subunit (SSU) ribosomal gene; the SSU gene has been sequenced in a range of *Ichthyophonus* isolates (Criscione, Watral et al. 2002; Rasmussen, Purcell et al. 2010). Heart and skeletal muscle tissue from *Ichthyophonus* infected herring will subjected to routine processing and paraffin embedding using published procedures (Garver, Conway et al. 2005). Serial 5 μm tissue sections will be subjected to ISH using previously described methods (Carnegie, Meyer et al. 2003) (Fredericks, Jolley et al. 2000). Briefly, fluorescently-labeled oligonucleotide probes will be purchased commercially. Sections will de-paraffinized, re-hydrated and digested with proteinase K and/or lysozyme. Probes will be hybridized to the sections, washed and slides will be examined by epifluorescence microscopy. A variety of parameters will be evaluated for optimal assay performance, including (1) probe design, (2) fluorochrome choice, (3) tissue fixation procedures, (4) hybridization conditions and (5) use of tyramide signal amplification (CARD-FISH) to enhance sensitivity.

Assay development and validation will be performed using tissues sampled from laboratory-challenged Pacific herring and *Ichthyophonus* culture. Assay sensitivity will be compared to tissue explant culture and histopathological examination. Specificity will be tested using fish infected with the freshwater form of *Ichthyophonus* (Hershberger, Pacheco et al. 2008; Rasmussen, Purcell et al. 2010) as well as tissue samples infected with other mesomycetozoeans (obtained from various collaborators).

C. Data Analysis and Statistical Methods

Standard statistical comparisons for pathogen virulence studies will be employed in all experiments. For example, percent cumulative mortalities in replicate tanks / aquaria will be arc sin transformed and transformed means from all groups will be statistically compared using Student's T-test (1-tailed) or ANOVA followed by the Tukey test for multiple comparisons. In non-replicated tanks, percent mortality in control and treatment groups will be statistically compared using the Chi Square statistic (χ^2). Statistical significance will be assigned to all comparisons with $p \leq 0.05$. Prevalences of infection and disease in wild populations from Prince William Sound, Sitka Sound, and Puget Sound will be based on minimum sample sizes of 60 fish, sufficient to detect 5% population prevalence with 95% confidence.

D. Description of Study Area

The study area includes all of Prince William Sound. However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 1). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

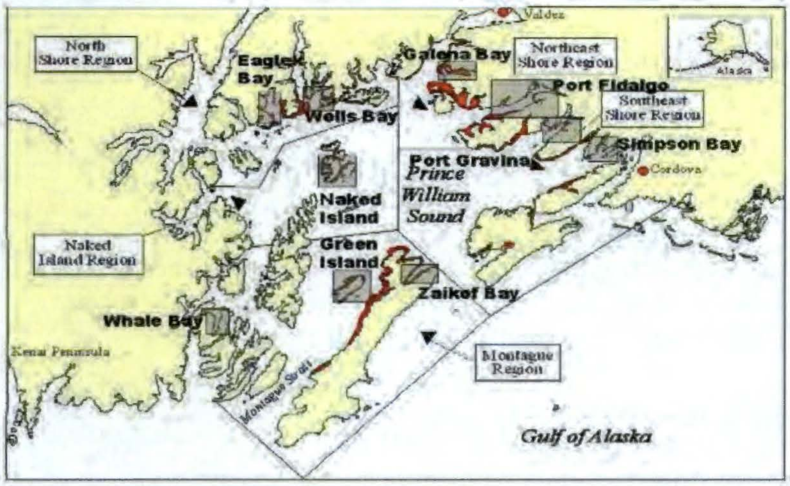

Figure 1. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

Herring collection sites in Sitka Sound and Puget Sound will be determined by the respective management authority in each region (ADF&G and WDF&W, respectively), but are likely to include locations similar to those described in Table 1.

Laboratory studies described in this proposal will be conducted at the USGS-Marrowstone Marine Field Station, and USGS-Western Fisheries Research Center where facilities ideally designed to safely and responsibly conduct experiments using endemic fish pathogens. The Marrowstone Marine Field Station represents the sole seawater-based biological research facility for the USGS. Facilities include three large wet laboratory buildings with approximately 10,000 square feet of wet laboratory space, replicated with approximately 60,000 liter tank capacity, and supplied with 400 gpm of high quality filtered and UV irradiated seawater. Back-up, redundant water treatment systems are incorporated into the supply water for each wet laboratory. Separate laboratory buildings are designated as specific pathogen-free nursery zones and experimental pathogen manipulation zones. Laboratory effluent water is disinfected with chlorine and treated to insure safe and responsible handling of endemic pathogens. The Western Fisheries Research Center (WFRC) is recognized as an international leader in fish health research. The WFRC maintains fish health laboratory facilities which are among the newest and best in the nation. The facility operates a state-of-the-art fresh water wet laboratory that is completely climate controlled and automated for disease challenges and studies in physiology and pathology. The nation's only Biosafety Level III disease containment wet laboratory for fish is also part of this facility. Additionally, the Center maintains fully equipped laboratories for molecular biology, virology, bacteriology, immunology, and histopathology.

E. Coordination and Collaboration with the Program

Results from the HDP will inform the larger Herring Research and Monitoring Project by providing disease information intended to help improve predictive models of herring stocks. This will be accomplished by informing the ASA model with infection and disease values and by applying novel techniques to assess diseases-related mortality in wild herring.

III. CV's/RESUMES

Paul K. Hershberger, Ph.D.
Marrowstone Marine Field Station, USGS-BRD
616 Marrowstone Point Road, Nordland, WA 98358
Telephone: (360) 385-1007, Ext 225, Email: phershberger@usgs.gov

Professional Interests

Disease ecology and processes affecting the health and survival of wild fishes
Effects of multiple stressors on the health and survival of wild fishes
Climatic/oceanic factors affecting populations of wild fishes

Membership in Professional Organizations

American Fisheries Society (AFS), and Fish Health Section (FHS): Current President
International Society of Aquatic Animal Epidemiology (ISAAE)
Pacific Northwest Society of Environmental Toxicology and Chemistry (PNW SETAC)

Recent Positions

2010 – Present: Affiliate Associate Professor: School of Aquatic and Fishery Sciences, University of Washington.
2004 – 2010: Affiliate Assistant Professor: School of Aquatic and Fishery Sciences, University of Washington.
2003 – Present: Research Fishery Biologist and Station Leader: USGS- BRD, Marrowstone Marine Field Station
1999-2003: Faculty Research Associate - University of Washington
2003: Co-Instructor, UW – Friday Harbor Labs: FISH-499B "Emerging Diseases and Latent Infections in Aquatic Organisms"
2001: Instructor, UW – School of Aquatic and Fishery Sciences: FISH 404 "Diseases of Aquatic Organisms"
2001: Co-Instructor, UW – Friday Harbor Labs: FISH 499B: "Latent Viruses in Marine Fish,"
2000: Co-Instructor, UW – Friday Harbor Labs: FISH-499B: "Marine Fish Disease Research"

Education:

Ph.D. Fisheries, University of Washington 1998
M.S. Fisheries, University of Washington 1995
B.S. Chemistry & Biology, Northland College (Manga Cum Laude) 1993

Recent Awards and Honors:

2008: USGS STAR Award
2004: USGS Exemplary Act Award
2004: USGS STAR Award
2001: Most significant paper of the year 2001: Journal of Aquatic Animal Health

Five Selected Publications Relevant to this Proposal:

Lovy, J., P. Piesik, P.K. Hershberger, K. A. Garver. 2013. Experimental infection studies demonstrating Atlantic salmon as a host and reservoir of viral hemorrhagic septicemia virus type IVa with insights into pathology and host immunity. Veterinary Microbiology 166: 91-101.

Kocan, R, S. LaPatra, P. Hershberger. 2013. Evidence for an amoeba-like infectious stage of *Ichthyophonus* sp. and description of a circulating blood stage: a probable mechanism for dispersal within the fish host. Journal of Parasitology 99: 235-240.

Hershberger, P.K., M K Purcell, L.M. Hart, J L Gregg, R.L Thompson, K A Garver, J.R Winton 2013 Influence of temperature on viral hemorrhagic septicemia (Genogroup IVa) in Pacific herring, *Clupea pallasii* Valenciennes Journal of Experimental Marine Biology and Ecology 444 81-86

Lovy, J , N.L Lewis, P.K. Hershberger, W Bennett, K A Garver. 2012 Viral tropism and pathology associated with viral hemorrhagic septicemia in larval and juvenile Pacific herring Veterinary Microbiology 161 66-76

Purcell, M.K., E S. Bromage, J Silva, J.D. Hansen, S M Badil, J C Woodson, P.K Hershberger 2012. Production and characterization of monoclonal antibodies to IgM of Pacific herring (*Clupea pallasii*) Fish and Shellfish Immunology 33. 552-558

Five Additional Selected Publications

Burge, C A , C. M. Eakin, C S Friedman, B Froelich, P K Hershberger, E. E Hofmann, L E Petes, K C. Prager, E. Weil, B L Willis, S E Ford, C. D. Harvell. *In Press* Climate change influences on marine infectious diseases: implications for management and society Annual Review of Marine Science

Hershberger, P.K , L Rhodes, G Kurath, J Winton *In Press.* Infectious diseases of fishes in the Salish Sea Fisheries.

Hart, L M , N. Lorenzen, S E LaPatra, C A. Grady, S.E Roon, J O'Reilly, J L Gregg, P.K Hershberger 2012 Efficacy of a glycoprotein DNA vaccine against viral hemorrhagic septicemia (VHS) in Pacific herring *Clupea pallasii* Journal of Fish Diseases 775-779

Glenn, J.A., E.J. Emmenegger, C M Conway, J. R Winton, C A Grady, J L. Gregg, S.E. Roon, P.K. Hershberger 2012 Kinetics of viral load and erythrocytic inclusion body formation in Pacific herring artificially infected with erythrocytic necrosis virus. Journal of Aquatic Animal Health 195-200

Gregg, J L , C A Grady, C S Friedman, P K. Hershberger. 2012. Inability to demonstrate fish-to-fish transmission of *Ichthyophonus* from laboratory-infected Pacific herring *Clupea pallasii* to naive conspecifics. Diseases of Aquatic Organisms 99 139-144

Recent Collaborators and Co-Authors (Past 4 years):

S.M. Badil (USGS – Western Fisheries Research Center), **J. Beaulaurier** (Central Michigan University), **W. Bennett** (DFO – Pacific Biological Station), **N. Bickford** (University of Great Falls), **E.S. Bromage** (U. Mass – Dartmouth), **C.A. Burge** (Cornell University), **H.E. Christiansen** (Columbia River Research Laboratories), **R. Collins** (U Hawaii), **C.M. Conway** (USGS – Western Fisheries Research Center), **E.S. Copeland** (USGS – Columbia River Research Laboratories), **H. Dolan** (University of Washington), **C.M. Eakin** (NOAA – Coral Reef Watch), **D. Elliott** (USGS – Western Fisheries Research Center), **E.J. Emmenegger** (USGS – Western Fisheries Research Center), **C.S. Friedman** (University of Washington), **B. Froelich** (University of North Carolina – Chapel Hill), **A. Gannam** (USFWS – Abernathy Fish Technology Center), **K.A. Garver** (DFO – Pacific Biological Station), **J.A. Glenn** (USGS – Western Fisheries Research Center), **T. L. Goldberg** (University of Wisconsin), **C. Grady** (USGS – Marrowstone Marine Field Station), **J.L. Gregg** (USGS – Marrowstone Marine Field Station), **S. Gutenberger** (Lower Columbia River Fish Health Center), **J.D. Hansen** (USGS – Western Fisheries Research Center), **L. Hart** (USGS – Marrowstone Marine Field Station), **C.D. Harvell** (Cornell University), **R.A. Heintz** (NOAA – Auke Bay Labs), **E.E. Hofmann** (Old Dominion University), **R.F. Goetz** (NOAA- Manchester Research Station), **A. Kagley** (NOAA – Northwest Fisheries Science Center), **R.M. Kocan** (University of Washington), **G. Kurath** (USGS – Western Fisheries Research Center), **K.L. Toohey-Kurth** (University of Wisconsin), **S.E. LaPatra** (Clear Springs Foods, Inc), **N.L. Lewis** (DFO – Pacific Biological Station), **N. Lorenzen** (National Veterinary Institute – Denmark), **J. Lovy** (New Jersey Department of Natural Resources), **K. Lujan** (USFWS – Lower Columbia River Fish Health Center), **S.V. Marquenski** (Wisconsin Department of Natural Resources), **M.G. Mesa**, (USGS – Columbia River Research Laboratories), **T.R. Meyers** (ADF&G), **C.H. Moon** (University of Ulsan, Korea), **B.L. Norcross** (U. Alaska – Fairbanks), **W. J. Olson** (University of Wisconsin), **J. O'Reilly** (USGS – Marrowstone Marine Field Station), **M. Parsley** (USGS – Columbia River Research Laboratories), **L. E. Petes** (NOAA – Climate Program Office), **P. Piesik** (DFO – Pacific Biological Station), **M.K. Purcell** (USGS – Western Fisheries Research Center), **K. C. Prager** (UCLA), **C. Rasmussen** (USGS – Western Fisheries Research Center), **L. Rhodes** (NOAA – Northwest Fisheries Science Center), **J. Richard** (DFO – Pacific Biological Station), **S.E. Roon** (Oregon State University), **A.C. Seitz** (U. Alaska – Fairbanks), **J. Silva** (U Mass – Dartmouth), **L. Taylor** (USGS – Marrowstone Marine Field Station), **R.L. Thompson** (USGS – Western Fisheries Research Center), **G.S. Traxler** (DFO – Pacific Biological Station), **B.K. van der Leeuw** (USGS – Columbia River Research Laboratories), **J. J. Vollenweider** (NOAA – Auke Bay Labs), **E. Weil** (University of Puerto Rico), **B. L. Willis** (James Cook University – Australia), **A.E. Wilson** (University of Wisconsin), **J.R. Winton** (USGS – Western Fisheries Research Center), **J.C. Woodson** (USGS – Western Fisheries Research Center), **S. Zuray** (Rapids Research Center)

IV. SCHEDULE

A. Project Milestones

- *Provision of disease prevalence data necessary for the ASA herring model*
  To be met by June 30 each year.
- *Provision of disease process studies intended to investigate the seasonality of herring diseases in PWS*
  Laboratory diagnostics will be completed <8 weeks after sample collections in the field
- *Collection of novel disease forecasting data*
  Laboratory diagnostics will be completed <4 weeks after the sample collections in the field
- *Production of Specific Pathogen-Free Pacific herring intended as laboratory hosts for controlled experiments intended to determine cause-and-effect disease relationships*
  SPF juveniles will be produced by Aug 15 each year
- *Development of a novel diagnostic technique (fluorescent in situ hybridization) intended to provide confirmatory diagnosis of Ichthyophonus from histology sections.*
  Will be developed by Sept 30, 2014

B. Measurable Project Tasks

<u>**Every Fiscal Year (FY 2010 - 2013)**</u>

1st Quarter (October 1-December 31)
- Project funding approved by TC
- Perform empirical disease studies in the laboratory

2nd Quarter (January 1-March 31)
- Attend Alaska Marine Science Symposium and present results
- Collect herring eggs for rearing SPF colonies
- Begin collecting adult herring to determine infection and disease prevalence
- Perform empirical disease studies in the laboratory

3rd Quarter (April 1-June 30)
- Finish collecting and processing spring adult herring to determine infection and disease prevalence.
- Participate in PI meeting in Cordova
- Perform empirical disease studies in the laboratory

4th Quarter (July 1- Sept. 30)
- Perform empirical disease studies in the laboratory

<u>**Additional Quarterly Tasks**</u>

FY14, 1st quarter (October-December 31, 2013)
- Begin CISH development

FY14, 4th quarter (July 1 – Sept 30, 2014)
- Complete CISH development

V. BUDGET

Budget Form (Attached)

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: PWS Herring Program – Herring Condition Monitoring

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

Primary Investigator(s): W. Scott Pegau, Prince William Sound Science Center, Box 705, Cordova, AK 99574 wspegau@pwssc.org
Ron Heintz, NOAA Auke Bay Laboratory ron.heintz@noaa.gov

Abstract:

Outlined here is a single herring monitoring project that is a part of an integrative program that will enhance the current herring monitoring efforts and examine aspects of particular life stages to allow better modeling of Prince William Sound herring populations. The long-term goal of the program is to improve predictive models of herring stocks through observations and research.

This project will be furthering the development of a herring overwintering mortality model that began with an ongoing monitoring project that began in 2007 and incorporates results from Prince William Sound herring research dating as far back as the 1990's. The model runs by applying herring condition observations made before and after winter. Accordingly, herring are sampled in November and the following March. Present sampling will end in March 2012. Proposed sampling will commence in November 2012 and end in March 2016. A future project is expected to continue the time series beginning in November 2016. The purpose of the time series is to relate overwinter mortality to herring recruitment.

This project will be furthering the development of a herring overwintering mortality model with additional data types as well energy levels per se. The goal is use physiological indicators to realistically modify the daily energy loss rate in the overwintering model. The results of model improvement will be tested using the March data model validation approach begun during the project that began in 2007.

Additionally, we will be assessing effects of competition of other juvenile fishes on condition of age-0 herring using stable isotope analysis on an opportunistic basis.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
0	230,000	238,700	251,500	253,900	974,100

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date:
8/30/13

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the Exxon Valdez Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

Described here is a single project that is a part of an integrative program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. The long-term goal of the program is to improve predictive models of herring stocks through observations and research. While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program

Studies conducted since the 1990's suggest that age-0 PWS herring begin winter deficient in energy, which leads to significant overwinter mortality Starvation was confirmed by using RNA/DNA as a physiological indicator. It is hypothesized that when these constraints are relaxed, first winter survival is much greater and this leads to a good recruitment.

B. Summary of Project to Date (if applicable)

Collection of samples in November and March were completed as scheduled. Processing of the fish to determine the energetic content remains underway. The November samples should be completed in October and the March samples by December.

For Heintz' component of the study, YOY herring samples from March 2013 field collections in PWS were received at ABL in August 2013 for analysis of proximate composition and RNA/DNA. Contracts have been awarded and commodities procured for laboratory processing of samples, to be completed in fall 2013.

A setback to the project occurred when one of the principal investigators (Dr. Thomas Kline) left the Prince William Sound Science Center in June 2013. The Science Center is currently seeking a replacement for Dr Kline and Dr. Pegau has taken responsibility for the project until a suitable replacement can be found. The gap in personnel may impact the completion of the analysis of this project, however Dr. Pegau worked with Dr Kline to ensure a smooth transition of materials and is in a position to rapidly bring a new person up to speed or complete the deliverables if needed Deliverables in the short term are related to work conducted by the project technician who remains working on the project.

II. PROJECT DESIGN

A. Objectives

We have sought input for the design of the first five-year proposal from scientists with ADF&G, NOAA, the current PWS herring survey program, and other institutions. Based on that input we have arrived at the following objectives for the first five-year period.

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008). The proposed monitoring efforts are designed to address this objective by either

expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events

2) *Inform the required synthesis effort* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers.

3) *Address assumptions in the current measurements* Many of the existing studies are based on historical or logistical constraints. We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program

4) *Develop new approaches to monitoring* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

Because we are at the beginning of a twenty-year effort, we want to maximize the value of any data collected. The objectives listed above are designed to ensure that research and monitoring efforts within the expected twenty-year program are most effective. The programs addressing the objectives provide the information necessary to evaluate existing efforts while continuing to move towards our long-term goal

Objectives specific to this project:

Objective 1. Monitor juvenile herring condition by sampling in November
Objective 2. Monitor juvenile herring condition by sampling in March
Objective 3. Apply resultant observations from objectives 1 and 2 to continue refining an overwintering mortality model with the addition of physiological indicators
Objective 4. Assess competition interactions with fishes using stable isotope analysis

B. Procedural and Scientific Methods

Overwinter energy loss based mortality modeling

Each year the Herring Condition Monitoring (HCM) project will make a prediction using an HCM overwinter mortality model (**Objective 3**), which will use the energy density observed in November (**Objective 1**) as model initial conditions. In addition to predicting mortality, the model predicts the frequency distribution of the population's March energy density assuming that there was no energy intake during winter. The difference between predicted and observed March distribution (**Objective 2**), which is currently very small, may lead to better forecasting if starvation is what is driving recruitment. The long-term goal is to develop a time series of these differences (each year being one difference, i e one data point, when considering the PWS as a whole) and correlate it to the resultant recruitment to test this hypothesis.

The initial overwinter mortality model and the methods used to obtain energy density are as described in Kline and Campbell (2010). Briefly, age-0 herring will be sampled in select Prince William Sound herring nursery bays in November and the following March (**Objectives 1 and 2**). By using energy density mortality criteria based on the experimental work of Paul and Paul (1998), the HCM overwinter mortality model is presently an improvement over the overwinter mortality model of Kline and Campbell (2010), which used a single "knife-edge" mortality criterion. This improved model predicted a March energy density frequency distribution that was much closer to that actually observed (Kline 2011). It remained skewed reflecting energy uptake by a small fraction of the population.

The next step is to incorporate physiological parameters (**Objective 3**). This is important because there are two ways in which starvation-related herring mortality might be reduced during winter, one is to begin winter with higher energy density (which can be observed directly) and second, by feeding during winter. A portion of the herring that have been sampled had non-empty stomachs However, using that information is problematic because of sampling bias and possible sampling artifacts, physiological indicators are expected to more quantitatively reflect a herring population's foraging status.

The HCM overwinter mortality model assumes a winter fast If fasting extends into starvation then mortality can be expected to occur. Use of proximate analysis and RNA/DNA can indicate the nutritional state and feeding status of fish (Sewall et al 2011) By contrasting the relative contributions of lipid and protein to overwinter energy loss we can establish the proportion of fish found starving at the end of winter Similarly, by comparing the RNA/DNA levels with levels known from starving and fed fish we can determine if fish in the field are actively feeding Hence, combining proximate analysis, RNA/DNA and energy density analysis will enable the mortality model to provide better estimates of potential mortality.

Competition assessment

Other small fishes are routinely sampled alongside age-0 herring These are assumed to be sympatric with herring and are important as potential competitors (Kline and Campbell 2010) Their presence and competition with herring may be driving the observed low herring energy density and consequent mortality. We may gain insight if for example we observed that herring were in better condition when there was reduced competition. Competitors may gain energy, or at least break even, at the expense of herring (Paul et al. 1998). Their interaction with age-0 herring has varied over time (Kline and Campbell 2010). We therefore need an index of competition that could be incorporated into the HCM overwinter mortality model. The mass spectrometric method used to obtain C/N ratio used to calculate energy density also provides natural stable isotope abundance, which is used to assess species interaction (**Objective 4**; e g , Kline and Campbell 2010). We can thus add a sympatric species interaction component to the HCM model at the relatively low cost of the additional analyses of the sympatric species (N ~ 100 to 200 per year according to actual catch)

C. Data Analysis and Statistical Methods

Experimental Design

Sampling will continue to follow the present experimental design (Kline and Campbell 2010). Sampling occurs during November and March and is focused on four reference bays, known as the SEA bays since they were established as reference sites during the SEA project of the 1990's (Norcross et al. 2001). As well, approximately two other bays will be selected according to observations of herring distribution made by acoustics surveys and available cruise time, which is generally weather-dictated The size distribution of age-0 herring can vary considerable by bay dictating that sampling additional bays is prudent A goal of the synthesis will be to assess the effects of sampling in order to improve long-term monitoring.

Sample sizing is based on recent past history of herring sampling in PWS (Kline and Campbell 2010) Relatively large samples are needed to initialize the HCM overwinter mortality model. Because of the high mortality between November and March, the effective sample size after mortality is accounted for is only about 20% of the starting number (Kline and Campbell 2010). Because the model simulates overwinter mortality, those herring expected to die are subtracted from the simulated population like those from the actual population For example, with a starting number of 100 herring in a given bay, there will be about 20 left in March to compare with observed March data. This is an absolute minimal amount for comparing frequency distributions in March. As part of the synthesis we will evaluate the effect of sample size on the model and make recommendations for future sampling. Sample size evaluation will involve simulating larger sample sizes, which will be done by data aggregation, such as pooling data across bays within one year or across years for one bay This necessarily requires multiple years of data collected in the same way, which will be achieved by this project.

Time series approach

This project is, in part, a continuation of herring energy level monitoring in November and March that began in 2007 One goal is to observe one or more year classes that recruit well. For example, in the decade prior to the

Exxon Valdez oil spill, there were several good recruitments, these numbered on the order of one billion herring at age three (Funk 2007). In recent years, herring recruitment has been on the order of tens of millions or only about one per cent of a good recruitment. Strong recruitments may occur again. If this should happen, a goal will be to assess what the condition of those herring were when they were at age-0. This will only be possible if the data are on hand. Furthermore, the poor recruitment years, such as we have been experiencing, will provide context (i.e., baseline values) for comparing with strongly recruiting cohorts. The time series will provide both before and after winter baseline values, making it possible to assess if strong year classes are determined prior to winter such as by having much higher November values (relative to the baseline) or if strong year classes are determined during winter such as my having much higher values in March without also having higher November values.

Table of time series of herring energy observations (by year and month of sampling) resulting from a past, ongoing, and future projects. Year classes recruiting in their third year from sampled age-0 cohorts as indicated. HFC = Herring Forage Contingency project, HERF = PWS Survey· Herring Energy Recruitment project, HCM = Herring Condition Monitoring project (this proposal).

Calendar Year	Sampling Period	Recruiting Year Class	Project doing the sampling
2007	March	2009	HFC
	November	2010	HFC
2008	March		HFC
	November	2011	HFC
2009	March		HFC
	November	2012	HERF
2010	March		HERF
	November	2013	HERF
2011	March		HERF
	November	2014	HERF
2012	March		HERF
	November	2015	HCM
2013	March		HCM
	November	2016	HCM
2014	March		HCM
	November	2017	HCM
2015	March		HCM
	November	2018	HCM
2016	March		HCM
	November	2019	future project
2017	March		future project
	November	2020	future project
2018	March		future project
	November	2021	future project
2019	March		future project
	November	2022	future project
2020	March		future project
	November	2023	future project
2021	March		future project

Data analysis

Herring will be measured for wet mass, dry mass, and length (fork and standard) Water content is calculated from these data. Samples will be ground to a fine power and analyzed for C/N ratio using an Elemental Analyzer mated to a Continuous Flow Isotope Ratio Mass Spectrometer. Energy density will be calculated from these data (Arrhenius and Hanson 1996, Paul et al. 2001, Kline and Campbell 2010). Energy density data are applied to the HCM overwinter mortality model as model initial conditions and for comparison with model predictions made for March (this ending time was selected to match our March observations; other ending times are also possible). Energy density will also be measured using bomb calorimetry on ten percent of the samples. This dual approach is used for quality control - quality assessment; it provides the means for assessing systematic error (Kline and Campbell 2010).

D. Description of Study Area

The study area includes all of Prince William Sound (N, E, S, and W boundaries of respectively, ~ 61, -145.5. 60, and -149°). However, most of the project will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment (SEA) and PWS Herring Survey programs (Figure 2). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

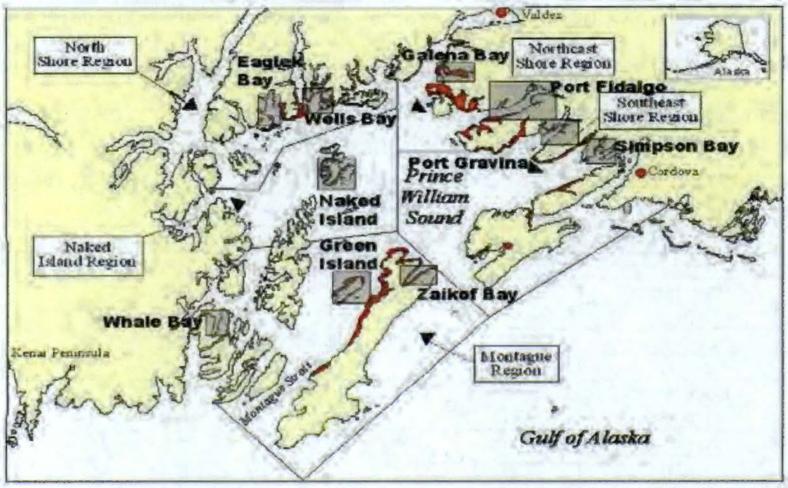

Figure 2. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with Other Efforts

This proposal is structured to be part of a collaborative programmatic effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Scott Pegau will act as the program team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program. He will also be responsible for outreach and public input efforts.

Dr. Pegau currently is the coordinator of the existing EVOSTC funding PWS Herring Survey program. This program consists of ten individual projects that provide a coordinated examination of juvenile herring in Prince William Sound. This proposal is heavily influenced by the early findings from that effort. Dr. Pegau also serves as the Research Program Manager for the Oil Spill Recovery Institute (OSRI). In that capacity he is responsible for developing annual work plans, ensuring proper reporting, making reports available, developing partnerships to leverage funding, and to ensure outreach of OSRI activities. All activities that provide experience delivering the team leader duties outline in the request for proposals.

One of his duties is to ensure proper scientific oversight of the research programs. To accomplish this we will be setting up a four-person scientific oversight panel that will help guide the program and ensure the research is relevant to the long-term goal. The team will consist of people representing Alaska Department of Fish and

Game, the National Oceanic and Atmospheric Administration, academia, and the local fishing community. There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermen United (CDFU), and others Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydro-acoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

Other important programs for coordinating with are the existing PWS herring survey program and existing ADF&G herring research. This program has been developed with input from both of these programs and the focus of this proposal is extending the interpretation of the data from those two programs. The Herring Survey program will still be operating in FY12 and FY13. There are field observations scheduled in FY12 and in FY13 funds are strictly for analysis and report writing. Included in the report writing is a synthesis of previous and current research. This report will be finished in FY13 and be the basis for the synthesis required under this request for proposals.

Lead Principal Investigator Dr. Thomas C. Kline, Jr. will be responsible for the execution of project's energy observations and energy modeling and oversight of the proposed project. Dr. Kline is a world-leader in applying natural stable isotope abundance to fish ecology problems. Dr. Kline has been a research scientist at the Prince William Sound Science Center (PWSSC) since 1995. During this time he has led numerous projects on the oceanography of Prince William Sound and adjacent Gulf of Alaska. He has published numerous research papers based on the resulting data.

Dr. Kline is currently the principal investigator of the *Exxon Valdez* Oil Spill Trustee Council project 'Prince William Sound Herring Survey: Pacific Herring Energetic Recruitment Factors' that is investigating the role of food sources and energy status of herring for recruitment. He was the principal investigator of several previous *Exxon Valdez* Oil Spill Trustee Council projects that had a herring focus These included Herring Forage Contingency (2007-9), Productivity Dependencies: Stable Isotopes (1998-9), and Sound Ecosystem Assessment: Conforming Food Webs of Fishes with Stable Isotope Tracers (1995-8). Results of these projects have been incorporated into approximately two-dozen scientific publications. The data from the existing project and past projects will synergize with this proposed project.

Co-Principal Investigator Dr Ron Heintz will be responsible for the execution of the RNA/DNA aspects of the proposed project. Heintz has been involved in Trustee herring studies aimed at contrasting energy loss rates of herring in different stocks (Project 100806) and examining the impacts of humpback whale predation on herring (Project 100804). In addition, Heintz is leading a study of RNA/DNA as a predictive tool for age-0 survival in PWS (10100132-D).

Both investigators are also investigators of ongoing herring condition monitoring projects that are part of the herring program as well as a separate process study proposal assessing fine scale temporal and spatial variation at one site. This multiple project role will facilitate near real-time integration of project results. Both investigators will contribute to programmatic synthesis scheduled to take place in FY14

The effectiveness of collaboration is often inversely proportional to the number of people gathered together Therefore, as well as participating with the collective program, the investigators will be collaborating more closely together and with smaller groups of the other investigators within the program. This is necessary for focused work on model refinement and for writing reports and scientific publications. While much of this collaboration will be done using long-distance communication such as email, there is also a need a for face to face meetings, which will be done opportunistically during larger meetings (such as the January symposium) and on trips dedicated to this purpose

As part of the integrated herring program, this project will be interacting with virtually all other aspects of the program. Personnel from multiple projects will be working in cooperation This project will furnish one field technician for field sampling This technician will be expected to cooperate with other projects during this sampling For example, Dr. Kline's current technician has been simultaneously collecting, sorting, and preparing samples for multiple investigators such as Dr. Hershberger's disease samples as part of research cruise duties. Field sampling is being conducted on shared research vessels, with funding for vessel charter time outside the scope of this project.

III. CV's/RESUMES

W. Scott Pegau
Oil Spill Recovery Institute
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Education:

1990 B.S., Physics, University of Alaska, Fairbanks
1996 Ph.D, Oceanography, Oregon State University

Professional Experience:

1987-1990	Research Assistant, University of Alaska, Fairbanks
1990-1996	Graduate Research Assistant, Oregon State University
1996-1997	Research Associate (Post Doc), Oregon State University
1997-1999	Faculty Research Associate, Oregon State University
1999-present	Assistant Professor, Oregon State University
2002-2003	Senior Scientist, Kachemak Bay Research Reserve
2003-2007	Research Coordinator, Kachemak Bay Research Reserve
2007-present	Research Program Manager, Oil Spill Recovery Institute

Research Interests:

To develop novel oil spill detection and tracking approaches. Understanding the fate and behavior of oil spilled in cold water environments. Development of response options for oceans with sea ice present. Circulation in Prince William Sound, Cook Inlet and the Gulf of Alaska and the associated larval transport. Relationship between oceanographic conditions and fisheries. Application of remote sensing for understanding coastal processes.

Publications

Selected publications

Pegau, W. Scott, Inherent optical properties of the central Arctic surface waters, *J. Geophys Res*, **107**, doi. 10.1029/2000JC000382, 2002.

Montes-Hugo, M. A., K. Carder, R. J. Foy, J. Cannizzaro, E. Brown, and S. Pegau, Estimating phytoplankton biomass in coastal waters of Alaska using airborne remote sensing, *Remote Sens. Environ.* **98**, 481-493, 2005.

Streever, B., R. Suydam, J.F. Payne, R. Shuchman, R.P. Angliss, G. Balogh, J. Brown, J. Grunblatt, S. Guyer, D.L. Kane, J.J. Kelley, G. Kofinas, D.R. Lassuy, W. Loya, P. Martin, S.E. Moore, W.S. Pegau, C. Rea, D.J. Reed, T. Sformo, M. Sturm, J.J. Taylor, T. Viavant, D. Williams, and D. Yokel, Environmental Change and Potential Impacts: Applied Research Priorities for Alaska's North Slope, *Arctic*, **64**, 390-397, 2011.

Moline, M.A., I. Robbins, B. Zelenke, W.S. Pegau, and H. Wijesekera, Evaluation of bio-optical inversion of spectral irradiance measured from an autonomous underwater vehicle, *J. Geophys. Res.*, **117**, 12pp., doi:10.1029/2001JC007352, 2012.

Musgrave, D.L., M.J. Halverson, and W.S. Pegau, Seasonal Surface Circulation, Temperature, and Salinity in Prince William Sound, Alaska, *Cont. Shelf Res.*, doi:10.1016/j.csr.2012.12.001, 2012

Collaborators

Mary Abercrombie (USF), Robyn Angliss (NOAA), Greg Balogh (USFWS), Mike Banner (UNSW), P. Bhandari (UM), Mary Anne Bishop (PWSSC), Rob Bochenek (Axiom consulting), Emmanuel Boss (U Maine), Kevin Boswell (FIU), Tim Boyd (SAM), Trevor Branch (UW), Evelyn Brown (Flying fish), John Brown, Michele Buckhorn (PWSSC), Lindsay Butters (PWSSC), Rob Cambell (PWSSC), L Carvalho (UCSB), Grace Chang (UCSB), Yi Chao (JPL), Paula Coble (USF), Robyn Conmy (EPA), Tim Cowles (OSU), Helen Czerski (U Southhampton), M. Darecki (PAS), Tommy Dickey (UCSB), C. Dong (IGGP), David Farmer (URI), Jim Farr (NOAA), Scott Freeman (NASA), J. Gemmrich (UVic), P. Gernez (U Nantes), Jess Grunblatt (UAF), Scott Guyer (BLM), Jeff Guyon (NOAA), B. Hagen (SAM), Nate Hall-Patch (IOS), Mark Halverson (PWSSC), Ron Heintz (NOAA), Paul Hershberger (USGS), Ben Holt (JPL), S. Jiang (UCSB), Mark Johnson (UAF), C. Jones (UCSB), Doug Kane (UAF), Lee Karp-Boss (U Maine), George Kattawar (TAMU), John Kelley (UAF), T. King (BIO), Tom Kline (PWSSC), Cory Koch (Wetlabs), Gary Kofinas (UAF), Kathy Kuletz (USFWS), J. Lacoste (Dalhousie), Denny Lassuy (DOI), D. LeBel (Lamont), Ken Lee (BIO), L. Lenain (SIO), Marlin Lewis (Satlantic), Y. Liu (MIT), L. Logan (UMiami), Wendy Loya (Wilderness org), Ted Maksym (WHOI), Darek Manov (UCSB) Phillip Martin (USFWS), W. Melville (SIO), Scott Miles (LSU), Steve Moffitt (ADF&G), Mark Moline (Cal Poly), Sue Moore (NOAA), Rue Morison (UNSW), Dave Musgrave, F. Nencioli (MIO), Carter Ohlmann (UCSB), John Payne (DOI), Sean Powers (USA), Caryn Rea (Conoco), Dan Reed (ADFG), B. Reineman (SIO), Ian Robbins (Cal Poly), B. Robinson (BIO), Chris Roman (WHOI), R. Rottgers (HZG), Scott Ryan (BIO), H. Schultz (UMass), Li Shen (Johns Hopkins), M. Shinki (CRI), Matt Slivkoff(ISMO), M. Sokolski (PAS), Frank Spada (Sea Engineering), Nate Statom (SIO), Darius Stramski (SIO), Bill Streever (BP), Todd Sformo (NSB), Robert Shuchman (Mich Tech), Petere Sutherland (SIO), Hanumat Singh (WHOI), Matt Sturm (ACE), Robert Suydam (NSB), J. Taylor, Richard Thorne (PWSSC), Mike Twardowski (Wetlabs), S. Vagle (IOS), Ronnie Van Dommelen (Satlantic), Tim Viavant (ADFG), Johanna Vollenweider (NOAA), Ken Voss (UMiami), Ian Walsh (Wetlabs), Libe Washburn (UCSB), J. Wei (Dal), Hemantha Wijesekera (NRL), Dee Williams (BOEM), Sharon Wilde (NOAA), Amanda Whitmire (OSU), Jeremy Wilkinson (BAS), Michelle Wood (UO), O. Wurl (Old Domin), D. Yankg (John Hopkins), Dave Yokel (BLM), Dick Yue (MIT), Len Zabilansky (CRREL), Ron Zaneveld (Wetlabs), Chris Zappa (Lamont), Brian Zelenke (Cal Poly)

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B S Ecology Ethology and Evolution, June 1979, University of Illinois, Urbana May 1979
M.S Fisheries Biology, May 1987, University of Alaska, Juneau May 1985
PhD. Fisheries Biology, University of Alaska, Fairbanks May 2009

PROFESSIONAL MEMBERSHIPS:

American Fisheries Society
American Institute of Biological Scientists
American Association for the Advancement of Science

EMPLOYMENT:

Program Manager, Recruitment Energetics and Coastal Assessment Program
National Marine Fisheries Service
Alaska Fisheries Science Center

Employed with NMFS for 27 years

RECENT PUBLICATIONS:

1 **Heintz,RA,** E.C. Siddon, E.V. Farley and J. Napp. In press. Correlation between recruitment and fall condition of age-0 pollock (*Theragra chalcogramma*) from the eastern Bering Sea under varying climate conditions. Deep Sea Research II. Accepted February 2013.
2. Siddon, EC, **Heintz RA**, Mueter FJ (In Press) Conceptual model of energy allocation in walleye pollock (*Theragra chalcogramma*) from larvae to age-1 in the southeastern Bering Sea. Deep Sea Research II. Accepted November, 2012.
3. Rinella, D. J., M. S. Wipfli, C. Stricker and **R. Heintz**. 2012. Salmon returns and consumer fitness: Marine-derived nutrients show saturating effects on growth and energy storage in stream-dwelling salmonids. Canadian Journal of Fisheries and Aquatic Sciences.69(1):73-84. DOI: 10.1139/f2011-133
4. Vollenweider, J.J., J.L. Gregg, **R.A. Heintz**, P.K. Hersberger. Energetic cost of *Ichthyophonus* infection in juvenile Pacific herring (*Clupea pallasi*). J. Parasit ology Research 2011:1-10. doi:10.1155/2011/926812
5. Gregg, KJ.L., J.J. Vollenweider, C.A. Grady, **R. A. Heintz** and P.K. Hershberger. Effects of environmental temperature on the dynamics of Ichthyophonus in juvenile Pacific herring (*Clupea pallasii*). J. Parasitology Research 2011:1-9. doi:10.1155/2011/563412

COLLABORATIONS IN LAST 48 MONTHS

AK. Dep. Fish and Game	S Moffit,
University of Alaska Fairbanks	E. Siddon, A. Pinchuk, F Mueter, B Norcross
U.S. Geological Survey.	P Hershberger
University of Alaska Southeast·	J. Straley
Florida International Univeristy	K Boswell
Prince William Sound Science Center:	T Kline

Oil Spill Research Institute	S Pegau
University of Washington	G. Hunt
Bureau Ocean Energy Management.	C. Coon
Sitka Sound Science Center·	A Sreenivasan
North Slope Borough	L de Sousa
Louisiana State University	C Li

IV. SCHEDULE

A. Project Milestones

Objective 1. **Monitor juvenile herring condition by sampling in November**
Sampling to be met by November 2015, analysis of samples collected through November 2014 by November 2015, incorporation of data generated through November 2015 into project synthesis by March 2016, and incorporated into herring program by August 2016

Objective 2. **Monitor juvenile herring condition by sampling in March**
Sampling to be met by March 2016, analysis of samples collected through March 2015 by March 2016, incorporation of data generated through March 2015 into project synthesis by April 2016, and incorporated into herring program by August 2016

Objective 3 **Apply resultant observations from 1 and 2 to and continue refining an overwintering mortality model using these observations.**
To be met by April 2016

Objective 4. **Assess competition interactions with fishes using stable isotope analysis**
To be met by April 2016 using data reflecting the same time frames as Objectives 1-3

B. Measurable Project Tasks

FY 14, 1st quarter (February 1 – May 31, 2014)

February	Submit annual report
March	Conduct March juvenile collection
May	Annual PI meeting

FY 14, 2nd quarter (June 1, 2014-August 30, 2014)

August	Submit semi-annual report

FY 14, 3rd quarter (September 1, 2014-November 30, 2014)

September	Support synthesis effort
October	Complete processing of March Samples
November	Participate in the fall herring collection cruise

FY 14, 4th quarter (December 1, 2015 – January 31, 2015)

January	Annual Marine Science Symposium

V. BUDGET

Budget Form (Attached)

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

Curriculum vitae

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COLLABORATIONS IN LAST 48 MONTHS

AK. Dep Fish and Game	S Moffit,
University of Alaska Fairbanks.	E Siddon, A Pinchuk, F Mueter, i
U S Geological Survey	P Hershberger
University of Alaska Southeast	J Straley
Florida International Univeristy	K. Boswell
Prince William Sound Science Center	T Kline
Oil Spill Research Institute	S Pegau
University of Washington	G Hunt
Bureau Ocean Energy Management:	C Coon
Sitka Sound Science Center	A Sreenivasan

Ron Heintz – BIBLIOGRAPHY

Currently submitted to journals and in review

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4. **Heintz,** RA, J. Moran, JJ vollenweider, J Straley and K Boswell. Submitted. The impact of fish and predate on Pacific herring production in different states of abundance. Fisheries Oceanography.
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6. Straley, J, J moran, JJ Vollenweider, K Boswell, RA **Heintz**, K McLaughlin, A McLaughlin and SD Rice. Submitted. A comparison of the diet, habitat use and impactof humpback whale predation upon three overwientering populations in the Gulf of Alaska. Fisheries Oceanography
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Published

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FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: PWS – Juvenile Herring Intensive Monitoring

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

Primary Investigator(s): W. Scott Pegau, Prince William Sound Science Center, Box 705, Cordova, AK 99574 wspegau@pwssc.org
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Abstract:

Described here is a single process study project that is a part of an integrative program that will enhance the current monitoring efforts, and examine aspects of particular life stages to allow better modeling of Prince William Sound herring populations. The long-term goal of the program is to improve predictive models of herring stocks through observations and research. The herring monitoring program is necessarily of coarse temporal and spatial resolution with just two observations per year at narrowly defined sampling sites spread around the large area comprising Prince William Sound. Data interpretation requires a greater context to impart greater meaning. In the case of temporal variation of herring condition it would be useful to know (1) how sensitive the herring overwinter mortality model is to starting time, and (2) the timing of recovery from winter starvation. In the case of spatial variation of herring condition it would be useful to know how sensitive the herring overwinter mortality model is to immigration and emigration from areas immediately adjacent to where herring are sampled at the time of our November and March surveys.

Fine-scale temporal and spatial variability at designated herring monitoring sites has never been characterized and therefore remains a data gap with potential ramifications for interpreting observed variation of herring condition that is part of the herring monitoring program as well as the aforementioned modeling. This will be addressed by sampling at Simpson Bay, which has been a key monitoring site for juvenile herring since the 1990's. Energy content and RNA/DNA will be measured monthly from September 2011 until June 2012 to assess fine-scale temporal variability. Fine-scale spatial variability will be assessed by sampling in November and March five separate sub-areas of a more extensive Simpson Bay than what is typically done during surveys. The results of the analysis will be contributed to the herring synthesis effort that will take place in FY14.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
207,000	77,300	20,400	0	0	304,700

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date:
8/30/13

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the Exxon Valdez Oil Spill (EVOS) occurred In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival

Described here is a single project that is a part of an integrative program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations The long-term goal of the program is to improve predictive models of herring stocks through observations and research. While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

The herring monitoring program is necessarily of coarse temporal and spatial resolution with just two observations per year at narrowly defined sampling sites spread around the large area comprising Prince William Sound (PWS). Data interpretation requires a greater context to impart greater meaning. In the case of temporal variation of herring condition it would be useful to know (1) how sensitive the herring overwinter mortality model is to starting time, and (2) the timing of recovery from winter starvation. The latter is important since the overwinter mortality model predicts that as little as 1 % of the November population would survive to May given a continuation of starvation after March (Kline 2011) PWS herring as late as May have been in very poor condition (Norcross et al. 2001). In the case of spatial variation of herring condition it would be useful to know how sensitive the herring overwinter mortality model is to immigration and emigration from areas immediately adjacent to where herring are sampled at the time of our November and March surveys. The herring population sampled at a given time at a sampling site is defined by the swath of water sampled by the device(s) used (e.g., a net), which is very small compared to the size of the habitat and thus may not be reflective of the local herring population.

B. Summary of Project to Date

The milestones of sample collection and processing for this project were completed as scheduled. During late winter the numbers of samples were limited as the fish became more difficult to locate The analysis phase is in progress.

For Heintz' component of the project, biological data (lengths, weights) has been collected on all YOY herring received at ABL from the PWS collections in September 2011 through June 2012. Due to prioritizing chemical analysis of samples associated with related herring projects (herring growth and condition, herring fatty acid study), processing has been delayed slightly from the original timeline Samples are currently in queue for chemical analysis, which is expected to be completed in fall 2013

A setback to the project occurred when one of the principal investigators (Dr. Thomas Kline) left the Prince William Sound Science Center in June 2013 The Science Center is currently seeking a replacement for Dr. Kline and Dr Pegau has taken responsibility for the project until a suitable replacement can be found. The gap in personnel may impact the completion of the analysis of this project, however Dr. Pegau worked with Dr. Kline to ensure a smooth transition of materials and is in a position to rapidly bring a new person up to speed or complete the deliverables if needed

II. PROJECT DESIGN

A. Objectives

We have sought input for the design of the first five year proposal from scientists with ADF&G, NOAA, the current PWS herring survey program, and other institutions. Based on that input we have arrived at the following objectives for the first five-year period.

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008) The proposed monitoring efforts are designed to address this objective by either expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events.

2) *Inform the required synthesis effort* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers

3) *Address assumptions in the current measurements* Many of the existing studies are based on historical or logistical constraints. We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program.

4) *Develop new approaches to monitoring* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

Because we are at the beginning of a twenty-year effort, we want to maximize the value of any data collected. The objectives listed above are designed to ensure that research and monitoring efforts within the expected twenty-year program are most effective. The programs addressing the objectives provide the information necessary to evaluate existing efforts while continuing to move towards our long-term goal.

Objectives specific to this project:

1. Expanded area Simpson Bay sampling in November 2011 and March 2012
2. Sample Simpson Bay monthly from September 2011 to June 2012

B. Procedural and Scientific Methods

We will sample at a single bay, Simpson Bay. However, the spatial scope of what is considered Simpson Bay will be expanded during the November and March sampling periods The scope of this expansion (Fig 1) is based on a combination of where herring have been previously sampled and where herring have been observed acoustically (R. Thorne. Pers comm).

<u>Sampling to increase spatial resolution (objective 1).</u> For this project we will augment current monitoring samples by sampling Simpson Bay as an aggregate of five sub-areas within the designated expanded bay area during November and March (Fig. 1). This entails dividing the designated expanded Simpson Bay into five sub-areas and sampling systematically within each area rather than just one location (the expansion per se is thus for four additional Simpson sites).

<u>Sampling to increase temporal resolution (objective 2):</u> For this project we will augment current November and March monitoring by also sampling Simpson Bay in September, October, December, January, April, May, and June as we are presently doing (sampling limited to either sub-areas 1 or 2 in Fig. 1 according to greatest fish abundance). The target minimum sample size at each time is 100 herring for energetics and 50 fish for RNA/DNA.

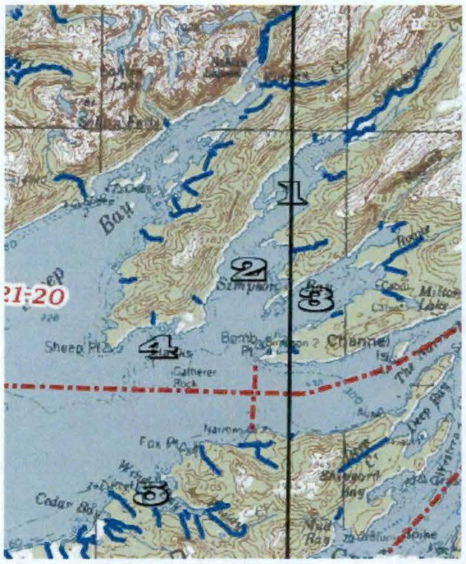

Figure 1. Map of Simpson Bay and surrounding waters showing five sampling areas.

The experimental design of the ongoing monitoring, i.e., sampling during November and March is a good match with respect to the experimental results used to develop the overwinter mortality model (Kline and Campbell 2011). The overwinter mortality model is based, in part, on a laboratory energy loss experiment that was conducted from 1 December to 25 January (Paul and Paul 1998). Therefore, measuring initial conditions during November is a good match. As well, one Paul and Paul (1998) experiment ended on 1 April, a good match to our field observations made in late March.

The energy value of herring that died during laboratory experiments ranged by 0.8 kJ/g wet mass (Paul and Paul 1998). The monthly (30 days) energy loss rate is very similar at 0.7 kJ/g wet mass suggesting this is a good sampling interval for the planned process study. If for example we sampled at twice per month, the expected energy loss would be ~ 0.3 kJ/g wet mass, much less than this range. Furthermore, with sampling trips possibly taking up to 10 days to complete from planned starting dates due to weather, there could be less than 10 days between samples, resulting in negligible change in measured energy.

Short-term (time intervals of months) increases in fish density previously observed at herring sampling sites suggest the possibility of localized migration (Table 1 in Stokesbury et al. 2002). For example, an undetected movement of the herring population to just outside/inside a given sampling bay prior to a survey would mimic a population loss/gain. If the condition of groups of herring within a bay was heterogeneous such short movements could result in a false apparent change in condition. For example, only those fish with higher condition might have migrated out. To test for this effect during our process study, we will sample more extensively during November and March during the process study year (late summer 2011 to spring 2012). The more extensive area comprising Simpson Bay will be sub-divided into five parts with one part corresponding to existing sampling. Therefore only the four additional parts need to be sampled as part of this study. To assess possible effect on the mortality model, the top 20% (the approximate present survival rate between November and March as well as between March and April) of each of the five sub-areas will be compared. Therefore at least 100 herring need to be sampled yielding 20 for this comparison. The mortality model will be run for each of the five sub-areas. The five outcomes will be compared with the five observed March distributions using ANOVA. At the end of the project we will make any necessary recommendations for altering sampling within a bay so as to achieve better representation.

Measurements of energy density can be misleading if the relative concentrations of lipid and protein remain constant when growth resumes. This would translate as a constant energy density leading the mortality model to overestimate mortality due to starvation. Monitoring growth would provide a more direct measure of the onset of feeding. Use of RNA/DNA as an indicator of feeding can be used to indicate the onset of feeding (Sewall et al. 2011). Moreover, RNA/DNA responds more quickly to changes in nutritional status than energy density.

Similarly, RNA/DNA could be used to indicate when feeding ceases in fall. When feeding ceases, energy density will remain elevated until fish deplete glycogen reserves and sufficient lipid is catabolized relative to protein to effect a change in energy density. Thus, reliance on energy density can underestimate the period in which feeding ceases. By combining RNA/DNA and energy density analysis the mortality model can provide better estimates of potential mortality.

C. Data Analysis and Statistical Methods

Other than tests specific to the experimental design aspects unique to this project (section B), the data analysis and statistical methods are the same as described in the accompanying Herring Condition Monitoring project. Energy measurement techniques will be done consistent with previous Prince William Sound herring studies dating as far back as the 1990's (Kline and Campbell 2011).

The null hypothesis for the higher spatial resolution sampling is that the five sub-areas of Simpson Bay have the same value for each of the parameters being measured. This will be tested using ANOVA For example, the whole body energy density should not vary spatially within the greater Simpson Bay. If this is so then small scale migration (within this area) should not be a concern.

The expectation for the monthly observations is that they will follow a consistent pattern over the course of the observation period. An inconsistent pattern would be if the values of a given parameter shifted erratically rather than with a consistent pattern. For example, energy values decreased, then increased, then decreased, etc. Evidence of immigration would be supported by a combination of erratic variation and a systematic relationship among shifting values consistent with two more populations mixing. The differences corresponding to these hypothetical populations would have to be consistent with the differences among the five sub-areas sampled in November and March to suggest shifting around of sub-populations (e g., the herring residing in each of the five sub-areas at a given time) from nearby.

However, if the de-trended monthly differences exceeded the differences from within the five sub-areas, it would suggest immigration/emigration from a greater space domain than that reflected by the expanded Simpson Bay sampling scheme of this project. If this is the case we may need to adjust the herring monitoring sampling strategy

D. Description of Study Area

The study area includes all of Prince William Sound (N, E, S, and W boundaries of respectively, ~ 61, -145.5 60, and -149°). However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 2) This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance

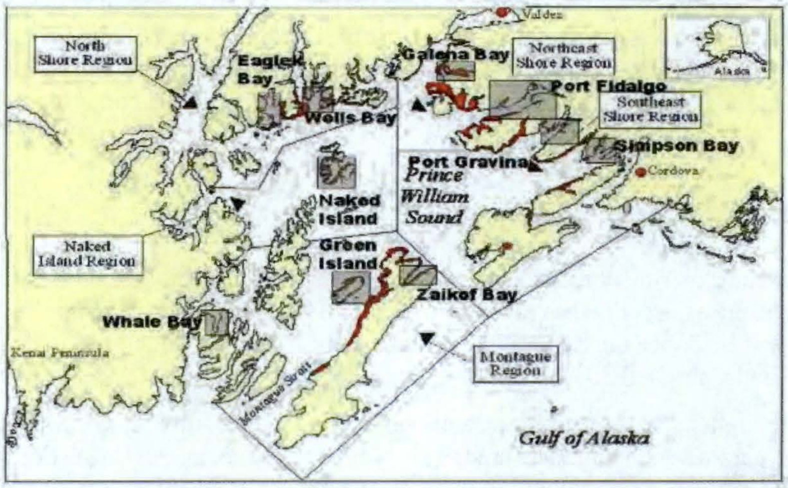

Figure 2. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with Other Efforts

This proposal is structured to be part of a collaborative programmatic effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the program team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program. He will also be responsible for outreach and public input efforts.

Dr. Pegau currently is the coordinator of the existing EVOSTC funding PWS Herring Survey program. This program consists of ten individual projects that provide a coordinated examination of juvenile herring in Prince William Sound. This proposal is heavily influenced by the early findings from that effort. Dr. Pegau also serves as the Research Program Manager for the Oil Spill Recovery Institute (OSRI). In that capacity he is responsible for developing annual work plans, ensuring proper reporting, making reports available, developing partnerships to leverage funding, and to ensure outreach of OSRI activities. All activities that provide experience delivering the team leader duties outline in the request for proposals.

One of his duties is to ensure proper scientific oversight of the research programs. To accomplish this we will be setting up a four-person scientific oversight panel that will help guide the program and ensure the research is relevant to the long-term goal. The team will consist of people representing Alaska Department of Fish and Game, the National Oceanic and Atmospheric Administration, academia, and the local fishing community. There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities. This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermens United (CDFU), and others. Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydroacoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations. We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

Other important programs for coordinating with are the existing PWS herring survey program and existing ADF&G herring research This program has been developed with input from both of these programs and the focus of this proposal is extending the interpretation of the data from those two programs. The Herring Survey program will still be operating in FY12 and FY13 There are field observations scheduled in FY12 and in FY13 funds are strictly for analysis and report writing. Included in the report writing is a synthesis of previous and current research. This report will be finished in FY13 and be the basis for the synthesis required under this request for proposals

Lead Principal Investigator Dr. Thomas C. Kline, Jr. will be responsible for the execution of project's energy observations and energy modeling and oversight of the proposed project. Dr. Kline is a world-leader in applying natural stable isotope abundance to fish ecology problems Dr. Kline has been a research scientist at the Prince William Sound Science Center (PWSSC) since 1995. During this time he has led numerous projects on the oceanography of Prince William Sound and adjacent Gulf of Alaska. He has published dozens of research papers based on the resulting data.

Dr Kline is currently the principal investigator of the *Exxon Valdez* Oil Spill Trustee Council project 'Prince William Sound Herring Survey: Pacific Herring Energetic Recruitment Factors' that is investigating the role of food sources and energy status of herring for recruitment. He was the principal investigator of several previous *Exxon Valdez* Oil Spill Trustee Council projects that had a herring focus. These included Herring Forage Contingency (2007-9), Productivity Dependencies: Stable Isotopes (1998-9), and Sound Ecosystem Assessment: Conforming Food Webs of Fishes with Stable Isotope Tracers (1995-8). Results of these projects have been incorporated into approximately two-dozen scientific publications The data from the existing project and past projects will synergize with this proposed project.

Co-Principal Investigator Dr Ron Heintz will be responsible for the execution of the RNA/DNA aspects of the proposed project.

Both investigators are also investigators of ongoing and proposed herring condition monitoring projects that are part of the herring program. This dual role will facilitate near real-time integration of project results with the monitoring program. Both investigators will contribute to programmatic synthesis scheduled to take place in FY14. This synthesis may include suggested changes to the herring monitoring according to depending on outcome.

III. CV's/RESUMES

W. Scott Pegau
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Education:

1990 B.S., Physics, University of Alaska, Fairbanks
1996 Ph.D, Oceanography, Oregon State University

Professional Experience:

1987-1990	Research Assistant, University of Alaska, Fairbanks
1990-1996	Graduate Research Assistant, Oregon State University
1996-1997	Research Associate (Post Doc), Oregon State University
1997-1999	Faculty Research Associate, Oregon State University
1999-present	Assistant Professor, Oregon State University
2002-2003	Senior Scientist, Kachemak Bay Research Reserve
2003-2007	Research Coordinator, Kachemak Bay Research Reserve
2007-present	Research Program Manager, Oil Spill Recovery Institute

Research Interests:

To develop novel oil spill detection and tracking approaches. Understanding the fate and behavior of oil spilled in cold water environments. Development of response options for oceans with sea ice present. Circulation in Prince William Sound, Cook Inlet and the Gulf of Alaska and the associated larval transport. Relationship between oceanographic conditions and fisheries. Application of remote sensing for understanding coastal processes.

Publications

Selected publications

Pegau, W. Scott, Inherent optical properties of the central Arctic surface waters, *J Geophys Res*, **107**, doi. 10.1029/2000JC000382, 2002.

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Collaborators

Mary Abercrombie (USF), Robyn Angliss (NOAA), Greg Balogh (USFWS), Mike Banner (UNSW), P. Bhandari (UM), Mary Anne Bishop (PWSSC), Rob Bochenek (Axiom consulting), Emmanuel Boss (U Maine), Kevin Boswell (FIU), Tim Boyd (SAM), Trevor Branch (UW), Evelyn Brown (Flying fish), John Brown, Michele Buckhorn (PWSSC), Lindsay Butters (PWSSC), Rob Cambell (PWSSC), L Carvalho (UCSB), Grace Chang (UCSB), Yi Chao (JPL), Paula Coble (USF), Robyn Conmy (EPA), Tim Cowles (OSU), Helen Czerski (U Southhampton), M. Darecki (PAS), Tommy Dickey (UCSB), C. Dong (IGGP), David Farmer (URI), Jim Farr (NOAA), Scott Freeman (NASA), J. Gemmrich (UVic), P. Gernez (U Nantes), Jess Grunblatt (UAF), Scott Guyer (BLM), Jeff Guyon (NOAA), B. Hagen (SAM), Nate Hall-Patch (IOS), Mark Halverson (PWSSC), Ron Heintz (NOAA), Paul Hershberger (USGS), Ben Holt (JPL), S. Jiang (UCSB), Mark Johnson (UAF), C. Jones (UCSB), Doug Kane (UAF), Lee Karp-Boss (U Maine), George Kattawar (TAMU), John Kelley (UAF), T. King (BIO), Tom Kline (PWSSC), Cory Koch (Wetlabs), Gary Kofinas (UAF), Kathy Kuletz (USFWS), J. Lacoste (Dalhousie), Denny Lassuy (DOI), D. LeBel (Lamont), Ken Lee (BIO), L. Lenain (SIO), Marlin Lewis (Satlantic), Y. Liu (MIT), L. Logan (UMiami), Wendy Loya (Wilderness org), Ted Maksym (WHOI), Darek Manov (UCSB) Phillip Martin (USFWS), W. Melville (SIO), Scott Miles (LSU), Steve Moffitt (ADF&G), Mark Moline (Cal Poly), Sue Moore (NOAA), Rue Morison (UNSW), Dave Musgrave, F. Nencioli (MIO), Carter Ohlmann (UCSB), John Payne (DOI), Sean Powers (USA), Caryn Rea (Conoco), Dan Reed (ADFG), B. Reineman (SIO), Ian Robbins (Cal Poly), B. Robinson (BIO), Chris Roman (WHOI), R. Rottgers (HZG), Scott Ryan (BIO), H. Schultz (UMass), Li Shen (Johns Hopkins), M. Shinki (CRI), Matt Slivkoff(ISMO), M. Sokolski (PAS), Frank Spada (Sea Engineering), Nate Statom (SIO), Darius Stramski (SIO), Bill Streever (BP), Todd Sformo (NSB), Robert Shuchman (Mich Tech), Petere Sutherland (SIO), Hanumat Singh (WHOI), Matt Sturm (ACE), Robert Suydam (NSB), J. Taylor, Richard Thorne (PWSSC), Mike Twardowski (Wetlabs), S. Vagle (IOS), Ronnie Van Dommelen (Satlantic), Tim Viavant (ADFG), Johanna Vollenweider (NOAA), Ken Voss (UMiami), Ian Walsh (Wetlabs), Libe Washburn (UCSB), J. Wei (Dal), Hemantha Wijesekera (NRL), Dee Williams (BOEM), Sharon Wilde (NOAA), Amanda Whitmire (OSU), Jeremy Wilkinson (BAS), Michelle Wood (UO), O. Wurl (Old Domin), D. Yankg (John Hopkins), Dave Yokel (BLM), Dick Yue (MIT), Len Zabilansky (CRREL), Ron Zaneveld (Wetlabs), Chris Zappa (Lamont), Brian Zelenke (Cal Poly)

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EDUCATION:

B.S. Ecology Ethology and Evolution, June 1979, University of Illinois, Urbana May 1979
M S Fisheries Biology, May 1987, University of Alaska, Juneau May 1985
PhD· Fisheries Biology, University of Alaska, Fairbanks May 2009

PROFESSIONAL MEMBERSHIPS:

American Fisheries Society
American Institute of Biological Scientists
American Association for the Advancement of Science

EMPLOYMENT:

Program Manager, Recruitment Energetics and Coastal Assessment Program
National Marine Fisheries Service
Alaska Fisheries Science Center

Employed with NMFS for 27 years

RECENT PUBLICATIONS:

1 **Heintz,RA,** E.C. Siddon, E.V. Farley and J. Napp. In press. Correlation between recruitment and fall condition of age-0 pollock (*Theragra chalcogramma*) from the eastern Bering Sea under varying climate conditions. Deep Sea Research II. Accepted February 2013.
2. Siddon, EC, **Heintz RA,** Mueter FJ (In Press) Conceptual model of energy allocation in walleye pollock (*Theragra chalcogramma*) from larvae to age-1 in the southeastern Bering Sea. Deep Sea Research II. Accepted November, 2012.
3. Rinella, D. J., M. S. Wipfli, C. Stricker and **R. Heintz.** 2012. Salmon returns and consumer fitness: Marine-derived nutrients show saturating effects on growth and energy storage in stream-dwelling salmonids. Canadian Journal of Fisheries and Aquatic Sciences.69(1):73-84. DOI: 10.1139/f2011-133
4. Vollenweider, J.J., J.L. Gregg, **R.A. Heintz,** P.K. Hersberger. Energetic cost of *Ichthyophonus* infection in juvenile Pacific herring (*Clupea pallasi*). J. Parasit ology Research 2011:1-10. doi:10.1155/2011/926812
5. Gregg, KJ.L., J.J. Vollenweider, C.A. Grady, **R. A. Heintz** and P.K. Hershberger. Effects of environmental temperature on the dynamics of Ichthyophonus in juvenile Pacific herring (*Clupea pallasii*). J. Parasitology Research 2011:1-9. doi:10.1155/2011/563412

COLLABORATIONS IN LAST 48 MONTHS

AK Dep Fish and Game	S. Moffit,
University of Alaska Fairbanks	E Siddon, A Pinchuk, F Mueter, B Norcross
U S Geological Survey	P Hershberger
University of Alaska Southeast	J Straley
Florida International Univeristy:	K. Boswell
Prince William Sound Science Center	T Kline

Oil Spill Research Institute	S. Pegau
University of Washington:	G. Hunt
Bureau Ocean Energy Management:	C. Coon
Sitka Sound Science Center:	A. Sreenivasan
North Slope Borough	L. de Sousa
Louisiana State University	C. Li

IV. SCHEDULE
A. Project Milestones

Objective 1. Expanded area Simpson Bay sampling in November 2011 and March 2012.
Sampling to be met by March 2012, analysis by March 2013, incorporation into project synthesis by October 2013, and incorporated into herring program by March 2014

Objective 2. Sample Simpson Bay monthly from September 2011 to June 2012
Sampling to be met by June 2012, analysis by June 2013, incorporation into synthesis by October 2013, and incorporated into herring program by March 2014

B. Measurable Project Tasks

FY 14, 1st quarter (February 1 – May 31, 2014)
March *Complete analysis*

FY 14, 2nd quarter (June 1, 2014-August 30, 2014)
July *Complete final report*

V. BUDGET
Budget Form (Attached)
Please complete the budget form for each proposed year of the project.

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: PWS Herring: Coordination and Logistics

Project Period: 1 February 2014 to 31 January 2015

Primary Investigator(s): W. Scott Pegau, Prince William Sound Science Center, Box 705 Cordova, AK 99574 ph: 907-424-5800 x222 email wspegau@pwssc.org

Abstract:

This project is for the coordination and logistics aspects of the proposed program titled, "PWS Herring Research and Monitoring". The objectives of the program are 1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model,* 2) *Inform the required synthesis effort, 3) Address assumptions in the current measurements, and 4) Develop new approaches to monitoring.* The Coordination and Logistics program objectives are to 1) ensure coordination between projects to achieve the program objectives, 2) Provide a synthesis from existing results, and 3) provide logistical support to the various projects.

Coordination includes scheduling of projects to ensure the maximum sharing of vessel time and so that projects dependent on results or samples from another project are in the correct order. Coordination will be primarily through email and teleconference, but each year all the investigators are required to meet in person. Coordination is also taking place with the existing Herring Survey program, the Long-Term monitoring program, and ADF&G herring sampling.

Logistics is primarily in providing vessel time although a remotely operated vehicle is requested in this budget to support non-lethal fish identification and being able to search under the ice.

The synthesis to be provided by this project is leveraging the required synthesis of the existing Herring Survey program. We intend to update that effort with new results and add a section on how environmental conditions affect herring growth.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
364,125	510,229	388,088	339,016	338,627	1,940,085

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: 16 August 2013

(THIS SUMMARY PAGE NOT TO EXCEED ONE PAGE)

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the Exxon Valdez Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

Described here is a single project that is a part of an integrative program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. **The long-term goal of the program is to improve predictive models of herring stocks through observations and research.** While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

B. Summary of Project to Date (if applicable)

All milestones to date have been met. The cruises have occurred as scheduled and there have been several meetings of the investigators to help coordination both within the program and with the PWS Herring Survey program and Gulf Watch Alaska program. All subcontracts to PWSSC are in place.

II. PROJECT DESIGN

A. Objectives

This project is designed as the oversight and logistics portion of the "PWS Herring Research and Monitoring" proposal submitted by the Prince William Sound Science Center. The objectives of that program are:

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model.* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008). The proposed monitoring efforts are designed to address this objective by either expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events.

2) *Inform the required synthesis effort* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers.

3) *Address assumptions in the current measurements.* Many of the existing studies are based on historical or logistical constraints. We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program.

4) *Develop new approaches to monitoring* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

This projects objectives are:
1) Ensure coordination between projects to achieve the program objectives.
2) Provide a synthesis from existing results.
3) Provide logistical support to the various projects.

The subcontracts for Data Management, Modeling, and Non-Lethal Sampling projects are contained within the budget of this project since the Coordination project has an oversight role for all projects.

B. Procedural and Scientific Methods

The first objective is to ensure coordination between programs. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the program team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program.

There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities. This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermens United (CDFU), and others. Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

The wide array of projects that make up PWS Herring Research and Monitoring program required careful integration to ensure the maximum collaboration between projects. Not all observation projects are directly connected to each other, but are connected through the objectives of the program. The full benefits of the linkages will be seen at the points where synthesis efforts occur.

Coordination between programs is also taking place through scheduling of vessels by the Coordination project and the scheduling order of individual projects. All the investigators are required to work together to determine vessel type and number of days needed. Coordination was also achieved through the scheduling of projects to ensure results would be available for projects dependent on samples or data from another project. More information is available in section E. of this proposal.

The second objective is to provide a synthesis of results in year 3. A synthesis is also required for the currently funded herring program and due at approximately the same time. To reduce the cost of this proposal we will be relying on the existing synthesis effort to provide the required work. The aim of the current synthesis effort is not to summarize the existing information, but to use that information to address specific questions. We are looking to address the questions of

1) How many bays must we sample to provide a juvenile herring index?
2) Where don't we find juvenile herring and why?
3) Energetically is it more important to be in good condition in the fall or have food available in the spring? This includes the quality of food available.
4) How do the sources of mortality (disease, energy, predation) interact with each other?

For the purpose of the synthesis required in this proposal we will add the question of how does environmental conditions affect growth and refine the answers to the other questions based on results obtained in this program.

The third objective is to supply logistical support. The primary logistical support is providing vessel time to the various projects. This is contained in the coordination budget to ensure maximum utilization of the vessels. This project will also obtain a remotely operated vehicle for use by the various projects. This is needed for non-lethal sampling, but has been identified as a need for the herring tagging project (mooring recovery), and for surveying under ice edges where large numbers of juvenile fish have been observed.

C. Data Analysis and Statistical Methods

This project is dependent on the investigators of the other projects to help identify questions for the synthesis and upon their expertise in the subject areas to define the appropriate data analysis and statistical methods.

D. Description of Study Area

The study area includes all of Prince William Sound (N, E, S, and W boundaries of respectively, ~ 61, -145.5. 60, and -149°). However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 2). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

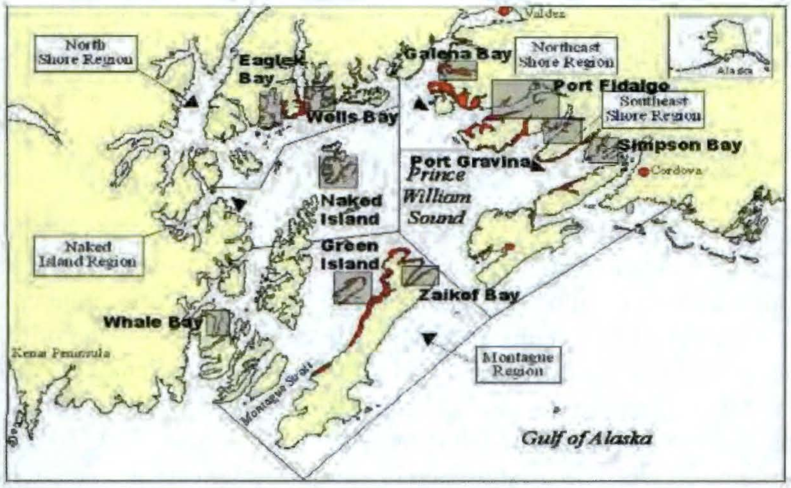

Figure 2. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with Other Efforts

This proposal is structured to be part of a collaborative programmatic effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the program team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program.

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The wide array of projects that make up this program required careful integration to ensure the maximum collaboration between projects. Not all observation projects are directly connected to each other, but are connected through the objectives of the program. The full benefits of the linkages will be seen at the points where synthesis efforts occur.

Direct overlap between observation projects occurs in the area of logistics. We intend to have the acoustic surveys, direct capture, and non-lethal collection components sharing a vessel. The direct capture and non-lethal collection are intended to provide validation to the acoustics. The direct capture component will be responsible for providing fish to the RNA condition, energetic condition, disease research, fatty acid indicators, and genetic stock indicator projects. Another direct project overlap occurs between the herring scale analysis and primiparous herring projects, which will share growth information as determined from the scales. The combined efforts will lead to a greater number of scales becoming digitized and improving the statistics for both projects. All projects will also interact with the data management efforts to ensure the data is properly archived and maintained.

Indirect project overlap occurs between projects through the scheduling. Projects like the genetic stock indicators are pushed back in the cycle to ensure that the methodologies used by the direct capture program are mature enough to ensure collection of the required samples. Non-lethal collection is also later in the program to ensure new direct capture techniques are fully tested. Fish collected from the RNA and energetics intensive studies will also be used by the fatty acid indicator project. The acoustic tagging project is early in the program to take advantage of the acoustic receiver array that is in place and has a limited life span. Some projects like the disease research component also start later in the program because of coordination with the existing herring monitoring program. We worked hard to ensure that there isn't duplication between the proposed program and the existing program. One apparent exception is the RNA and energetic condition intensives. By moving these projects early in the program we intend to fill what is seen as a major gap in the existing program and hopefully more quickly resolve the information value that each project provides.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydroacoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations. We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

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III. CV's/RESUMES

W. Scott Pegau
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Education:

1990 B.S., Physics, University of Alaska, Fairbanks
1996 Ph.D, Oceanography, Oregon State University

Professional Experience:

1987-1990	Research Assistant, University of Alaska, Fairbanks
1990-1996	Graduate Research Assistant, Oregon State University
1996-1997	Research Associate (Post Doc), Oregon State University
1997-1999	Faculty Research Associate, Oregon State University
1999-present	Assistant Professor, Oregon State University
2002-2003	Senior Scientist, Kachemak Bay Research Reserve
2003-2007	Research Coordinator, Kachemak Bay Research Reserve
2007-present	Research Program Manager, Oil Spill Recovery Institute

Research Interests:

To develop novel oil spill detection and tracking approaches. Understanding the fate and behavior of oil spilled in cold water environments. Development of response options for oceans with sea ice present. Circulation in Prince William Sound, Cook Inlet and the Gulf of Alaska and the associated larval transport. Relationship between oceanographic conditions and fisheries. Application of remote sensing for understanding coastal processes.

Publications

Selected publications

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Montes-Hugo, M. A., K. Carder, R. J. Foy, J. Cannizzaro, E. Brown, and S. Pegau, Estimating phytoplankton biomass in coastal waters of Alaska using airborne remote sensing, *Remote Sens Environ.* **98**, 481-493, 2005.

Streever, B., R. Suydam, J.F. Payne, R. Shuchman, R.P. Angliss, G. Balogh, J. Brown, J. Grunblatt, S. Guyer, D.L. Kane, J.J. Kelley, G. Kofinas, D.R. Lassuy, W. Loya, P. Martin, S.E. Moore, W.S. Pegau, C. Rea, D.J. Reed, T. Sformo, M. Sturm, J.J. Taylor, T. Viavant, D. Williams, and D. Yokel, Environmental Change and Potential Impacts: Applied Research Priorities for Alaska's North Slope, *Arctic*, **64**, 390-397, 2011.

Moline, M.A., I. Robbins, B. Zelenke, W.S. Pegau, and H. Wijesekera, Evaluation of bio-optical inversion of spectral irradiance measured from an autonomous underwater vehicle, *J. Geophys Res.*, **117**, 12pp., doi:10.1029/2001JC007352, 2012.

Musgrave, D.L., M.J. Halverson, and W.S. Pegau, Seasonal Surface Circulation, Temperature, and Salinity in Prince William Sound, Alaska, *Cont. Shelf Res*, doi:10 1016/j.csr.2012.12.001, 2012

Collaborators

Mary Abercrombie (USF), Robyn Angliss (NOAA), Greg Balogh (USFWS), Mike Banner (UNSW), P. Bhandari (UM), Mary Anne Bishop (PWSSC), Rob Bochenek (Axiom consulting), Emmanuel Boss (U Maine), Kevin Boswell (FIU), Tim Boyd (SAM), Trevor Branch (UW), Evelyn Brown (Flying fish), John Brown, Michele Buckhorn (PWSSC), Lindsay Butters (PWSSC), Rob Cambell (PWSSC), L Carvalho (UCSB), Grace Chang (UCSB), Yi Chao (JPL), Paula Coble (USF), Robyn Conmy (EPA), Tim Cowles (OSU), Helen Czerski (U Southhampton), M. Darecki (PAS), Tommy Dickey (UCSB), C. Dong (IGGP), David Farmer (URI), Jim Farr (NOAA), Scott Freeman (NASA), J. Gemmrich (UVic), P. Gernez (U Nantes), Jess Grunblatt (UAF), Scott Guyer (BLM), Jeff Guyon (NOAA), B. Hagen (SAM), Nate Hall-Patch (IOS), Mark Halverson (PWSSC), Ron Heintz (NOAA), Paul Hershberger (USGS), Ben Holt (JPL), S. Jiang (UCSB), Mark Johnson (UAF), C. Jones (UCSB), Doug Kane (UAF), Lee Karp-Boss (U Maine), George Kattawar (TAMU), John Kelley (UAF), T. King (BIO), Tom Kline (PWSSC), Cory Koch (Wetlabs), Gary Kofinas (UAF), Kathy Kuletz (USFWS), J Lacoste (Dalhousie), Denny Lassuy (DOI), D. LeBel (Lamont), Ken Lee (BIO), L. Lenain (SIO), Marlin Lewis (Satlantic), Y. Liu (MIT), L. Logan (UMiami), Wendy Loya (Wilderness org), Ted Maksym (WHOI), Darek Manov (UCSB) Phillip Martin (USFWS), W. Melville (SIO), Scott Miles (LSU), Steve Moffitt (ADF&G), Mark Moline (Cal Poly), Sue Moore (NOAA), Rue Morison (UNSW), Dave Musgrave, F. Nencioli (MIO), Carter Ohlmann (UCSB), John Payne (DOI), Sean Powers (USA), Caryn Rea (Conoco), Dan Reed (ADFG), B. Reineman (SIO), Ian Robbins (Cal Poly), B. Robinson (BIO), Chris Roman (WHOI), R. Rottgers (HZG), Scott Ryan (BIO), H. Schultz (UMass), Li Shen (Johns Hopkins), M. Shinki (CRI), Matt Slivkoff(ISMO), M. Sokolski (PAS), Frank Spada (Sea Engineering), Nate Statom (SIO), Darius Stramski (SIO), Bill Streever (BP), Todd Sformo (NSB), Robert Shuchman (Mich Tech), Petere Sutherland (SIO), Hanumat Singh (WHOI), Matt Sturm (ACE), Robert Suydam (NSB), J. Taylor, Richard Thorne (PWSSC), Mike Twardowski (Wetlabs), S. Vagle (IOS), Ronnie Van Dommelen (Satlantic), Tim Viavant (ADFG), Johanna Vollenweider (NOAA), Ken Voss (UMiami), Ian Walsh (Wetlabs), Libe Washburn (UCSB), J. Wei (Dal), Hemantha Wijesekera (NRL), Dee Williams (BOEM), Sharon Wilde (NOAA), Amanda Whitmire (OSU), Jeremy Wilkinson (BAS), Michelle Wood (UO), O. Wurl (Old Domin), D. Yankg (John Hopkins), Dave Yokel (BLM), Dick Yue (MIT), Len Zabilansky (CRREL), Ron Zaneveld (Wetlabs), Chris Zappa (Lamont), Brian Zelenke (Cal Poly)

IV. SCHEDULE

A. Project Milestones

Objective 1. Ensure coordination between projects to achieve the program objectives.
This is an ongoing objective and will last through the proposal period

Objective 2. Provide a synthesis from existing results.
To be met by November 2014

Objective 3 Provide logistical support to the various projects.
This is an ongoing objective and will last through the proposal period

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.

FY14 2nd Quarter

January	Annual Marine Science Symposium
March	Complete acoustic intensive
March	Conduct spring juvenile collection

FY14 2nd Quarter

April	Conduct extended adult biomass cruise, collect samples for genetics
May	Conduct annual PI meeting

FY14 3rd Quarter

August	Submit semi-annual report and FY15 work plan for review
October	Complete herring program synthesis.

FY14 4th Quarter (November 1, 14 to January 31, 15)

November	Conduct juvenile index survey

V. BUDGET

Budget Form (Attached)

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

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: *Genetic stock structure - Herring*

Project Period: 2014

Primary Investigator(s): Dr. Jeffrey Guyon and Sharon Wildes (NOAA)

Abstract:
Understanding if there is one PWS herring stock or multiple stocks is important for proper management of fisheries. We propose to study the genetic uniqueness of herring from PWS to determine if it may be a complicating factor in the recovery process. A previous genetic study of herring in the region indicated that the PWS herring population was genetically distinct from other stocks spawning outside the Sound (O'Connell et al. 1998), providing an impetus for additional work. Several recent studies have made advancements in herring research using microsatellite loci, and have detected fine-scale genetic differentiation among local regions of herring (Beacham et al. 2008; Andre et al. 2011; Wildes et al. 2011). Each microsatellite locus contains multiple alleles making microsatellites ideal genetic markers for analyzing migratory fish with limited stock structure like herring. Based on our experience studying Pacific herring in Southeast Alaska using microsatellite markers (Wildes et al. in 2011), successful completion of this proposal will require (1) increasing the number of genetic samples per collection from the 50 used in the previous analysis (O'Connell et al. 1998) to 150 fish, (2) using an increased number of informative markers (from 5 to 15), (3) analyzing at least two years of collections to examine temporal stability, and if sampling allows (4) spatial stability from collections from two different historical locations (east, west). Evaluation of temporal and spatial variation of herring population(s) in and around PWS using updated genetic protocols will provide important information about herring life history that will contribute to improving the application of the ASA model.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
0	0	$50,500	$53,100	0	103,600

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date:
August 10, 2013

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I. NEED FOR THE PROJECT

A. Statement of Problem

Pacific herring, once an important fishery, form a critical part of the Prince William Sound (PWS) ecosystem. Stocks remain depressed over the majority of the last20 years and reasons for lack of recovery remain complex and unknown. Information about herring stock structure is critical to determining the best management objectives for recovery of Pacific herring (*Clupea pallasi*) population(s), particularly if a fishery were re-established. It would be important to understand the uniqueness of spawning areas. Results from the genetic analysis outlined in this proposal will help managers understand if multiple sub-stocks are involved in issues such as spawning sites and fidelity, which may contribute to the complexities in understanding their lack of recovery.

B. Summary of Project to Date (if applicable)

Some samples (n=600) have already been collected in 2012 from the Port Gravina, Port Fidalgo, eastern PWS.

II. PROJECT DESIGN

A. Objectives

The primary objective of this proposal is to identify genetic uniqueness of herring in Prince William Sound using a group of 15 informative microsatellite markers to:

a. Determine if unique populations exist by sampling within and around PWS;
b. Determine temporal stability by sampling for two consecutive years at each location;
c. Determine if fine-scale structure exists across two age classes at each site -if ample sample size allows (Same, or different? Answer will aid in evaluation of the adopted-migrant hypothesis);
d. Determine spawning site fidelity of herring in PWS by comparing PWS spawners and nearby spawners outside of the Sound.

B. Procedural and Scientific Methods

Age class will be approximated from size information and DNA will be isolated from two age classes (150 each) from each collection of 500. Scale reading later will determine the age classes. Samples will be genotyped using 15 microsatellite markers, all of which have already been standardized in our laboratory for Pacific herring (Wildes et al., 2011).

C. Data Analysis and Statistical Methods

Resulting genotypes will be analyzed using standard genetic analyses in MICROCHECKER, GENEPOP, and FSTAT. Using PHYLIP, genetic distance among collections will be calculated and a neighbor-joining tree constructed to illustrate genetic relationships. The degree of genetic diversity will be examined with F_{ST}, G-test, and AMOVA among the following collections: (1) inside/outside PWS, (2) between collections within PWS, as samples permit (3) among year classes within a spawning cohort and (4) among years of collections. Finally, genetic results will be summarized to communicate their biological significance, as well as their significance to management and restoration.

D. Description of Study Area

It is anticipated that herring will be collected from within Prince William Sound, with the goal of collecting from both east and west. As a means to examine the fidelity of herring remaining in the Sound or returning to spawn in PWS, additional samples from outside PWS will be used. Through collaboration with the Alaska Department of Fish and Game (ADF&G) in Cordova and Yakatat, the goal will be to collect at least 150 samples from each group (for a specific location, year, spawn time, and age class). Samples will be collected by coordinating with ADF&G and other EVOS funded projects from locations as outlined in Table 1.

Table 1

Location	Area	Year	Collected from Late Spawn	Number* Analyzed
Montague area	Western PWS	2014	500	300
St Matthews Bay	Eastern PWS	2012	600	200
		2013	500	200
		2014	500	200
Kamishak	Cook Inlet	2012	200	200
Yakutat	Central Alaska	2008	200	200
Kukak	Kodiak	2013	150	150
Total			**2650**	**1450**

*number analyzed will include two year classes, obtained from the larger amount collected.

E. Coordination and Collaboration with the Program

This project is part of the Overall Project Objective 1: Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model. Evaluation of temporal and spatial variation of herring population(s) in PWS using updated genetic protocols will provide important information about herring life history that will contribute to improving the application of the ASA model.

III. CV's/RESUMES

CURRICULUM VITAE

NAME: Jeffrey R. Guyon

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EDUCATION:

Jun 1983 - May 1987	B.S. in Mathematics, U.S. Coast Guard Academy, New London, CT
Aug 1993 - Aug 2000	Ph.D. in Biochemistry, University of Notre Dame, Notre Dame, IN

EMPLOYMENT AND WORK EXPERIENCE:

May 1987 - Jun 1993	Staff Officer, United States Coast Guard
Aug 1993 - Aug 1997	Graduate student, University of Notre Dame, South Bend, IN
Aug 1997 - Aug 2000	Graduate Student, Massachusetts General Hospital, Boston, MA.
Aug 2000 - Dec 2004	Post-doctoral fellowship, Children's Hospital Boston, Boston, MA.
Jan 2005 – Jun 2007	Instructor, Children's Hospital Boston, Boston, MA.
Jul 2007 – Jun 2008	Geneticist, Alaska Department of Fish and Game, Anchorage, AK.
Jul 2008 – Apr 2010	Supervisory Geneticist, Auke Bay Laboratories, Juneau, AK.
Apr 2010 – present	Program Manager, Auke Bay Laboratories, Juneau, AK.

SCIENCE BIBLIOGRAPHY (selected)

1. Farley, E.V., A. Starovoytov, S. Naydenko, R. Heintz, M. Trudel, C. Guthrie, L. Eisner, and J.R. Guyon. (2011) Implications of a warming eastern Bering Sea for Bristol Bay sockeye salmon. ICES Journal of Marine Science 68:1138-46.
2. McCraney, W.T., Farley, E.V., Kondzela, C.M., Naydenko, S.V., Starovoytov, A.N., and J.R. Guyon. (2012) Genetic stock identification of overwintering chum salmon in the North Pacific Ocean. Environmental Biology of Fishes 94:663-668.
3. McCraney, W. T., Saski, C.A. and Guyon, J.R. 2012. Isolation and characterization of 12 microsatellites for the commercially important sablefish, *Anoplopoma fimbria*. Conservation Genetics Resources 4(2): 415-417.
4. Vulstek, S. C., Linderoth, T.P., Guyon, J.R., and D.A. Tallmon. 2013. Spatio-temporal population genetic structure and mating system of red king crab (*Paralithodes camtschaticus*) in Alaska. Journal of Crustacean Biology in press.
5. Garvin, M. R., Kondzela, C. M., Martin, P. C., Finney, B., Guyon, J., Templin, W. D., DeCovich, N., Gilk-Baumer, S. and Gharrett, A. J. (2013), Recent physical connections may explain weak genetic structure in western Alaskan chum salmon (*Oncorhynchus keta*) populations. Ecology and Evolution. doi: 10.1002/ece3.628

Collaborators/coauthors within last 4 years:

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Vulstek, S.C	National Marine Fisheries Service, Juneau, AK
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CURRICULUM VITAE

Sharon Wildes

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Education:

B. S., Biology, emphasis on Genetics, Hiram College, Hiram, Ohio, 1987.
Graduate Coursework at University of Alaska
- Russian Language I and II, 1992, 1993
- Fisheries Genetics, 1992
- Vascular Plants of Southeast AK, 1991
- Natural History of Alaska, 1990

Graduate Coursework at Case Western Reserve University
- Spanish I and II, 1986, 1987.
- Mammalian Physiology, 1988

Employment:

Research Assistant, Cleveland Metro General Hospital and Case Western Reserve University, 1987-1989. Investigated human neuropathological afflictions.

Research Geneticist, Auke Bay Labs, 1990-present. Population genetics, stock composition analyses, species identification.

Service:

Juneau Federal Employee of the year 1995.
Chair and proceedings editor, 19th N.E. Pacific pink and chum workshop 1999.
Science Outreach- Elementary to University- 1987-present.

Current Research Activities:

mtDNA barcoding of pacific sand lance and analysis of sequence data for species identification.
Species identification of rougheye/blackspotted rockfish complex using SNP and microsatellite markers.
Microsatellite development of Arctic cod
Examination of microsatellite frequencies for Arctic cod and capelin
Microsatellite development of Pacific sleeper sharks
mtDNA sequence evaluation of Pacific sleeper sharks in the Bering Sea and Gulf of Alaska

Publications:

Wildes, S.L., J.W. Orr, Y. Kai, N. Raring, T. Nakabo, O. Katugin, and J. Guyon. Systematics of North Pacific sand lances of the genus *Ammodytes* based on molecular and morphological evidence, with the description of a new species from Japan. In Prep.

Liu, J.X., A. Tatarenkov, T.D. Beacham, V. Gorbachev, **S. Wildes**, and J. Avise. 2011. Effects of Pleistocene climatic fluctuations on the phylogeographic and demographic histories of Pacific herring (Clupea pallasii). Mol. Ecol. 20:3879-3893.

Wildes, S.L., J.J. Vollenweider, H.V. Nguyen and J.R. Guyon. 2011. Genetic variation between outer-coastal and fjord populations of Pacific herring *(Clupea pallasi)* in the eastern Gulf of Alaska. Fishery Bulletin 109:382-393.

Orr, J. W., and **S. L. Hawkins**. 2008. Species of the rougheye rockfish complex: resurrection of *Sebastes melanostictus* (Matsubara, 1934) and a redescription of *Sebastes aleutianus* (Jordan and Evermann, 1898) (Teleostei: Scorpaeniformes). Fishery Bulletin 106(2):111-134.

Hawkins, S.L., L., J. Heifetz, C. M. Kondzela, J. E. Pohl, R. Wilmot, O. N. Katugin, and V. N. Tuponogov (2005). Genetic variation of rougheye rockfish (*Sebastes aleutianus*) and shortraker rockfish (*S borealis*) inferred from allozymes. Fish. Bull. 103:524-535.

Hawkins, S. L., N. V. Varnavskaya, E.A. Matzak, V. V. Efremov, C. M. Guthrie III, R. L. Wilmot, H. Mayama, F. Yamazaki, and A. J. Gharrett (2002). Population structure of odd-broodline Asian pink salmon and its contrast to the even-broodline structure. Journal of Fish Biology 60, 370-388.

Collaborators/coauthors within last 4 years:

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Raring, Nate, Alaska Fisheries Science Center, Seattle, WA
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Vollenweider, Johanna, Alaska Fisheries Science Center, Auke Bay Lab, Juneau, AK
Wilmot, Dr. Richard, Alaska Fisheries Science Center, Auke Bay Lab, Juneau, AK

IV. SCHEDULE

A. Project Milestones

Objective 1. To identify population structure of herring in Prince William Sound.
To be met by September 2017

B. Measurable Project Tasks

FY 14, 1st quarter (February 1 – May 31, 2014)
February, 2014 *Project funding available*

FY 14, 2nd quarter (June 1, 2014-August 30, 2014)
Finalize samples to analyze, Isolate DNA

FY 14, 3rd quarter (September 1, 2014-November 30, 2014)
Begin collection of microsatellite data

FY 14, 4th quarter (December 1, 2015 – January 31, 2015)
Continue collection of microsatellite data

V. BUDGET

Budget Form (Attached)
Please complete the budget form for each proposed year of the project.

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: Modeling the population dynamics of Prince William Sound herring

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

Primary Investigator(s): Trevor A. Branch, University of Washington, tbranch@uw.edu, 206-221-0776

Abstract: Shortly after the Exxon Valdez oil spill, the Prince William Sound herring populations collapsed and have not yet recovered. We propose a modeling project to (1) revise and update the ASA model used to manage this population, (2) conduct simulations to test which data sources are most important in assessing the current status of this population, and (3) collect data on herring populations worldwide to find out how often these populations collapse under ordinary conditions.

Estimated Budget:
EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
36,907	87,014	97,836	100,406	104,920	427,083

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
		0			

Date:

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I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the Exxon Valdez Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.
Described here is a single project that is a part of an integrative program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. **The long-term goal of the program is to improve predictive models of herring stocks through observations and research.** While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

B. Summary of Project to Date (if applicable)
All milestones have been met. A graduate student has been identified and hired, and completed most of the remaining coursework on schedule, and has translated the current Excel model of herring dynamics into AD Model Builder, ready for conversion to a Bayesian model of herring abundance. The immediate goal is a fast-running model that assesses population status of Prince William Sound herring including characterization of uncertainty in abundance.

II. PROJECT DESIGN

A. Objectives

This project is designed to complement the "PWS Herring Research and Monitoring" proposal submitted by the Prince William Sound Science Center. The objectives of that program are:

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008). The proposed monitoring efforts are designed to address this objective by either expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events.
2) *Inform the required synthesis effort* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers.
3) *Address assumptions in the current measurements* Many of the existing studies are based on historical or logistical constraints. We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program.
4) *Develop new approaches to monitoring.* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

This modeling program addresses objectives 1, 2 and 3 by examining which data sources provide the most informative inputs to the ASA assessment model, holistically modeling the PWS herring life cycle, identifying possible issues with the assumptions of the measurement program, and examining factors that could determine future herring recruitment.

The specific objectives of this project are to:

a) Determine which datasets provide the most informative information for the ASA model (objective 1).
b) Predict levels of future recruitment, and autocorrelation in recruitment, using information from other herring populations and other species of clupeids (objective 1).
c) Synthesize the data collected from the monitoring program into a holistic model of herring dynamics (objective 2), to determine which life stages the observational program should focus on (objective 3).

B. Procedural and Scientific Methods

Identify the most informative datasets: conduct a management strategy evaluation (e.g. Butterworth & Punt 1999, Sainsbury et al. 2000) to identify which types of data are most informative for the ASA model. This task will comprise developing an operating model (modeling the "truth") to generate data types used by the ASA model (hydroacoustic survey, surveys of milt production, age composition, etc.), particularly the new time series developed as part of this program. For each model run, one type of data will be omitted, a large number of data sets will be generated (100-1000 depending on the time it takes to run the model), and the ASA model applied to the generated data to produce estimates of abundance. The estimates will then be compared to the underlying "truth" in the operating model to see how well the ASA model performs in the absence of that particular source of data. The end result will be an ordering of input data types from most to least informative, providing critical information to prioritize current and future monitoring efforts.

Predict future levels of recruitment: collate time series of herring abundance and recruitment in Pacific herring stocks, and for stocks of other clupeid species. Conduct a meta-analysis to estimate the average duration that a typical herring stock would be expected to remain at low abundance. Estimate the average level of autocorrelation in herring recruitment from other stocks, to understand how much recruitment covaries from one year to the next. Gather covariates (e.g. length, trophic level, price, latitude, sea surface temperature) to understand which factors influence recruitment in clupeid populations. Much of the data for this task has already been completed in the RAM Legacy stock assessment database (e.g. Branch et al. 2010, 2011, Ricard et al. submitted), but more stocks will be added for the analysis.

Create holistic model of herring dynamics: develop a life stage model to synthesize data from each aspect of the monitoring program, to understand which age groups and sources of mortality are most likely to explain the decline in the abundance of PWS herring. The model will be age-based and include separate terms for each component of mortality. The model will be fitted to time series of abundance at each life history stage and time series of disease prevalence.

These tasks will be conducted on computers by University of Washington students and faculty, who have access to a wide range of in-house fisheries modeling expertise (e.g. faculty members Ray Hilborn, André Punt, Tim Essington). This will allow us to examine statistical modeling, process based modeling, and ecosystem modeling approaches in choosing the best approach for each objective.

C. Data Analysis and Statistical Methods

By working with a well-established measurement program we foresee being able to learn about previous work and have access to historical data more rapidly than if this was a stand-alone project. Thus there will be no need to collect data or analyze data separately from the ongoing efforts of the monitoring program. The only data collection will involve gathering time series of abundance and recruitment for clupeid stocks as described above.

Computer models will be written in a combination of R, a high level language such as C++ or Fortran, and AD Model Builder (ADMB Project 2010) software which can rapidly and efficiently fit models to data.

D. Description of Study Area

The study area includes all of Prince William Sound (N, E, S, and W boundaries of respectively, ~ 61, -145.5. 60, and -149°). However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 2). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

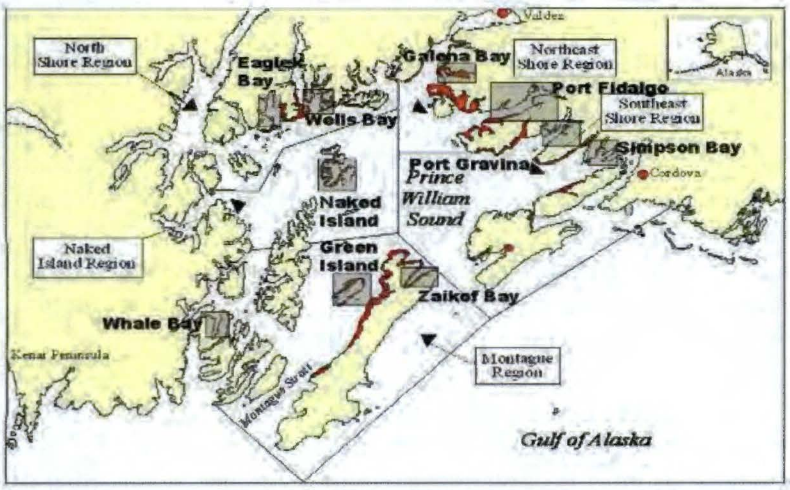

Figure 2. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with the Program

This proposal is structured to be part of a collaborative programmatic effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the program team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program.

There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities. This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermens United (CDFU), and others. Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

The wide array of projects that make up this program required careful integration to ensure the maximum collaboration between projects. Not all observation projects are directly connected to each other, but are connected through the objectives of the program. The full benefits of the linkages will be seen at the points where synthesis efforts occur. As the modeling component to this program the proposed project is one of the main tools for synthesizing the different observation program. It is designed to utilize data from the observation programs and help guide future sampling efforts to maximize the likelihood of achieving the program objectives.

Direct overlap between observation projects occurs in the area of logistics. We intend to have the acoustic surveys, direct capture, and non-lethal collection components sharing a vessel. The direct capture and non-lethal collection are intended to provide validation to the acoustics. The direct capture component will be responsible for providing fish to the RNA condition, energetic condition, disease research, fatty acid indicators, and genetic stock indicator projects. Another direct project overlap occurs between the herring scale analysis and primiparous herring projects, which will share growth information as determined from the scales. The combined efforts will lead to a greater number of scales becoming digitized and improving the statistics for both projects. All projects will also interact with the data management efforts to ensure the data is properly archived and maintained.

Indirect project overlap occurs between projects through the scheduling. Projects like the genetic stock indicators are pushed back in the cycle to ensure that the methodologies used by the direct capture program are mature enough to ensure collection of the required samples. Non-lethal collection is also later in the program to ensure new direct capture techniques are fully tested. Fish collected from the RNA and energetics intensive studies will also be used by the fatty acid indicator project. The acoustic tagging project is early in the program to take advantage of the acoustic receiver array that is in place and has a limited life span. Some projects like the disease research component also start later in the program because of coordination with the existing herring monitoring program. We worked hard to ensure that there isn't duplication between the proposed program and the existing program. One apparent exception is the RNA and energetic condition intensives. By moving these projects early in the program we intend to fill what is seen as a major gap in the existing program and hopefully more quickly resolve the information value that each project provides.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydroacoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations. We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

Other important programs for coordinating with are the existing PWS herring survey program and existing ADF&G herring research. This program has been developed with input from both of these programs and the focus of this proposal is extending the interpretation of the data from those two programs. The Herring Survey program will still be operating in FY12 and FY13. There are field observations scheduled in FY12 and in FY13 funds are strictly for analysis and report writing. Included in the report writing is a synthesis of previous and current research. This report will be finished in FY13 and be the basis for the synthesis required under this request for proposals.

III. CV's/RESUMES

Biographical sketch

Trevor A. Branch, tbranch@uw.edu

Professional preparation

University of Cape Town	Zoology, Computer Science	B.Sc. 1994
University of Cape Town	Zoology	B.Sc.(Hons) 1995
University of Cape Town	Conservation Biology	M Sc 1998
University of Washington	Aquatic and Fishery Sciences	Ph.D 2004

Appointments

2010–present	Assistant Professor, School of Aquatic and Fishery Sciences, Univ. of Washington
2006–2010	Research Scientist, School of Aquatic and Fishery Sciences, Univ. of Washington
2005–2006	Research Scientist, Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town
2000–2004	Research Assistant, School of Aquatic and Fishery Sciences, Univ. of Washington
1999–2000	Research Assistant, Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town
1998–2000	Consultant, Marine Resources Assessment Group, London (MRAG, Ltd)
1995–1998	Research Assistant, Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town

Products

<u>Five scientific papers closely related the proposed project:</u>

Branch TA, Watson R, Fulton EA, Jennings S, McGilliard CR, Pablico GT, Ricard D, Tracey SR (2010) The trophic fingerprint of marine fisheries. Nature 468:431-435

Sethi SA, Branch TA, Watson R (2010) Fishery development patterns are driven by profit but not trophic level. Proc Natl Acad Sci USA 107:12163-12167

Branch TA, Jensen OP, Ricard D, Ye Y, Hilborn R (2011) Contrasting global trends in marine fishery status obtained from catches and from stock assessments. Cons Biol 25:777-786

Worm B, Branch TA (2012) The future of fish. Trends Ecol Evol 27:594-599

Worm B, Hilborn R, Baum JK, Branch TA, Collie JS, Costello C, Fogarty MJ, Fulton EA, Hutchings JA, Jennings S, Jensen OP, Lotze HK, Mace PM, McClanahan TR, Minto C, Palumbi SR, Parma AM, Ricard D, Rosenberg AA, Watson R, Zeller D (2009) Rebuilding global fisheries. Science 325:578-585

<u>Five other significant scientific papers (n = 53):</u>

Branch TA, Lobo AS, Purcell SW (2013) Opportunistic exploitation: an overlooked pathway to extinction. Trends Ecol Evol 28:409-413

Branch TA, DeJoseph BM, Ray LJ, Wagner CA (2013) Impacts of ocean acidification on marine seafood. Trends Ecol Evol 28:178-186

Branch TA and 42 coauthors (2007) Past and present distribution, densities and movements of blue whales *Balaenoptera musculus* in the Southern Hemisphere and northern Indian Ocean. Mammal Rev 37:116-175

Branch TA, Hilborn R, Haynie AC, Fay G, Flynn L, Griffiths J, Marshall KN, Randall JK, Scheuerell JM, Ward EJ, Young M (2006) Fleet dynamics and fishermen behavior: lessons for fisheries managers. Can J Fish Aquat Sci 63:1647-1668

Hilborn R, Branch TA (2013) Does catch reflect abundance? No, it is misleading. Nature 494:303-306

Synergistic activities

1. Outstanding Researcher award for the College of the Environment, University of Washington, 2013. For "research or scholarship contributed within the past two years that has been or has the potential to be widely recognized by peers and whose achievements have had or may have a substantial impact of the profession, on research or the performance of others, or on society as a whole."
2. Ecological Society of America "2011 Sustainability Science Award" for the paper Worm et al. (2009) "Rebuilding Global Fisheries" published in Science. For "the peer reviewed paper published in the past

five years that makes the greatest contribution to the emerging science of ecosystem and regional sustainability through the integration of ecological and social sciences."
3. Aldo Leopold Fellow, 2013, training mid-career researchers in "translating their knowledge to action and for catalyzing change to address the world's most pressing environmental and sustainability challenges."
4. Editor, Animal Conservation, 2012-present
5. Reviewer for 32 journals including Science, Nature, Proceedings of the National Academy of Sciences USA, Ecology Letters, Ecology, Proceedings of the Royal Society B, Biology Letters, Canadian Journal of Fisheries and Aquatic Sciences, Marine Ecology Progress Series, Fisheries Research, ICES Journal of Marine Science, and Fish and Fisheries.

Collaborators and co-editors in the last 48 months (*n* = 117)
Acevedo-Whitehouse, K (UK), Agnew, D (UK), Alagiyawadu, A (Sri Lanka), Altweg, R (South Africa), A'mar, ZT (NOAA), Anderson, RC (Maldives), Anderson, SC (Simon Fraser Univ), Ashe, E (UK), Austin, J (Univ Florida), Baker, CS (Oregon State Univ), Baker, MR (UW), Baldwin, R (Oman), Banobi, J (UW), Baum, JK (Univ Victoria, Canada), Bianci, PL (UC Santa Barbara), Bravington, M (Australia), Clarke, E (NOAA), Clark, S (Sea World), Collie, JS (Univ Rhode Island), Cope, JM (NOAA), Cornejo-Donoso, J (Chile), Costello, C (UC Santa Barbara), DaVolls, L (UK), Defeo, O (Uruguay), deJoseph, B (UW), Dziak, RP (NOAA), Essington, TE (UW), Evans, DM (UK), Findlay, KP (South Africa), Fogarty, MJ (NOAA), Froese, R (Germany), Fulton, EA (Australia), Garner, TWJ (UK), Gedamke, J (NOAA), Gompper, ME (Univ Missouri), Gordon, IJ (UK), Guinet, C (France), Guttierrez, NL (UK), Haynie, AC (NOAA), Hammond, P (UK), Hancock-Hanser, B (NOAA), Hedley, S (UK), Heppell, SS (Oregon State Univ), Hilborn, R (UW), Hively, DJ (UW), Hoggarth, DD (UK), Hollowed, A (NOAA), Holtgrieve, GW (UW), Hoyt, E (UK), Hutchings, JA (Dalhousie Univ), Jackson, JA (Oregon State Univ), Jennings, S (UK), Jensen, OP (Rutgers Univ), Johnson, JA (Univ N Texas), Karachle, PK (Greece), Kato, H (Japan), Katzner, TE (W Virginia Univ), Kendall, NW (UW), Krkosek, M (New Zealand), Larsen, A (UC Santa Barbara), LeDuc, RL (NOAA), Link, JS (NOAA), Lobo, AS (India), Lotze, HK (Dalhousie Univ), Mace, PM (New Zealand), Marsac, F (South Africa), Martell, SJD (Int Pac Halibut Comm), McClanahan, TR (Kenya), McGilliard, CR (UW), Melnychuk, MC (UW), Mikhalev, Y (Ukraine), Minto, C (Ireland), Ninnes, C (UK), Noren, DP (NOAA), Pablico, GT (Philippines), Palomares, MLD (Univ British Columbia), Palumbi, SR (Stanford Univ), Parma, AM (Argentina), Pettorelli, N (UK), Pope, JG (UK), Purcell, SW (Australia), Proelß, A (Germany), Quaas, M (Germany), Quinn, TP (UW), Ranjan, R (India), Rantanen, E (UK), Ray, L (UW), Ricard, D (Dalhousie Univ), Rosen, D (Univ British Columbia), Rosenberg, AA (Univ New Hampshire), Royer, J-Y (France), Sainsbury, K (Australia), Samaran, F (France), Schindler, DE (UW), Selden, RL (UC Santa Barbara), Sethi, SA (UW), Sistla, S (UC Santa Barbara), Smith, ADM (Australia), Sremba, A (Oregon State Univ), Stafford, KM (UW), Stern-Pirlot, A (UK), Stewart, IJ (NOAA), Teck, SJ (UC Santa Barbara), Thorson, JT (UW), Tracey, SR (Australia), Valencia, SR (UC Santa Barbara), Visser, IN (New Zealand), Wagner, C (UW), Watson, R (Australia), Williams, NE (Australia), Williams, RS (Canada), Winship, A (Dalhousie Univ), Worm, B (Dalhousie Univ), Ye, Y (Italy), Zeller, D (Univ British Columbia), Zerbini, AN (Cascadia Research), Zimmermann, C (Germany)

Graduate advisors and postdoctoral sponsors: Douglas S Butterworth, University of Cape Town (M.Sc.), John G. Field, University of Cape Town (M.Sc.), Ray Hilborn, University of Washington (Ph D)

Thesis advisor and postgraduate-scholar sponsor (last five years) Cole Monnahan (MS, UW), Melissa Muradian (MS, UW), Peter Kuriyama (MS, UW). Total graduate students· 3. Postdoctoral: 0.

IV. SCHEDULE

A. Project Milestones

All projects will be conducted simultaneously and are interlinked. The dates given are the expected dates of submission of scientific papers, but preliminary results will be used to improve the monitoring efforts as they are generated.

Objective 1. Create life history model of herring dynamics.
To be met by September 2014

Objective 2. Identify the most informative datasets using management strategy evaluation.
To be met by September 2015

Objective 3. Predict future levels of recruitment from other herring and clupeid stocks.
To be met by September 2016

B. Measurable Project Tasks

FY14, 2nd quarter
January Annual Marine Science Symposium, Anchorage
March Draft manuscript: life history model of herring dynamics

FY14, 3rd quarter
May Annual Cordova meeting with broader project PIs
June Student completes all required coursework and milestones

FY14, 4th quarter
August Annual report
September Manuscript submission: life history model of herring dynamics

FY15, 1st quarter (October 1, 2014-December 31, 2014)
December Finalize gathering of time series of abundance and recruitment for herring stocks and other clupeids

References

Branch, T. A., R. Watson, E. A. Fulton, S. Jennings, C. R. McGilliard, G. T. Pablico, D. Ricard, and S. R. Tracey. 2010. The trophic fingerprint of marine fisheries. Nature 468:431-435.

Branch, T. A., O. P. Jensen, D. Ricard, Y. Ye, and R. Hilborn. 2011. Contrasting global trends in marine fishery status obtained from catches and from stock assessments. Conservation Biology doi: 10.1111/j.1523-1739.2011.01687.x.

Butterworth, D. S. and A. E. Punt. 1999. Experiences in the evaluation and implementation of management procedures. ICES Journal of Marine Science 56:985-998.

Ricard, D., C. Minto, J. K. Baum, and O. P. Jensen. Submitted. RAM Legacy: a new global stock assessment database for exploited marine species. Fish and Fisheries.

Sainsbury, K. J., A. E. Punt, and A. D. M. Smith. 2000. Design of operational management strategies for achieving fishery ecosystem objectives. ICES Journal of Marine Science 57:731-741.

V. BUDGET
Budget Form (Attached)

FY14 PROGRAM PROJECT
PROPOSAL FORM

Project Title: PWS Herring: Aerial Survey Support

Project Period: 1 February 2014 to 31 January 2016

Primary Investigator(s): W. Scott Pegau, Prince William Sound Science Center

Abstract:

This project is for providing aerial survey support to the EVOSTC sponsored Herring Research and Monitoring (HRM) and Gulf Watch Alaska (GWA) programs. For the HRM program the aerial support will be used to help collect herring samples for the genetics project and to provide an aerial index of age-1 herring abundance. For the GWA program the aerial support will be used by the forage fish project. The desire is to provide an aerial index of forage fish abundance and guide the capture efforts of the vessel. In turn the vessel will be providing ground truth of fish types and size of schools for better interpretation of the aerial based forage fish information. This proposal request is strictly for aerial support, all analysis and vessel funding will come from the existing projects. Funding for this project will be managed as a supplement to the HRM Coordination and Logistics project (12120111-O) led by Dr. Pegau.

Estimated Budget:
EVOSTC Funding Requested: $130,000
(breakdown by fiscal year and must include 9% GA)

FY 12	FY13	FY14	FY15	FY16
$ 0	$ 0	$65,000	$65,000	$ 0

Non-EVOSTC Funds to be used:
(breakdown by fiscal year)

Date:
August 30, 2013

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the Exxon Valdez Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

There are several needs for aerial support for the EVOSTC funded Herring Research and Monitoring (HRM) and Gulf Watch Alaska (GWA) programs. We need a capability to rapidly respond to remote locations in PWS for the collection of required samples that have been difficult to obtain using ships. The age-structure-analysis (ASA) model results can be improved by better knowledge of the expected incoming recruit class. Prediction of the recruiting class strength requires information that currently is not available. The aerial surveys provide one mechanism to address that need. The forage fish project in the GWA program also requires a better idea of the distribution of forage fish schools to help ensure their sampling program provides the best estimate of forage fish population. Additional aerial surveys will complement and improve the ongoing GWA forage fish research.

II. PROJECT DESIGN

A. Objectives

This project's objectives are:

1) Provide aerial support for collection of samples for the genetics project.
2) Provide an index of abundance of age-1 herring.
3) Provide aerial support to the forage fish project of the GWA program:
    a. Test the efficiency of adaptive vs. conventional sampling methods to optimize survey design for estimating stock size with an accurate estimate of the associated variance
    b. Validate aerial observations for species, age class, average biomass and school density.

B. Procedural and Scientific Methods

The herring genetics project is dependent on collecting samples from multiple spawning locations. In recent years there have been limited spawn events in areas outside of the Port Gravina and Port Fildago areas. This makes it difficult to ensure we can get a vessel to the spawning locations in time to collect fish. In 2013 we were able to use a plane to collect a herring sample from Kayak Island. The ability to rapidly access the spawning event allowed us an opportunity to get a rare sample of fish from that location. The fish were turned over to ADF&G for their analysis and then to be shared with the genetics project of the HRM program. We intend to use a plane to access regions with active spawn for capture using cast nets, jigs, or gill nets. Four days of survey effort is requested for this purpose each of the next two years.

Aerial surveys led by Dr. Evelyn Brown during the Sound Ecosystem Assessment, Apex Predator Experiment, and PWS Herring Survey program provided an indication of the potential for using aerial surveys to provide an index of age-1 herring. This index has the potential for greatly improving the estimate of the number of age-3 herring to recruit to the spawning stock. The estimation of recruitment is critical to the ability for the age-structure-analysis model to be used to forecast herring biomass.

In the past, the aerial surveys were used to provide a measure of the density of age-1 herring in either June or July. In the last year of the aerial surveys for the PWS Herring Survey program Dr. Brown set up a survey approach that could be transitioned to a single spotter pilot. The approach divides PWS into several regions (Figure 1) and the pilot then surveys the region recording the number and size of schools and the assumed species/age. Size is split into three categories (small, medium, and large) based on the number of grid cells covered using the sighting tube used in previous surveys. Species and age is based on appearance of the school, with herring divided into age-0, age-1, and age-2+. Additional verification of aerial observations using vessel-based methods (i.e., hook and line, net collection methods, and hydroacoustics) will improve the reliability of the aerial schools index. Based on the previous surveys it was determined that June was the ideal month for surveying age-1 herring. This is due to no age-0 herring being present and eulachon and capelin tending to be in separate areas due to spawning. The simplified method proposed here is not used to estimate total density, but is used to provide a total number of schools per region. This simplified approach was used successfully in 2013.

Each survey region represents about one day of effort. By splitting the Sound into regions we can prioritize the regions in case the entire Sound cannot be surveyed due to weather. This will be done to maximize consistency between years. We expect to refine the survey regions this fall based on analysis of the previous data. Enough location information was collected in 2013 to allow us to reanalyze existing data if the boundaries of sampling regions are changed. The most likely changes will be in discontinuing surveys on the Gulf of Alaska side of Montague and Hinchinbrook islands and region 13. These are areas that traditionally do not have age-1 herring and are riskier to fly. Regions 2 and 3 will likely be combined.

Data from the previous years of surveys is currently being converted into the number of schools per region to determine how well the approach provides a prediction of incoming recruitment levels. We only have one measure of recruitment from the last four years of surveys. The age data from the 2013 spawning population needed to assess the recruitment will become available in the fall of 2013. There has been over an order of magnitude difference in the numbers of schools of age-1 herring observed in June in the recent years. From 2010 through 2013 the numbers of schools observed were 595, 150, 131, and 1,980 respectively. We still need to assess the number of schools observed during the Sound Ecosystem Assessment program, but the years of the observations were generally associated with small recruitment classes.

Dr. Pegau will be responsible for ensuring that proper data collection and analysis is conducted for the aerial data collected in support of the HRM program. His funding is included in the HRM coordination and logistics project. Eight days of survey effort are requested each year for this purpose.

The forage fish component of the GWA program identified the desire for aerial observations to provide another index of forage fish distribution and to help guide vessel-based sampling efforts. As originally proposed, the objectives of this work are to: 1) identify robust indices for monitoring forage fish populations over time and devise a sampling strategy for long term monitoring of those indices, 2) assess the current distribution, abundance, species composition, and body condition of forage fishes (other than herring) in selected areas of Prince William Sound at selected times of the year, and 3) relate abundance and distribution of forage species to abiotic characteristics of the marine environment. We originally designed a stratified systematic survey design for sampling forage fish. After testing this design in 2012-2013, and exploring the potential for using aerial surveys to locate schools in 2013, we believe a more efficient approach will incorporate larger scale aerial surveys to identify high density areas in the Sound, coupled with finer scale vessel-based hydroacoustic surveys to quantify forage schools.

In 2013 we worked with an experienced spotter pilot to find schools of herring, sand lance and capelin. The pilot was skilled at directing the boat to schools, and we were successful in quantifying the species and size composition of the schools. We also quantified small and medium herring schools with split beam dual frequency hydroacoustics, and we are working on those data to estimate biomass and density during fall 2013. Hydroacoustic validation of aerial observations will improve the schools/region index by increasing certainty in allocation of schools to species and age class, and may facilitate the quantification of biomass and fish density over time.

This project is designed as a supplement to the Herring Research and Monitoring (HRM) and Gulf Watch Alaska (GWA) programs. Oversight and reporting regarding this funding will be incorporated into the HRM coordination and logistics project.

Because both programs need similar survey information we are trying to determine if a single set of surveys can serve both programs. This would allow us to stretch the funding to cover the remaining three years of the programs instead of the two we expect the funding to cover. What we are balancing is the logistical constraints of the forage fish surveys that may not have access to the vessel in June and the quality of observations of age-1 herring in June. Both groups are looking for opportunities to ensure the highest quality data is provided and collaborate in the most effective manner.

C. Data Analysis and Statistical Methods

For the HRM program the initial analysis will be by the number of schools per region (Figure 1). The assumption is that the relative proportion of small, medium, and large schools remains constant through time. We will be testing that assumption using an ANOVA analysis using the data collected to determine if significant differences exist. The number of years of data to include remains small (seven), which limits the ability to discern differences. If there are significant differences in school composition then we will shift from number of schools in our analysis to the area covered by the schools. Each school size is associated with an approximate area that will allow us to make the conversion.

As the recruitment information becomes available we will regress the number of schools observed against the estimated number of age-3 fish recruiting to the spawning stock. We will examine if a subset of the regions can be used to provide an accurate predictor of the total number of schools. This will be used to determine if reduced survey effort can be used in the future and to help prioritize survey efforts.

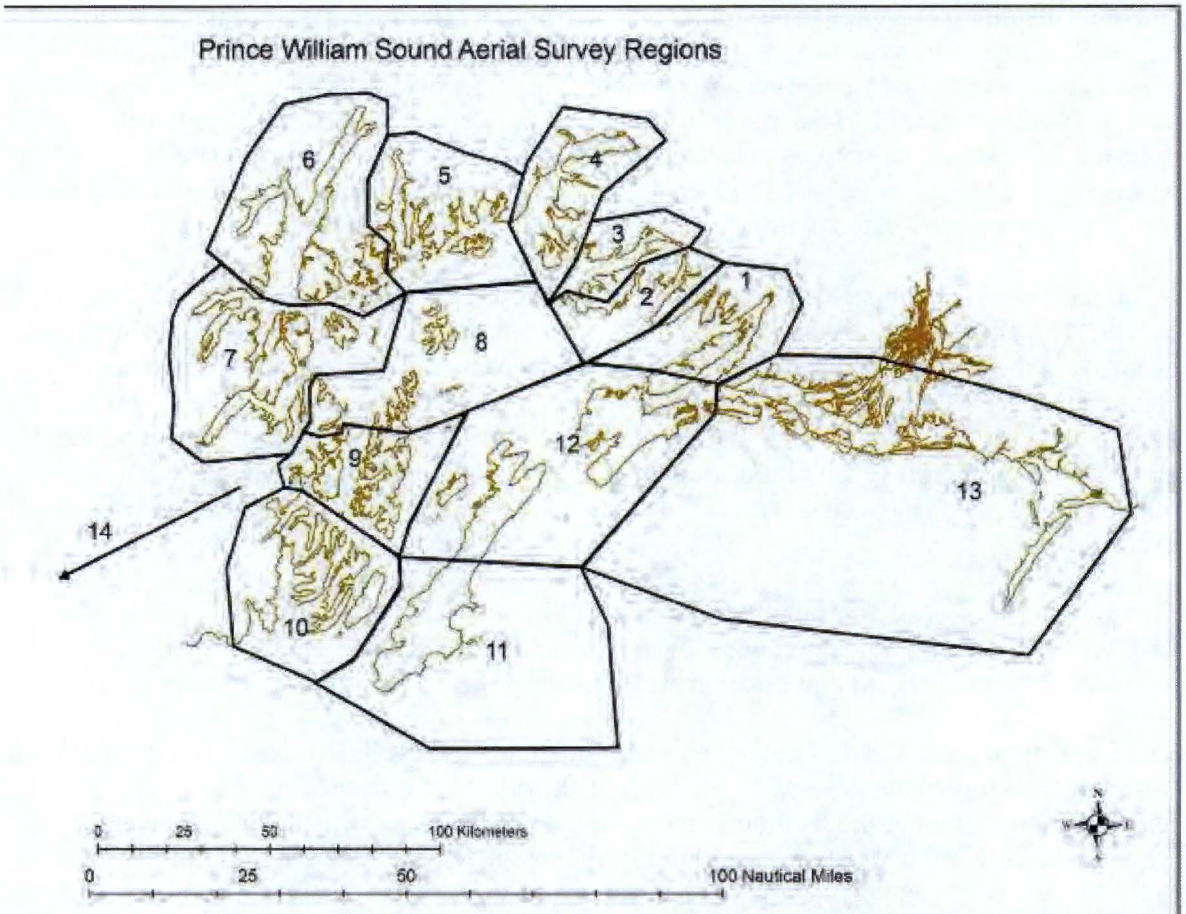

Figure 1. Survey regions as identified for the 2013 season. We expect to make refinements to regions 12 and 11 to remove the Gulf side of the islands and will probably drop region 13. These are not areas where age-1 herring tend to be found.

Work for the GWA forage fish program will require greater spatial resolution than proposed for the HRM program. In July 2013 the pilot made track lines using a handheld GPS, and recorded observations using a digital recorder. At the end of each flight day, the pilot handed off the data recorder and tracks so we could plot the locations of schools and rapidly assess high density areas for vessel-based work. This worked reasonably well (see Figure 2), and we would continue this level of effort at a minimum. Ideally we will have a near-real time large scale map of school locations to aid in the allocation of hydroacoustic survey effort in the Sound. The validation of aerial observations will include 1) capture of fish in schools with jig, cast net, purse seine, midwater trawl, dip net, and underwater camera, and 2) hydroacoustic estimate of fish density and biomass for schools of different size and species classifications.

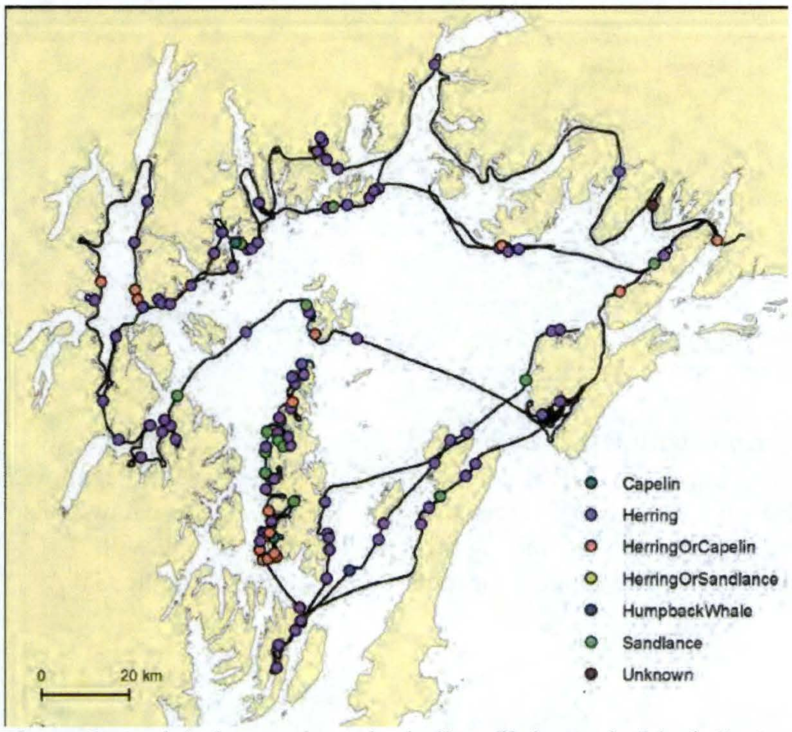

Figure 2. Aerial observations, including flight track (black line) and school locations (colored circles) during flights in July 2013.

D. Description of Study Area

The study area includes all of Prince William Sound (N, E, S, and W boundaries of respectively, ~ 61, -145.5. 60, and -149°). However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 2). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction of bays sampled based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

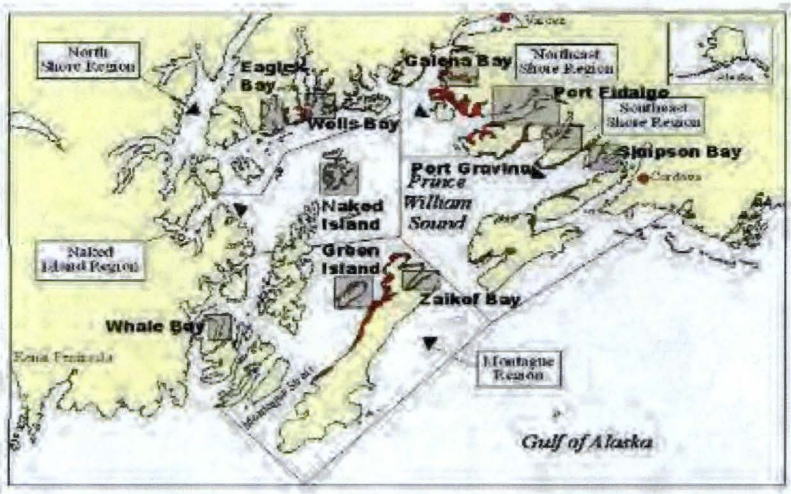

Figure 2. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with Other Efforts

This proposal will support projects in both the HRM and GWA programs. W. Scott Pegau will be responsible for ensuring the contracting of flights to support the two programs. He will also be responsible for ensuring the data related to the herring program is analyzed. He will coordinate with Mayumi Arimitsu to provide support for the forage fish project in the GWA program.

III. CV's/RESUMES

W. Scott Pegau
Oil Spill Recovery Institute
Box 705
Cordova, AK 99574
ph: 907-424-5800 x222
email: wspegau@pwssc.org

Education:

1990 B.S., Physics, University of Alaska, Fairbanks
1996 Ph.D, Oceanography, Oregon State University

Professional Experience:

1987-1990	Research Assistant, University of Alaska, Fairbanks
1990-1996	Graduate Research Assistant, Oregon State University
1996-1997	Research Associate (Post Doc), Oregon State University
1997-1999	Faculty Research Associate, Oregon State University
1999-present	Assistant Professor, Oregon State University
2002-2003	Senior Scientist, Kachemak Bay Research Reserve
2003-2007	Research Coordinator, Kachemak Bay Research Reserve
2007-present	Research Program Manager, Oil Spill Recovery Institute

Research Interests:
To develop novel oil spill detection and tracking approaches. Understanding the fate and behavior of oil spilled in cold water environments. Development of response options for oceans with sea ice present. Circulation in Prince William Sound, Cook Inlet and the Gulf of Alaska and the associated larval transport. Relationship between oceanographic conditions and fisheries. Application of remote sensing for understanding coastal processes.

Publications
Selected publications

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IV. SCHEDULE

A. Project Milestones

Objective 1. Provide aerial support for collection of samples for the genetics project.
This is an annual objective and will last through the two-year period.

Objective 2. Provide an index of abundance of age-1 herring.
This is an annual objective

Objective 3 Provide aerial support to the forage fish project of the GWA program.
This is an annual objective and will last through the two-year period.

B. Measurable Project Tasks

FY14 1st Quarter (February 1, 2014 to May 30, 2014)

February	Establish finding
March	Contract pilot for survey efforts
May	Complete collection of fish for genetics research

FY14 2nd Quarter

June	Conduct aerial surveys for age-1 herring
July	Conduct aerial surveys for forage fish project

FY14 3rd Quarter

August	Complete annual processing of age-1 herring data.

FY14 4th Quarter

FY15 1st Quarter (February 1, 2014 to May 30, 2014)

February	Establish finding
March	Contract pilot for survey efforts
May	Complete collection of fish for genetics research

FY15 2nd Quarter

June	Conduct aerial surveys for age-1 herring
July	Conduct aerial surveys for forage fish project

FY15 3rd Quarter

August	Complete annual processing of age-1 herring data.

FY15 4th Quarter

V. BUDGET

Budget Form (Attached)

Budget Explanation

This budget includes a request for funding of aerial surveys. Twenty survey days are requested each year at a cost of $2,500 per day. Because the contracts are for a professional service and are actually three separate contracts the amount is subject to the PWSSC overhead rate of 30%.