11.20.02

Exxon Valdez Oil Spill Trustee Council Meeting

January 16, 2009

DRAFT 1/7/09

Motions - January 16, 2009 Trustee Council Meeting

Item 3: Asset Allocation

Motion to approve the asset allocation as outlined in Resolution 09-01.

Item 6: 20th Anniversary

Motion to approve the budget of $15,515 to be used as indicated in the "The 20th Anniversary of the *Exxon Valdez* Oil Spill at the new Education Center at the Alaska Zoo, Anchorage" support paper and budget table, and as outlined in Resolution 09-02.

Item 7: Policies and Procedures

Motion to approve the revision to the EVOS Procedures for the Preparation and Distribution of Reports and revision to the Financial Procedures allowing for 10% of project funding to be withheld pending receipt of final deliverables. For multi-year projects, the 10% withholding will apply to the final year of the funding.

Item 8: 2009 Update on Injured Resources and Services List

Motion to approve the 2009 Update on Injured Resources and Services as presented.

Item 9: Herring Steering Committee

Motion to approve the following FY 09 Herring Steering Committee members: Doug Hay, Evelyn Brown, Gary Fandrei, Paul Hershberger, Rob Campbell, Ross Mullins, Jeep Rice, Steve Moffitt, Vince Patrick, and Scott Pegau

Item 10: Integrated Herring Restoration Plan – tentative

Item 11: FY 2010 Invitation for Proposals

Motion to approve the FY 2010 Invitation for Proposals.

Agenda

DRAFT 1/7/09

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, AK 99501-2340 • 907 278 8012 • fax 907 276 7178

AGENDA
EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
January 16, 2009 8:30 a.m. – 12:30 p.m.
Anchorage, Alaska

Trustee Council Members:

TALIS COLBERG
Attorney General
Alaska Department of Law

LARRY HARTIG
Commissioner
Alaska Department of
Environmental Conservation

DENBY S. LLOYD
Commissioner
Alaska Department of Fish and Game

CRAIG O'CONNOR
Special Counsel
National Oceanic & Atmospheric
Administration
U.S. Department of Commerce

HANS NEIDIG
Special Assistant to the
Secretary for Alaska
U.S. Department of the Interior

JOE MEADE
Forest Supervisor
Forest Service
U.S. Department of Agriculture

Meeting in Anchorage, Trustee Council Office 441 West 5th Avenue, Suite 500
Teleconference number: 800.315.6338. Code: 8201

Denby S. Lloyd
State Chair

1. Call to Order –8:30 a.m.

2.	Consent Agenda - Approval of Agenda* - Approval of Meeting Notes* September 29, 2008	
3.	Approval of Asset Allocation* (15 minutes)	Bob Mitchell State Investment Officer Department of Revenue
4	Public comment – 8:50 a.m. (3 minutes per person)	
5.	Public Advisory Committee comments (10 minutes)	Doug Mutter, US DOI PAC Designated Federal Officer
6.	Briefing re 20th Anniversary* (15 minutes) - 20th Anniversary Report - Film - EVOS website revision - 2009 Marine Science Symposium - Alaska Forum on the Environment - 20th Anniversary of the *Exxon Valdez* Oil Spill Event at the new Education Center at the Alaska Zoo – Budget*	Rebecca Talbott Communication and Outreach Coordinator
7.	Policies and Procedures* (15 minutes) - Procedures for the Preparation and Distribution of Reports; and - Financial Procedures: Allow for 10% of project funding to be withheld pending final deliverables	Carrie Holba, ARLIS JoEllen Lottsfeldt Environmental Program Specialist
8.	2009 Update on Injured Resources and Services* (10 minutes)	Catherine Boerner Restoration Specialist
9.	Approval of FY 09 Herring Steering Committee Member Contracts* (10 minutes)	Elise Hsieh Interim Executive Director

10.	Integrated Herring Restoration Plan (IHRP) (30 minutes)	Catherine Boerner Restoration Specialist IHRP Committee Members 1. Rob Campbell, PWSSC 2. Jeep Rice, NOAA
11.	Draft FY 2010 Invitation for Proposals* (10 minutes)	Catherine Boerner Restoration Specialist

Adjourn – 12:30 p.m.

* Indicates action items

Sept 29, 2008 Meeting
Notes

DRAFT 1/13/09

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, AK 99501-2340 • 907 278 8012 • fax 907 276 7178

TRUSTEE COUNCIL MEETING NOTES

Anchorage, Alaska
September 29, 2008

Chaired by: Steve Zemke
Trustee Council Member

Trustee Council Members Present:

• Steve Zemke, USFS*	Craig Tillery, ADOL ***
Randall Luthi, USMMS	Denby Lloyd, ADF&G
Craig O'Connor, NOAA **	Larry Hartig, ADEC

- • Chair
- * Steve Zemke alternate for Joe Meade
- ** Craig O'Connor alternate for James Balsiger
- *** Craig Tillery alternate for Talis Colberg sitting in at 10:35 a.m.

The meeting convened at 9:00 a.m., September 29, 2008 in Anchorage at the EVOS Conference Room.

1. Approval of the Agenda

APPROVED MOTION: Motion to approve the September 29, 2008 draft agenda

Motion by Hartig, second by Colberg

2. Approval of August 28, 2008 meeting notes

APPROVED MOTION: Motion to approve the August 28, 2008 meeting notes

Motion by Luthi, second by Hartig

Public Advisory Committee (PAC) comments: Stacy Studebaker

Public comment period began at 9:10 a.m.

Three public comments were received.

Public comment closed at 9:23 a.m.

3. Executive Session

APPROVED MOTION: Motion to move into executive session to discuss personnel issues and Public Advisory Committee selection

Motion by Luthi, second by Hartig

Off the record: 9:25 a.m.
On the record: 10:35 a.m.

4. Public Advisory Committee Member Selections

APPROVED MOTION: Motion to approve the following nominees as recommended by the Acting Executive Director for appointment by the Secretary of the Interior to the Public Advisory Committee's 2008-2010 term:
Aquaculture/Mariculture – Gary Fandrei
Commercial Fishing – Robert (RJ) Kopchak
Commercial Tourism – Amanda Bauer
Conservation/Environmental – Jennifer Gibbons
Local Government – Tim Joyce
Marine Transportation – Torie Baker
Native Land Owners – Larry Evanoff
Public at Large – Jason Brune
JoAnn Vlasoff
Recreational Users – Stacy Studebaker
Regional Monitoring – John French
Science/Technical – Bill Rosetti
Sport Hunting and Fishing – Kurt Eilo
Subsistence – Patience Anderson-Faulkner

Tribal Government – Sue (Lori) Johnson

Motion by Luthi, second by Hartig

4. Personnel

APPROVED MOTION: Motion to recommend that the Trustee Council directs that recruitment begins for both the Executive Director and Science Director positions as soon as possible

Motion by Luthi, second by Hartig

APPROVED MOTION: Motion to appoint Elise Hsieh as Interim Executive Director and Jennifer Schorr as Interim Deputy Director effective October 1, 2008

Motion by Tillery, second by Luthi

5. Habitat Protection

APPROVED MOTION: Motion to authorize $1,900,000 to be used as matching funds for the purchase of Shuyak Parcels 2A and 2B, subject to the terms and conditions specified for these parcels in Resolution 08-16

Motion by Hartig, second by Luthi

APPROVED MOTION: Motion to authorize $2,008,000 for the purchase of Uganik Parcels 3A and 3B, subject to the terms and conditions specified for these parcels in Resolution 08-17

Motion by Hartig, second by Tillery

APPROVED MOTION: Motion to authorize $1,205,000 for the purchase of timber rights on Parcel 5A, subject to the terms and conditions specified in the resolution for this parcel and of that amount $5,000 would be used for closing costs and the balance for purchase of 5A

timber rights from Rocky Mountain Elk Foundation and American Land Conservancy

Motion by Hartig, second by Luthi

6. Project 090100 – FY 09 Annual Program Development and Implementation

APPROVED MOTION: Motion to approve Project 090100, the FY 09 Annual Program Development and Implementation budget October 1, 2008 through September 30, 2009 in the amount of $2,477,722 in Resolution 08-19

Motion by Luthi, second by O'Connor

7. Sole Source for Film Production

APPROVED MOTION: Motion to approve the amount of $28,000 for production of a 12-13 minute video for the purpose of the 20th anniversary of the oil spill and that the money would be intended to go to a contract with Mr. Kevin Hartwell

Motion by Tillery, second by O'Connor

8. FY 08 Project Amendments

APPROVED MOTION: Motion to approve the FY 08 project amendments recommended for funding by the acting Executive Director in the FY 09 Draft Work Plan totaling $3,649,952 as described in Resolution 08-20 regarding the FY 09 Draft Work Plan and the FY 09 Funding for Multi-Year Projects

Motion by O'Connor, second by Luthi

Adjourn Motion to adjourn

Motion by Luthi, second by Hartig

Adjourned at 12:15 p.m.

Key Points, Comments, Suggestions
from the January 9, 2009 EVOS PAC meeting:

--All PAC members participated in the teleconference meeting.
--There are two vacancies: Commercial Fishing and Local Government
--PAC officers will be elected at their February 4 face-to-face meeting.

Draft Integrated Herring Restoration Plan:

- Need to explain why some projects were eliminated or put in a "go slow" mode.
- A risk assessment would strengthen the document and help explain the choices made.
- Nutrient enrichment looks interesting if it will work and do no additional harm.
- Would be helpful to understand the range of costs for proposed actions and projects.
- The relationship of pink salmon production and herring recovery needs to be fully explored.

Draft Update to the Injured Resources and Services List:

- It appears that the status of injured resources and services has not changed in the last 3 years, so we have accomplished no restoration.
- Not clear why "unknown" status (e.g., rockfish and cutthroat trout) is there and what can be done about it.

Draft FY 2010 Invitation for Restoration Proposals:

- Past Principal Investigators who are delinquent (not responsive/responsible bidders) on final reports should not be allowed to submit new proposals—need to be flexible on this regarding organizations vs. individuals.
- Generally like the document and its clarity.
- What happened to the community-specific category for projects based on the outreach/education plan that the PAC recommended?
- The proposed projects seem focused on research and data gathering and not on restoration.

General Comments:

- When the Executive Director is hired, they should be able to hire the Science Director.
- Need to make materials to be discussed by the PAC available for the public on the EVOS web site.

Asset Allocation

Draft Language for 10% Withholding to be Inserted in Financial Operating Procedures (Page III-4) and Reporting Procedures (Page 9)

Ten percent (10%) of the project funding will be withheld by project managers until the following requirements have been met:

- the final report has gone through peer review and format review;
- all print copies of the final report have been delivered to ARLIS;
- an electronic copy of the final report has been delivered to the EVOSTC office; and
- project data and metadata have been submitted to approved archives in accordance with the EVOSTC Data Policy.

For multi-year projects, the 10% withholding will apply to the final year of funding.

For projects in which agency personnel have the primary responsibility for producing the deliverables required above, the project managers will work within their respective agency's supervisory structure, fiscal procedures and other applicable policies to ensure project deliverables are provided in a timely manner.

The EVOSTC has the discretion to extend the due date on the deliverables required above, whether planned for or for other grounds the Executive Director determines are reasonable. Project funding will be withheld from Principal Investigators who have deliverables outstanding from other projects.

The EVOSTC has the discretion to waive this 10% holdback requirement for grounds the Executive Director determines are reasonable. Justifications for a waiver may include the nature of the project deliverables or significant delays that are beyond the control of the Principal Investigators.

Exxon Valdez Oil Spill Trustee Council

Investment Presentation

Bob Mitchell, CFA

January 16, 2009

Overview of Role Department of Revenue Plays

- Custodian for Assets
- Convey Annual Capital Market Assumptions from External Investment Consultant Upon Request
- Recommend Target Asset Allocation to the Council to Achieve Investment Objective
- Provide Commingled Investment Options to the Council
  - Internally-Managed Broad Domestic Bond Investment
  - Externally-Managed Domestic and International Equity Investment Options through State Street Global Advisors

2008 Capital Market Review and Asset Allocation Policy Implications

Michael J. O'Leary CFA
Executive Vice President
Callan Associates Inc.

February 2008

Perspective

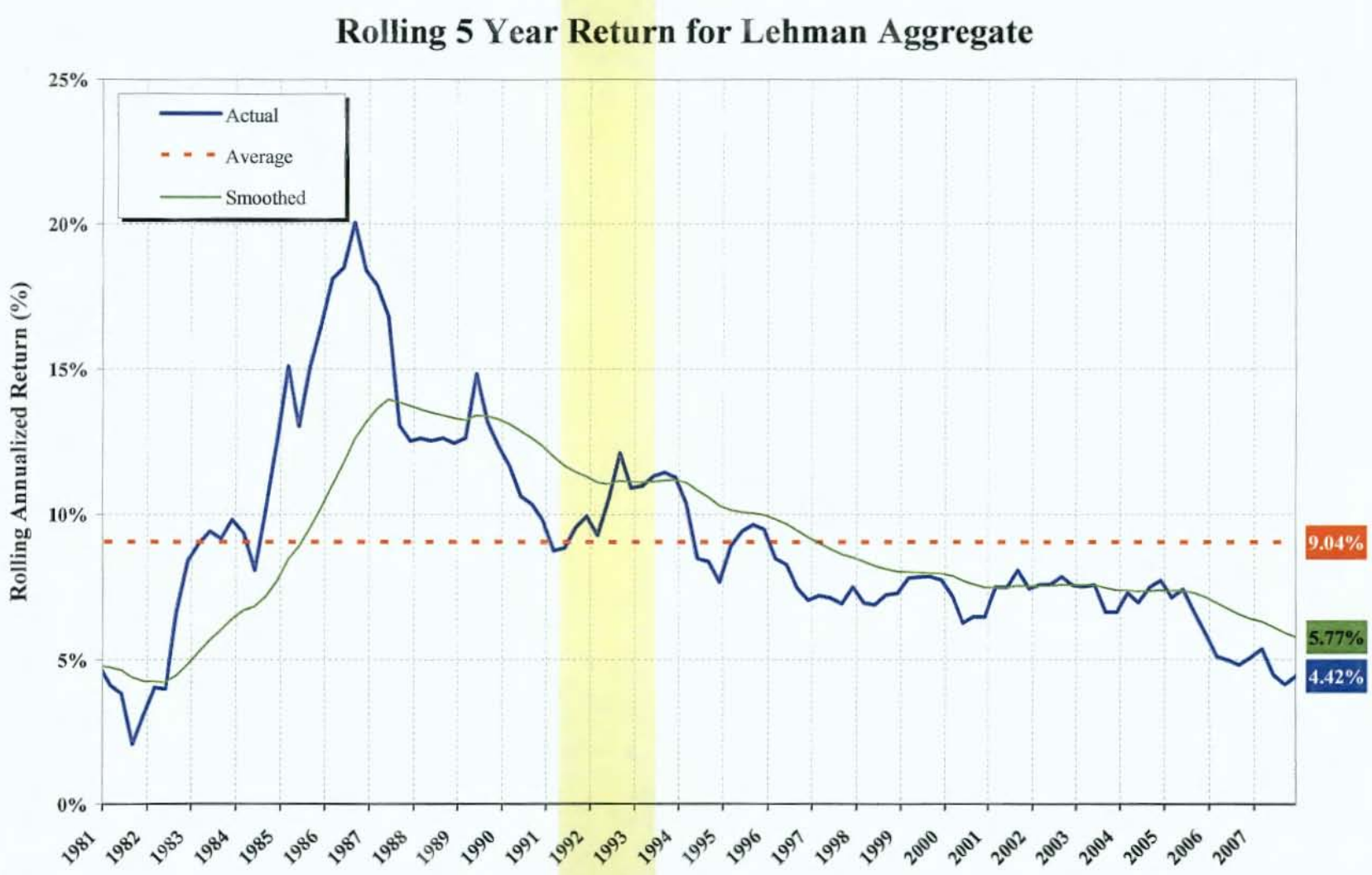
- Callan focuses on a 5-year planning horizon because we believe that it is the shortest time period consistent with using "strategic" return estimates.
  - ✓ Shorter periods, in our view, are less predictable and would require substantial implementation challenges for most institutional investors.
- We project ranges of return for major asset categories that are consistent with long-term observed real returns combined with current inflation estimates.
- We begin with review of historic return, risk and correlation data. We then provide an economic context that influences our judgments at the margin.

Capital Market Expectations as a Set

- Relationships between asset class assumptions are as important, or more important, than the individual asset class level of assumptions, with the following relationships being most important:
  - ✓ Inflation versus cash equivalents.
  - ✓ Fixed income returns versus inflation.
  - ✓ Stock returns versus bonds - the equity premium.
  - ✓ Large capitalization versus small capitalization equities.
  - ✓ U.S. equity versus international equity.
- These relationships will have a strong effect on the generation of efficient asset mixes using the optimizer.

Inflation (CPI)

Lehman Aggregate Historic Returns

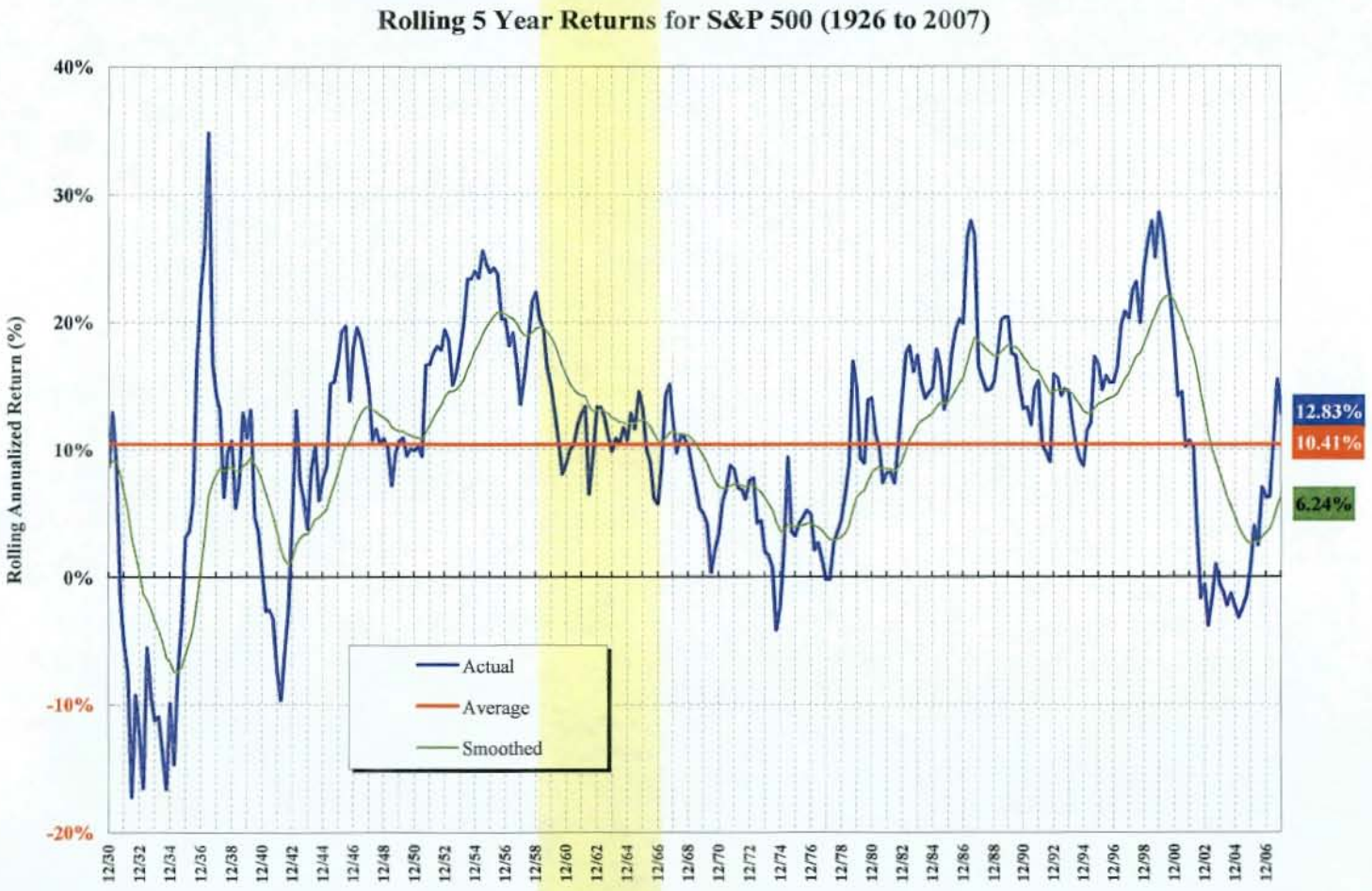


Domestic Fixed Income

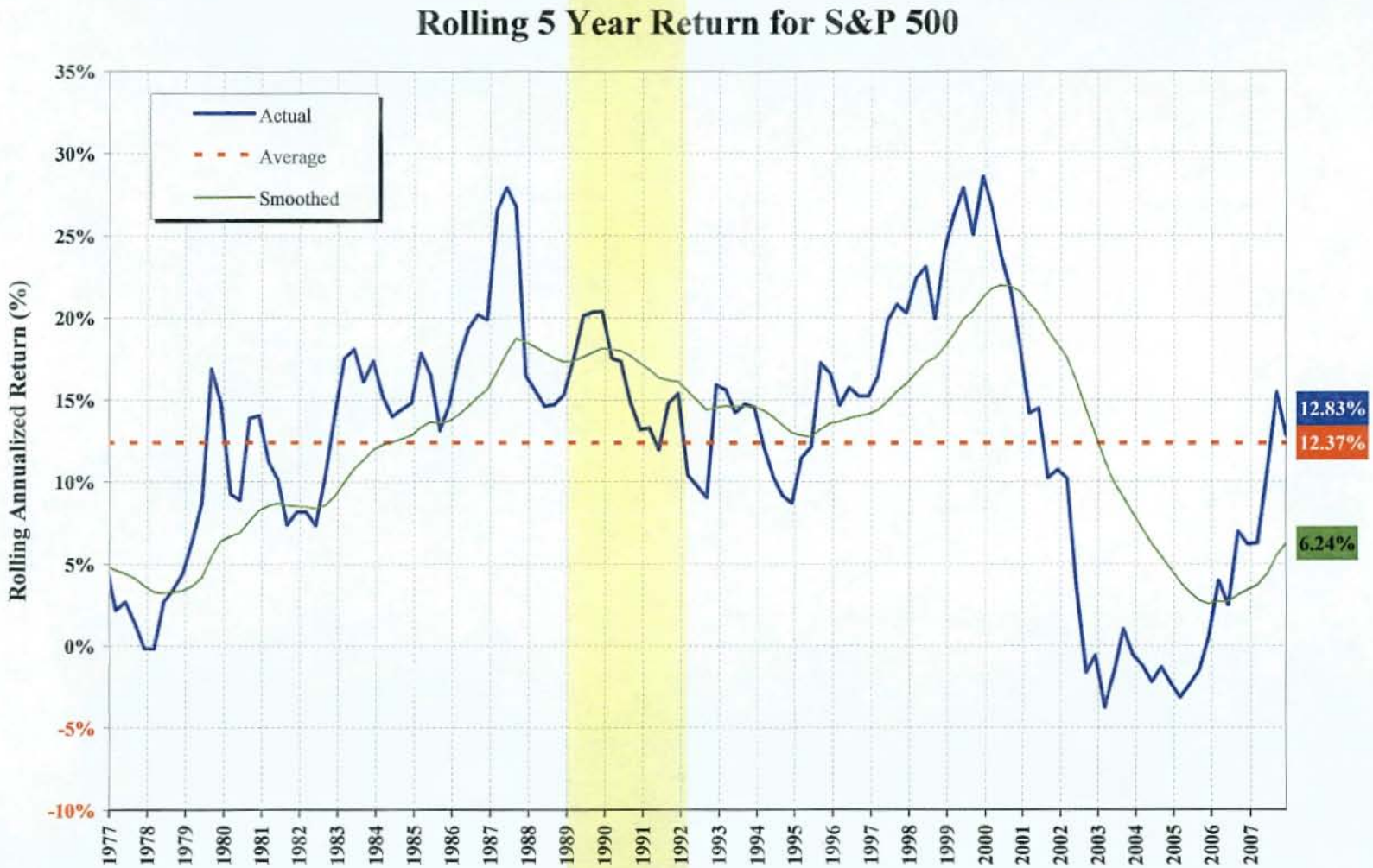
Current Yield Is A Strong Predictor of Returns

Lehman Aggregate Index 5 Year Returns vs. Lagged Yield to Worst

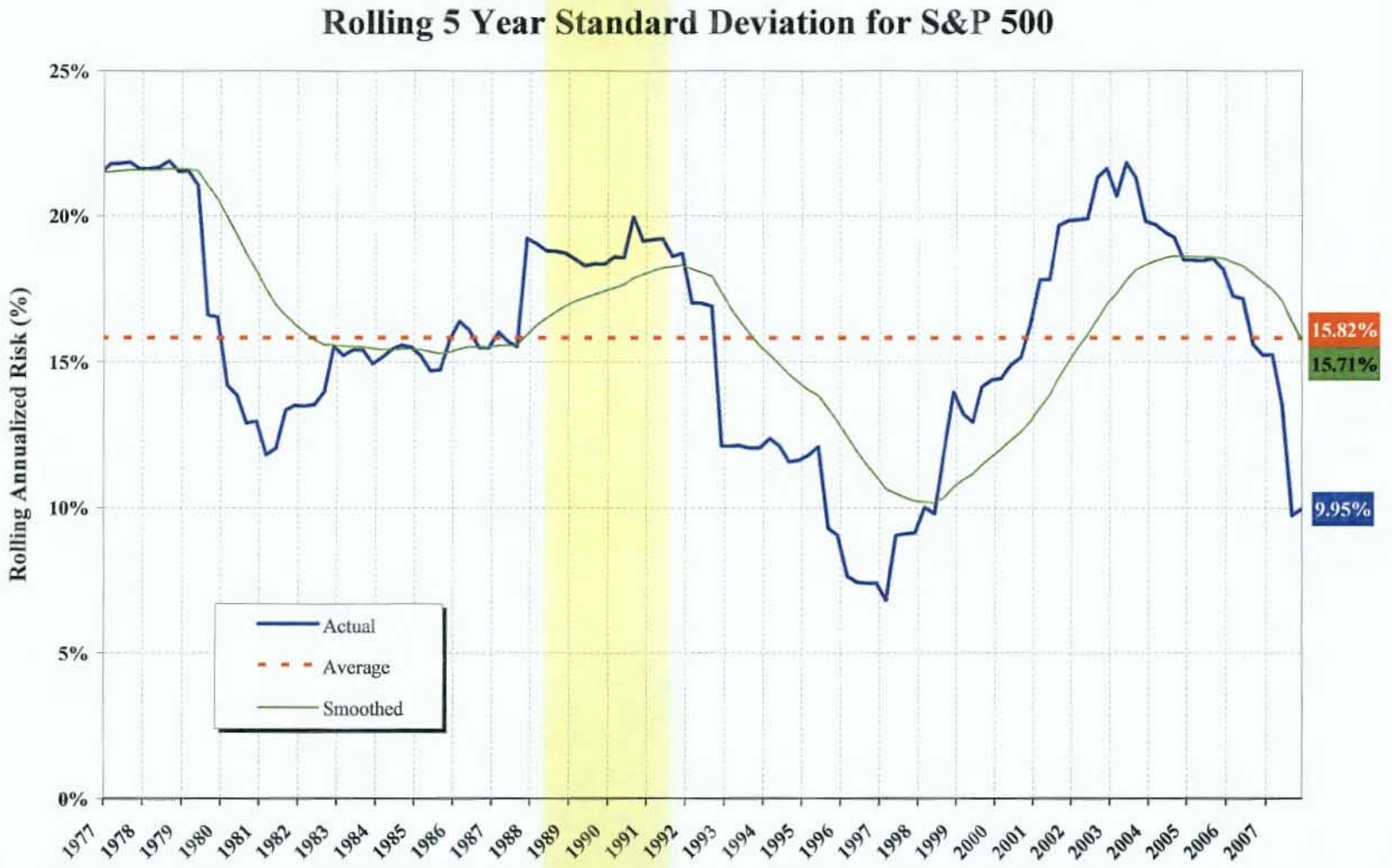
Large Cap Stocks
Rolling 5-year Returns



More Recent S&P 5-Year Returns

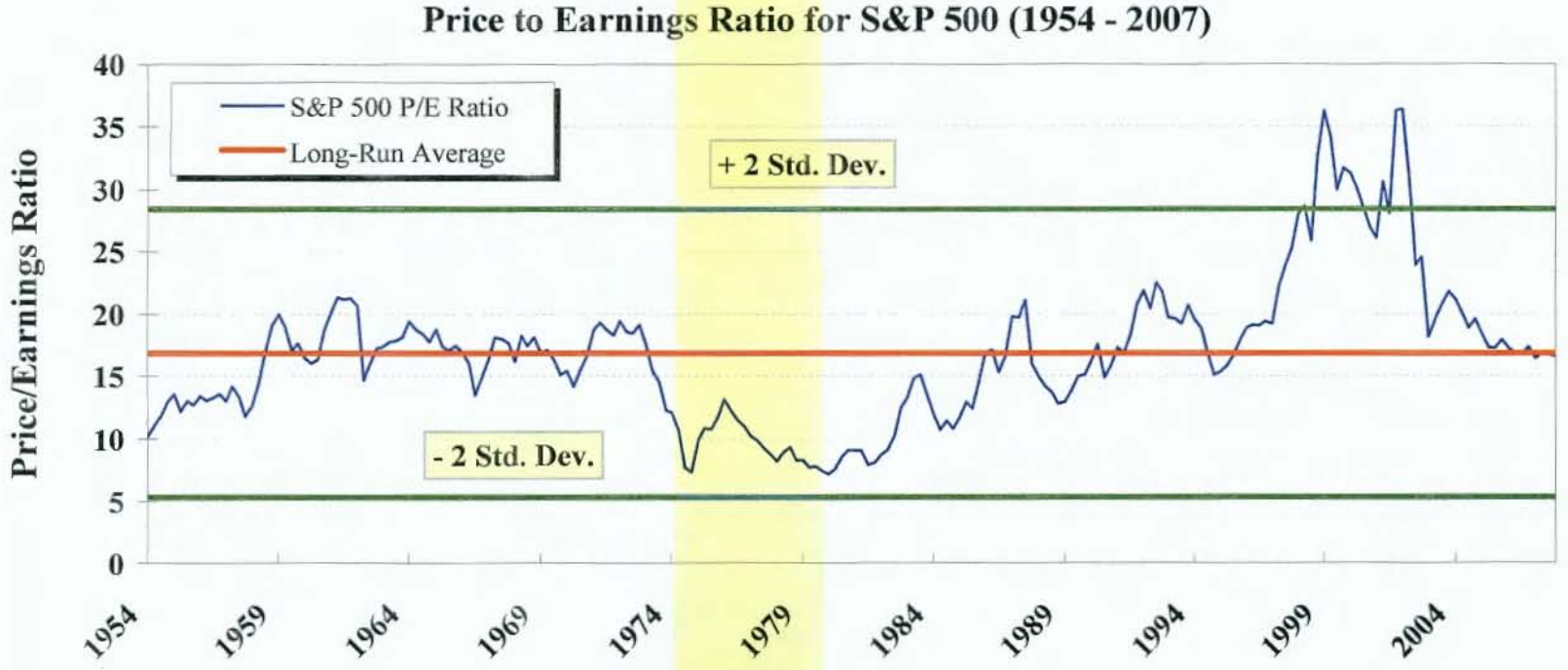


Rolling 5-Year Annualized Volatility



Stocks appear reasonably priced unless one expects earnings decline

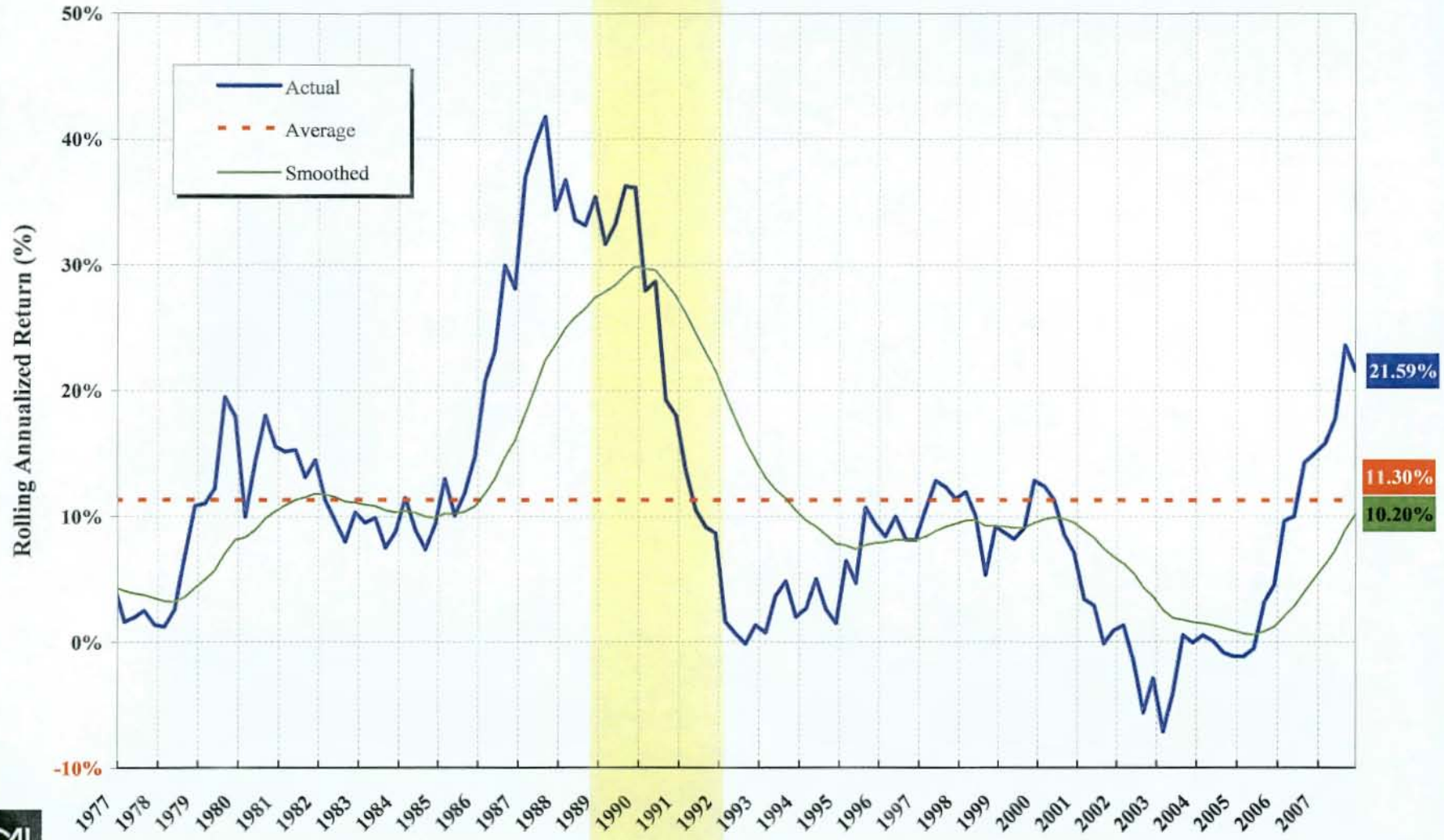
Trailing P/E Near Long-Run Average



Trailing earnings as reported for the fiscal year; includes negative earnings from 1998 onward.

International Stocks Historic Returns

Rolling 5 Year Return for MSCI EAFE



2008 5-Year Projections

Asset Class	Projected Return	Projected S.D.	Projected Yield
Broad Domestic Equity	9.00	16.90	2.10
Large Cap	8.85	16.40	2.20
Small/Mid Cap	9.85	22.70	1.20
International Equity	9.00	19.20	2.00
Emerging Markets Equity	9.60	31.20	0.00
Domestic Fixed	5.25	4.50	5.25
TIPS	4.90	6.00	4.90
High Yield	7.00	11.50	7.00
Non US Fixed	5.15	9.60	5.20
Real Estate	7.60	16.50	6.00
Private Equity	12.00	34.00	0.00
Absolute Return	6.50	9.70	0.00
Cash Equivalents	3.50	0.80	3.50

The only changes from 2007 are 20bps reductions in Int'l & Emerging returns and a 50bps reduction in cash returns. SD for international & emerging were also reduced slightly

2008 Correlation Coefficient Matrix

Key to Constructing Efficient Portfolios

Asset Mix Correlations

	Broad Domestic Equity	Large Cap	Small/Mid Cap	International Equity	Emerging Markets Equity	Domestic Fixed	TIPS	High Yield	Non US Fixed	Real Estate	Private Equity	Absolute Return	Cash Equivalents
Broad Domestic Equity	1.00												
Large Cap	0.96	1.00											
Small/Mid Cap	0.92	0.84	1.00										
International Equity	0.70	0.70	0.63	1.00									
Emerging Markets Equity	0.50	0.50	0.44	0.45	1.00								
Domestic Fixed	0.20	0.21	0.14	0.15	0.10	1.00							
TIPS	(0.04)	(0.04)	(0.05)	(0.10)	(0.14)	0.40	1.00						
High Yield	0.66	0.65	0.59	0.55	0.30	0.29	0.15	1.00					
Non US Fixed	(0.03)	(0.01)	(0.06)	0.21	(0.02)	0.32	0.11	0.10	1.00				
Real Estate	0.54	0.54	0.47	0.47	0.39	0.17	0.00	0.55	0.03	1.00			
Private Equity	0.68	0.68	0.62	0.64	0.50	0.15	(0.03)	0.47	0.10	0.44	1.00		
Absolute Return	0.56	0.55	0.52	0.50	0.32	0.40	0.05	0.45	0.15	0.40	0.43	1.00	
Cash Equivalents	(0.12)	(0.10)	(0.15)	(0.25)	(0.15)	0.30	0.29	0.07	(0.05)	(0.06)	0.07	0.50	1.00

Mean-Variance Optimization Analysis

2008	Constraints		Current Target				Recommended					
Asset Classes	Min	Max	1	2	3	4	5	6	7	8	9	10
Equity - Broad Market	0.00%	100.00%	47%	32%	37%	42%	47%	52%	56%	61%	66%	71%
Equity - International	0.00%	100.00%	17%	14%	16%	18%	20%	22%	24%	25%	27%	29%
Bonds - Aggregate	0.00%	100.00%	36%	53%	47%	40%	33%	27%	20%	13%	7%	0%
Totals			100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Projected Return			7.650%	7.000%	7.250%	7.500%	7.750%	8.000%	8.250%	8.500%	8.750%	9.000%
Projected Risk			10.927%	8.454%	9.383%	10.339%	11.316%	12.309%	13.316%	14.332%	15.356%	16.386%
1 Yr. Probability of Loss			24.19%	20.38%	21.98%	23.41%	24.67%	25.79%	26.78%	27.66%	28.44%	29.14%
5 Yr. Probability of Loss			5.87%	3.21%	4.20%	5.24%	6.28%	7.31%	8.30%	9.24%	10.13%	10.97%
10 Yr. Probability of Loss			1.34%	0.44%	0.73%	1.09%	1.52%	1.99%	2.50%	3.04%	3.58%	4.12%

Investment Recommendation

- The EVOS funds are targeting a five percent return above inflation.

- Callan provides capital market projections that are calibrated on an inflation projection of 2.75%. Therefore, the Exxon Valdez Oil Spill Trustee Council should target 7.75% to be consistent with its investment policy.

- The following asset allocation is expected to achieve target return while minimizing the volatility of returns:
  - 47% Broad Market Equities (Index: Russell 3000)
  - 20% International Equity (Index: MSCI EAFE)
  - 33% Domestic Bonds (Index: Barclays Aggregate).

DRAFT 1/7/09

RESOLUTION 09-01 OF THE *EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL PERTAINING TO THE ASSET ALLOCATION FOR PERIOD JANUARY 2009-FEBRUARY 2010

The *Exxon Valdez* Oil Spill Trustee Council (the "Council") is responsible for the management and investment of the *Exxon Valdez* Oil Spill Joint Trust Fund (the "Joint Trust Fund"). The Joint Trust Fund is used by the governments for purposes of restoring, replacing, enhancing, rehabilitating or acquiring the equivalent of natural resources and services lost or injured as a result of the oil spill.

Public Law 106-113 allows investment of the Joint Trust Funds (EVOS Research Investment, EVOS Habitat Investment, EVOS Koniag Investment) outside the Untied States Treasury but limits investments to "income-producing asset classes, including debt obligations, equity securities, and other instruments or securities that have been determined by unanimous vote of the Council to have a high degree of reliability and security."

The investment objective for the joint Trust Funds, as described in the Investment Policies adopted by the Trustee Council on February 29, 2000, is to provide adequate liquidity for ongoing restoration purposes and preserve the inflation-adjusted value of the principal, while realizing competitive, total rates of return. In order to meet this investment objective, the Trustee Council unanimously agreed on this date that Joint Trust Fund monies shall be invested outside the Federal Court Registry under the authority of Pubic Law 106-113. The Council has reviewed the capital market returns and risk assumptions developed by the Alaska Department of Revenue, Division of Treasury's, Callan Associates (dated February 2008).

THEREFORE, BE IT RESOLVED THAT the Council adopts the following asset allocation.

ASSET ALLOCATION

Equities Broad Market	47% +/- 7%
Equities International	20% +/- 5%
Fixed Income – Domestic	33% +/- 7%

AND FURTHER THAT the Council further recognizes that the asset allocation adopted today has a median expected return of 7.75% with a standard deviation of 11.316%.

Approved by the Council at its meeting of January 16, 2009 held in Anchorage, Alaska, as affirmed by our signatures affixed below.

JOE L. MEADE
Forest Supervisor
Forest Service Alaska Region
U.S. Department of Agriculture

TALIS J. COLBERG
Deputy Attorney General
Alaska Department of Law

HANS NEIDIG
Special Assistant to the Secretary
for Alaska
U.S. Department of the Interior

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

DENBY S. LLOYD
Commissioner
Alaska Department of Fish and Game

LARRY HARTIG
Commissioner
Alaska Department of
Environmental Conservation

DRAFT 12/19/08

The 20th Anniversary of the *Exxon Valdez* Oil Spill at the new Education Center at the Alaska Zoo, Anchorage

EVENT DATES:

- Saturday, March 21, 2009, 10:00 a.m. to 5:00 p.m. at the new Gateway Education Center for the Alaska Zoo. Free and open to the public.
- Monday and Tuesday, March 23-24 open to the Anchorage School District.

EVENT DESCRIPTION:

This is intended for the general public with restoration related programs for all ages in an interactive and free setting. It completes the suite of 20th Anniversary events beginning with the scientific focus of the Alaska Marine Science Symposium, January 19-23; the state-wide outreach of the Alaska Forum on the Environment, February 2-6; and local events in spill affected communities. The zoo setting offers a powerful supplement to *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) restoration programming, with the opportunity for people to see live animals injured by the spill such as river otters, seals and bald eagles.

PARTNERS:

In addition to the Alaska Zoo, partners include: the Bird Treatment and Learning Center; Alaska SeaLife Center; Cordova Historical Society; U.S. Fish and Wildlife Service; U.S. Geological Survey; and National Oceanic and Atmospheric Administration. Other interested partners include: the Alaska Native Heritage Center; Prince William Sound Regional Citizens Advisory Council; Alaska Department of Environmental Conservation; and Alaska Department of Fish and Game. Partners are providing significant staffing, programming and materials.

ACTIVITIES INCLUDE:

- Three different EVOSTC films running continuously spotlighting spill effects and restoration, impacts to native subsistence and other related oil spill issues.
- Scheduled lectures and discussion with EVOSTC scientists accompanied by audio-visual aids, research tools or other hands-on items to facilitate discussion.
- Display of the updated Darkened Waters exhibit.
- Samples of *Exxon Valdez* oil and a piece of Bligh Reef as hands-on spill artifacts.
- Hands-on oil spill experiments.

- Bird Treatment and Learning Center table: with live bald eagles, presentations and activities, and webcam to seabirds at the Alaska SeaLife Center.

- Sea Otter table with web feed to a 'sea otter cam' of an EVOS sea otter now at an aquarium; continuous showing of "Nyac the Sea Otter" (a 2 minute video sponsored by the EVOSTC); copies of Alaska SeaLife Center otter treatment records from the spill; and the USGS sea otter education kit.

- Information on the changes in spill prevention and response.

The 20th Anniversary Report and other EVOSTC publications will be available as well as materials from partners. Also on display will be poster boards with photos and information about the spill and restoration including an exhibit of a map of Alaska showing habitat purchases made by the EVOSTC in the spill area.

BUDGET ITEMS	COSTS
Facility rental includes: audio and visual equipment, tables/chairs, etc.	$5,000
Funding for Speakers: Bodkin, Matkin, Rice	$5,000
Promotional materials: Banners for inside and outside of building includes design and fabrication. The banners have multiple uses before and after the event.	$1,500
Exhibit materials: oil spill experiments, otter table items, publications	$2,000
Public Service Announcements: Alaska Public Radio Network (APRN) and local radio stations Paid Newspaper Ads: Anchorage Daily News (daily) and Anchorage Press (weekly)	$2,000
Native Alaskan Subsistence and Spill Presentation	$700
Public meeting: Coffee and refreshments (anticipate 1,000 participants on March 21, 2009	$800
Total	$15,515

RESOLUTION 09-02 OF THE *EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL REGARDING THE 20TH ANNIVERSARY OF THE *EXXON VALDEZ* OILSPILL AT THE NEW EDUCATION CENTER AT THE ALASKA ZOO, ANCHORAGE

We, the undersigned, duly authorized members of the *Exxon Valdez* Oil Spill Trustee Council do hereby certify that, in accordance with the Memorandum of Agreement and Consent Decree entered as settlement of United States of America v. State of Alaska, No. A91-081 Civil, U.S. District Court for the District of Alaska, and after public meetings, unanimous agreement has been reached to expend funds received in settlement of State of Alaska v. Exxon Corporation, et al., No. A91-083 CIV, and United States of America v. Exxon Corporation, et al., No. A91-082 CIV, U.S. District Court for the District of Alaska for necessary Natural Resource Damage Assessment and Restoration activities for fiscal year 2009 in the amount of $15,515 designated to fund "The 20th Anniversary of the *Exxon Valdez* Oil Spill at the new Education Center at the Alaska Zoo, Anchorage." The funds are designated to the State of Alaska. Funding is distributed as follows:

State of Alaska – Department of Fish & Game	$15,515
Total State of Alaska	$15,515

By unanimous consent, we hereby request the Alaska Department of Law and the Assistant Attorney General of the Environmental and Natural Resources Division of the United State Department of Justice to take such steps as may be necessary to make funds available in the amount of $15,515 from the appropriate accounts as designated by the Executive Director.

Approved by the Council at its meeting of January 16, 2009 as affirmed by our signatures affixed below.

JOE L. MEADE
Forest Supervisor
Forest Service Alaska Region
U.S. Department of Agriculture

TALIS J. COLBERG
Attorney General
Alaska Department of Law

HANS NEIDIG
Special Assistant to the Secretary
for Alaska
U.S. Department of Interior

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

DENBY S. LLOYD
Commissioner
Alaska Department of Fish and Game

LARRY HARTIG
Commissioner
Alaska Department of Environmental
Conservation

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

Adopted: _____

Table of Contents

Exxon Valdez Oil Spill Trustee Council

Procedures for the Preparation and Distribution of Reports

Adopted: _____

INTRODUCTION

These *Procedures for the Preparation and Distribution of Reports* provide instructions regarding the preparation, peer review, printing and distribution of final and annual reports for projects funded by the *Exxon Valdez* Oil Spill Trustee Council. Quarterly reports address administrative reporting requirements. Principal investigators shall work with their agency liaisons to fulfill their quarterly reporting obligations as outlined in the *Invitation for Proposals* and the *General Operating Procedures of the Trustee Council.*

Unless otherwise specified by the Trustee Council Office, each project funded by the Trustee Council shall ultimately produce a final report that has been subjected to the Trustee Council's peer review process. In the case of multi-year projects, an annual report shall also be prepared each year until the project is completed, at which time a final report shall be prepared. Subject to the approval of the Trustee Council Office, on a project-by-project basis, journal articles or manuscripts may be used to fulfill requirements for the preparation of final reports (See page 7).

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:*

> Messmer, T. and M. Morrison. 2006. Unified manuscript guidelines for The Wildlife Society peer-reviewed publications, Journal of Wildlife Management, 70(1):304-320, www.wildlife.org/publications/wild-70-01-guide_304%20320_ebook1.pdf

To the extent that there are any inconsistencies between these *Procedures for the Preparation and Distribution of Reports* and the guidance provided by Messmer, T. and M. Morrison (2006), the instructions provided in these *Procedures* shall be followed.

The primary changes in these *Procedures*, as compared to the previous version of this document (July 2002), clarify the peer review process and apply consistency to final report procedures for all projects funded by the Trustee Council.

The Trustee Council encourages principal investigators to publish the results of their work in peer-reviewed journals. All manuscripts shall include the Disclaimer Statement on page 8. Manuscripts or journal articles may be used to help satisfy final report requirements. (See *Use of Manuscripts for Final Report Writing*, page 7.)

FINAL REPORTS

Purpose: A final report for a project must be a comprehensive report addressing all the objectives identified over the course of the entire study. The final report shall address the original objectives of the study as identified in the approved proposal and account for any changes in the objectives. The principal investigator for a project is responsible for the submission and production of a final report. To ensure report obligations are met, future project funding is dependent upon completion of project deliverables.

Project Numbers: For purposes of identification each project is assigned a number. Natural Resource Damage Assessment (NRDA) projects are designated by alpha-numeric project numbers (e.g., MM6 for "Marine Mammal Study 6" or FS2 for "Fish/Shellfish Study 2"). Restoration projects, Gulf Ecosystem Monitoring and Research Program (GEM) projects, and other projects funded by the Trustee Council each have a five or six-digit project number (e.g., 95225, 030452). The first two digits identify the fiscal year in which the project was authorized; the last three or four digits provide a specific project identifier. Those projects funded between FY 1993 and FY 2002 have five digits; those funded for FY 2003 and after have six digits.

I. Preparation: Final Reports

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

1. **Report Cover** – The report shall have a front and back cover of quality cover stock. To ensure consistent appearance, the color shall be goldenrod. An example of a final report cover is provided. (Attachment A) A final report cover shall:

   a. identify the report, using the appropriate series title, as a

   (1.) Restoration Project final report – series title: *Exxon Valdez* Oil Spill Restoration Project Final Report, or

   (2.) Gulf Ecosystem Monitoring and Research Project final report – series title: *Exxon Valdez* Oil Spill Gulf Ecosystem Monitoring and Research Project Final Report, or

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

b. provide the report title;

c. include the project identification number;

d. identify the author(s) with appropriate affiliation(s);

e. include the date (month and year) of publication; and

f. 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, 441 West 5th Avenue, Suite 500, Anchorage, Alaska 99501-2340; or O.E.O. U.S. Department of the Interior, Washington D.C. 20240. "

2. **Title Page** – The Title Page of the report shall immediately follow the report cover page on white bond paper and be identical in terms of content and format to the front of the report cover page. (Attachment A)

3. **Study History, Abstract, Key Words, Project Data and Citation** – Following the Title Page, the report shall include, on not more than two pages: (1) a study history; (2) an abstract; (3) key words; (4) summary of data gathered during the project; and (5) a recommended citation for the final report. (Attachment A)

   a. 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 reports or other reports which contributed to the final report; and citation of publications that have preceded publication of the final report.

   b. Abstract – An abstract, with a maximum length of 200 words (limit for processing through the National Technical Information Service), 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 report consists of several chapters or manuscripts (See Use of Manuscripts

for Report Writing, page 7), the abstract shall summarize the entire report. Do not use abbreviations or acronyms in the abstract.

c. **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: (1) common and scientific names of principal organisms, if any; (2) geographic area or region; (3) phenomena and entities studied (e.g., behavior, reproduction); (4) methods (only if the report describes a new or improved method); and (5) other words not covered above but useful for indexing.

d. **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: (1) describe the data; (2) indicate the format of the available data collections; (3) 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 (4) indicate any access limitations placed on the data. Limiting access requires pre-approval by the Trustee Council Office.

e. **Citation** – A recommended citation for the final report shall be provided. See Attachment A for the correct citation format.

4. <u>Remainder of Report</u> – After the Study History, Abstract, Key Words, Project Data and Citation, the report shall continue as follows:

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

   b. **Executive Summary** – The executive summary shall:

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

      (2.) be written so that it can stand 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 single-spaced pages;

      (4.) concisely state the objectives, methods, results and conclusions of the report; and

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

c. **Introduction** – The introduction shall:

(1.) present first, with all possible clarity, 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 method(s) of investigation and briefly state principal results.

d. **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.

e. **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.

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

g. **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 GEM studies, and published literature.

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

i. Acknowledgments

j. Literature Cited

k. 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.

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

1. Word Processing Conventions

a. 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 left, right
Tabs:	every 0.5"
Widow Protection:	yes
Page	
Page numbering:	bottom center
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).

b. 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.

2. **Other Conventions**

   a. Use italics, rather than underlining, for Latin names and for *Exxon Valdez.*

   b. Use good quality white paper 8.5 x 11" (215 x 280mm) or metric size A4.

   c. Do not use dot matrix printers to print the report.

   d. 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.

   e. Clearly define any acronyms. Avoid the use of acronyms completely in the Abstract and Executive Summary.

   f. Use the terms "damages" and "injury" as defined by CERCLA regulations (See 43 CFR 11.14):

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

      (2.) "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."

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

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

C. **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 approval of the Science Director, on a project-by-project basis, m*anuscripts or journal articles may be used to help satisfy project final report writing requirements. When a manuscript is used to fulfill 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 the section on *Copyright and Publication Rights*, page 8.).

   1. **Authority to Use Manuscripts** – Principal investigators shall contact the Science Director at the Trustee Council Office to request authority to use a manuscript(s) as the body of a final report.

2. **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.

   a. 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 in the next section.)

   b. 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 project 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 project activities and results.

3. **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 Final Report Format, page 2).

4. **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:

   a. 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.

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

5. **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."

6. **Reprints** – Investigators who publish the results of Trustee Council sponsored projects shall provide the Trustee Council Office (attention: Science Director) 3 reprints of any published manuscript. The Trustee Council Office shall provide 1 of the reprints to the Alaska Resources Library and Information Services (ARLIS).

D. Due Date – Draft final reports shall be *submitted for peer review by April 15 of the year following the fiscal year in which project work was completed* unless a different date is specified in the approved proposal or contract. If this due date cannot be met, the principal investigator or liaison shall file an extension request with the Science Director 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. Draft final reports will undergo the peer review process outlined below. Principal investigators shall address peer review comments as appropriate for the final report. A final report shall be delivered to the Trustee Council office 30 days after receipt of reviewer's comments.

E. Portion of Project Funding Withheld Pending Final Deliverables - Ten Percent (10%) of the project funding will be withheld by project managers until the following criteria have been met:

- the final report has gone through peer review and format review;
- all print copies of the final report have been delivered to ARLIS;
- an electronic copy of the final report has been delivered to the EVOSTC office; and
- project data and metadata have been submitted to approved archives in accordance with the Data Policy.

The EVOSTC has the discretion to extend the due date on deliverables, whether planned or for other grounds the Executive Director determines are reasonable. For multi-year projects, the 10% withholding will apply to the final year of funding. Principal Investigators with tardy deliverables will not be awarded future funding.

II. Review Process

A. Submission of Draft Final Reports for Peer Review – The principal investigator shall submit 1 paper copy and 1 electronic copy of the draft final report to the Science Director for peer review. The electronic copy shall be

submitted as a word processing document (most recent version of Microsoft Word for Windows or WordPerfect) with any figures and tables imbedded.

Science Director
Trustee Council Office
441 W. 5th Ave., Suite 500
Anchorage, AK 99501

phone: (907) 278-8012
fax: (907) 276-7178
science_director@evostc.state.ak.us

B. **Draft Final Report Peer Review and Acceptance Process** – Draft final reports shall be scientifically or technically peer reviewed under the direction of the Science Director:

1. The Science Director shall secure the services of a minimum of two qualified reviewers who will provide comments, identify questions, and suggest revisions as appropriate for the report.

2. Reviewers will be selected based upon experience, expertise, availability, and objectivity.

3. 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.

4. Peer reviews will be confidential. Comments will be submitted in writing to the Science Director.

5. Peer reviewers will be anonymous to the authors of the report and the general public.

6. The Science Director shall consolidate the peer review comments and provide the consolidated comments and any recommendations in writing to the principal investigator(s).

7. Final reports shall be revised by the principal investigator to address peer review comments within 30 days of receiving them. The final report shall be resubmitted for final acceptance, as above, by the Science Director. (1 paper copy and 1 electronic copy of the revised final report to the Science Director).

8. Once the final report is accepted, the Science Director shall notify the principal investigator in writing and send a copy of the letter of acceptance to the project manager and ARLIS.

9. Final reports will not be distributed from the Trustee Council Office until peer review is complete.

C. **Final Report Review of Format** – Once the content of the report is accepted by the Science Director, the principal investigator shall prepare the final report for publication.

1. **Format Review** – Within 30 days of the date on which the Science Director accepts the final report, the principal investigator shall remove all references to "draft" from the report and submit the first several pages of the approved final report to ARLIS for format review (i.e., Cover, Title Page, Study History, Abstract, Key Words, Project Data and Citation). These pages can be mailed, faxed, or e-mailed to ARLIS (attention: Carrie Holba):

   Carrie Holba
   ARLIS
   Suite 111, Library Bldg.
   3211 Providence Drive
   Anchorage AK 99508

   phone (907) 786-7660
   fax (907) 786-7652
   carrie@arlis.org

2. **Revisions** – Within 15 days of receipt of the first several pages of the final report, ARLIS staff shall review it for compliance with the report format standards and notify the principal investigator in writing regarding any changes that need to be made.

3. **Approval** – To be certain that format revisions are made correctly, the principal investigator shall fax or e-mail a copy of the corrected version to ARLIS within 30 days of the format review. The principal investigator shall not reproduce the report until format approval is confirmed in writing by ARLIS.

III. Printing and Distribution Process

A. **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 final copies as follows:

1. **Two-sided Pages** – The body of the report shall be printed in two-sided format to reduce the space needed to store reports.

2. **Number of Copies** – The principal investigator shall provide a total of 20 paper copies and 2 electronic copies, as follows:

   a. **18 bound copies, 2 camera-ready copies and 1 electronic copy** of the approved final report to ARLIS, which shall include a copy for the Science Director and a copy for the Trustee Council's official record. A camera-ready copy is an unbound copy of the report as it will appear in its final format, except that it is single-sided with blank pages inserted as appropriate. The electronic copy shall be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (using the most recent versions of Acrobat, Word, or Word Perfect) with all figures and tables imbedded. 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; and

b. **1 electronic copy** to the Science Director. The electronic copy shall be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document, according to the requirements listed in the previous section.

B. **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; see address, page 10).

C. **Distribution of Final Reports** – ARLIS shall distribute the bound and camera-ready copies of final reports to the appropriate individuals and libraries. (Attachment C) Final reports shall be posted on the Trustee Council website at www.evostc.state.ak.us.

ANNUAL REPORTS

Purpose: In the case of multi-year projects, an annual report shall be prepared each year until the project is completed, at which time a final report shall be prepared. All NRDA annual reports have been completed, and so are not addressed in this section of the *Procedures*. The principal investigator for a project is responsible for the submission and production of an annual report.

I. Preparation of Annual Reports

A. **Annual Report Format** – Annual reports shall be brief documents (2-3 pages) that include the information listed below. An example of the annual report form, available for downloading from the Trustee Council's web site (www.evostc.state.ak.us) or from the Trustee Council Office upon request, is provided. (Attachment B)

1. **Project Number**
2. **Project Title**
3. **Principal Investigator's Name(s)**
4. **Time Period Covered by the Report**
5. **Date of Report**

6. **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.

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

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

9. **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.

10. **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.

11. **Budget** – This section shall explain any differences and/or problems between actual and budgeted expenditures, including any substantial changes in the allocation of funds among line items on the budget form. Any new information regarding matching funds or funds from non-Trustee Council sources for the project shall be included.

B. **Due Date** – Annual reports shall be *submitted by September 1 of each fiscal year for which a project receives funding*. The information in the annual reports shall be a key component in the Trustee Council's annual decision to continue funding a project. Failure to submit an annual report by September 1 of each year, or unsatisfactory review of an annual report, will result in withholding of additional project funds, and may result in cancellation of the project or denial of funding for future projects.

II. Review Process: Annual Reports

A. **Submission of Annual Report for Review** – The principal investigator shall electronically submit the annual report to the Science Director, care of science_director@evostc.state.ak.us. The subject line of the e-mail

transmitting the report must include the project number and the words "annual report" (e.g., "035620 Annual Report"). Electronic reports shall be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (using the most recent versions of Acrobat, Word, or Word Perfect) with all figures and tables imbedded. 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

B. Annual Report Review Process – Annual reports shall be reviewed by the Science Director. Under the guidance of the Science Director, annual reports may also be reviewed by qualified outside peer reviewers. The review process 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 annual reports shall be provided to the principal investigator and kept on file at the Trustee Council Office, available upon request.

III. Distribution of Annual Reports

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

QUARTERLY REPORTS

Quarterly reports address administrative reporting requirements. Principal investigators shall work with their agency liaisons to fulfill their quarterly reporting obligations as outlined in the Invitation for Proposals and the General Operating Procedures of the Trustee Council.

ATTACHMENT A

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.

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.

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 Action 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, 441 West 5th Avenue, Suite 500, Anchorage, Alaska 99501-2340; or O.E.O. U.S. Department of the Interior, Washington, D.C. 20240.

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 B

EVOS ANNUAL PROJECT REPORT

All recipients of funds from the *Exxon Valdez* Oil Spill Trustee Council must submit an annual project report in the following format by September 1 of each fiscal year for which project funding is received, with the exception of the final funding year in which a final report must be submitted. Satisfactory review of the annual report is necessary for continuation of multi-year projects. Failure to submit an annual report by September 1 of each year, or unsatisfactory review of an annual report, will result in withholding of additional project funds and may result in cancellation of the project or denial of funding for future projects.

PLEASE NOTE: Significant changes in a project's objectives, methods, schedule, or budget require submittal of a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.

Project Number:

Project Title:

PI Name:

Time Period Covered by Report:

Date of Report:

1. **Work Performed:** Summarize work performed during the reporting period, including any results available to date and their relationship to the original project objectives. Describe and explain any deviation from the original project objectives, procedural or statistical methods, study area, or schedule. Also describe any known problems or unusual developments, and whether and how they have been or can be overcome. Include any other significant information pertinent to the project.

2. **Future Work:** Summarize work to be performed during the upcoming year, if changed from the original proposal. Describe any proposed changes in objectives, procedural or statistical methods, study area, or schedule. [**PLEASE NOTE:** Significant changes in a project's objectives, methods, schedule, or budget require submittal of a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.]

3. **Coordination/Collaboration:** Describe efforts undertaken during the reporting period to achieve the coordination and collaboration provisions of the proposal, if applicable.

4. **Community Involvement/TEK & Resource Management Applications:** Describe efforts undertaken during the reporting period to achieve the community involvement/TEK and resource management application provisions of the proposal, if applicable.

5. **Information Transfer:** List (a) publications produced during the reporting period, (b) conference and workshop presentations and attendance during the reporting period, and (c) data and/or information products developed during the reporting period. [**PLEASE NOTE:** Lack of compliance with the Trustee Council's data policy and/or the project's data management plan will result in withholding of additional project funds, cancellation of the project, or denial of funding for future projects.]

6. **Budget:** Explain any differences and/or problems between actual and budgeted expenditures, including any substantial changes in the allocation of funds among line items on the budget form. Also provide any new information regarding matching funds or funds from non-EVOS sources for the project. [**PLEASE NOTE:** Any request for an increased or supplemental budget must be submitted as a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.]

Signature of PI: _____

Project Web Site Address: _____

SUBMIT ANNUAL REPORTS ELECTRONICALLY TO science_director@evostc.state.ak.us. THE REPORTS WILL BE POSTED ON THE TRUSTEE COUNCIL'S WEB SITE AND SHOULD ALSO BE POSTED ON THE PI'S WEB SITE. The subject line of the e-mail transmitting the report must include the project number and the words "annual report" (e.g., "035620 Annual Report"). Electronic reports must be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (using the most recent versions of Acrobat, Word, or Word Perfect) with all figures and tables imbedded. 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.

ATTACHMENT C

Distribution of Final Reports

The Alaska Resources Library and Information Services (ARLIS) receives and distributes 18 bound copies and 2 camera-ready copies of the final reports as follows:

ARLIS collection (6 bound, 1 electronic and 1 camera-ready copy)*
Alaska State Library (4 bound copies)**
Holmes Johnson Library (Kodiak) (1 bound copy)
National Marine Fisheries Service Auke Bay Laboratory (1 bound copy)
National Library of Canada (Ottawa) (1 bound copy)
National Technical Information Service (1 bound copy and 1 camera-copy for reproduction upon request)
University of Alaska Anchorage (1 bound copy)
University of Alaska Southeast (Juneau) (1 bound copy)
University of Washington Library (1 bound copy)
Valdez Consortium Library (1 bound copy)

*ARLIS distributes its 6 bound copies as follows:
1 to the Trustee Council's Science Director
1 to the Trustee Council's official record
4 to the ARLIS permanent collection

** The Alaska State Library distributes its 4 copies as follows:
Alaska State Library
Alaska Historical Library
E. E. Rasmuson Library (University of Alaska Fairbanks)
Library of Congress

Financial Procedures

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
FINANCIAL PROCEDURES

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EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
FINANCIAL PROCEDURES

SETTLEMENT FUNDS

1. *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.

2. *Court Registry Investment System.* 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 for the Southern District of Texas. The CRIS established two accounts – the *Exxon Valdez* Oil Spill Settlement Account and the CRIS – *Exxon Valdez* Reserve Fund to receive and hold the Joint Trust Funds. Although the Joint Trust Funds were moved in October 2000 from the Court Registry System to the Alaska Department of Revenue, Division of Treasury, the Court Registry Investment System is still an investment option for the Trustee Council.

3. *Investment Fund(*s). The Governments sought and obtained Congressional approval to expand options for investment of the settlement proceeds. Public Law 106-113, the Consolidated Appropriations Act, 2000, was enacted November 29, 1999. 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. See section on Investment Fund.

4. *CRIS Disbursement.* Upon joint application of counsel for the United States and the State of Alaska, the United States District Court for the District of Alaska orders the disbursement of funds for purposes consistent with the Memorandum of Agreement and Consent Decree. The joint application shall consist of legal documents required by the Court and documentation demonstrating the unanimous agreement of the Trustee Council. When appropriate, interest earned on the federal and state accounts and/or unobligated balances from prior years' Work Plans shall be subtracted from the disbursement.

5. *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. The notification shall consist of legal documents required by the Court and documentation demonstrating the unanimous agreement of the Trustee Council. 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. When appropriate, interest earned on the federal and state accounts and/or unobligated balances from prior years' authorizations shall be subtracted from the disbursement.

6. *Authority to Spend.* No obligations shall be incurred until such time as a Court Order is entered by the United States District Court for the District of Alaska or a notification is filed with the United States District Court for the District of Alaska and any terms and conditions placed on the funding by the Trustee Council have been met.

7. *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.

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

INVESTMENT FUND

1. *General.* Under Public Law 106-113 (1999), some or all of the joint trust funds may be deposited in the Natural Resource Damage Assessment and Restoration Fund or accounts outside the United States Treasury, or both. Where the Trustee Council exercises this authority, it is responsible for the prudent investment of the settlement funds in income-producing obligations and other instruments or securities that have been determined by unanimous vote of the Trustee Council to have a high degree of reliability and security.

2. *Policies.* The Trustee Council shall adopt written investment policies to protect and manage an Investment Fund(s).

3. *Asset Allocation.* The Trustee Council recognizes that strategic asset allocation is the single most important policy decision affecting investment return and risk for an Investment Fund. At least annually, the Trustee Council shall evaluate its strategic asset allocation.

4. *Reporting.* Revenues and disbursements associated with the Investment Fund shall be reported to the Trustee Council on a monthly basis. Fees assessed by the Alaska Department of Revenue for the Investment Fund shall be paid on a quarterly basis.

PROJECT AUTHORIZATION

1. *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.

2. *Fiscal Year.* Unless otherwise approved by the Trustee Council, the fiscal year

begins on October 1 and ends on September 30. In the event the Trustee Council approves a project with a different fiscal year, the fiscal year must be clearly stated in the approval motion. In the event the Trustee Council approves, 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. In the event the Trustee Council approves a capital project, the designation as a capital project must be clearly stated in the approval motion.

3. *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. Justification and supporting documentation as to the reason for all such adjustments shall be maintained by the agencies. 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 of these procedures.

4. *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. Justification and supporting documentation as to the reason for all such adjustments must be maintained by the agencies. 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 of these procedures.

5. *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. Justification and supporting documentation as to the reason for all such adjustments must be maintained by the agencies. 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 of these procedures.

6. *Revisions.* Trustee Council action is required to move amounts greater than that authorized in section 3 above. Trustee Council action is also required if the adjustment changes the scope or objectives of a project, establishes a new project, or terminates an approved project before its scheduled completion. 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.

7. *Portion of Project Funding Withheld Pending Final Deliverables.* Ten Percent (10%) of the project funding will be withheld by project managers until the following criteria have been met:

- the final report has gone through peer review and format review;
- all print copies of the final report have been delivered to ARLIS;
- an electronic copy of the final report has been delivered to the EVOS TC office; and
- project data and metadata have been submitted to approved archives in accordance with the Data Policy.

The EVOSTC has the discretion to extend the due date on deliverables, whether planned or for other grounds the Executive Director determines are reasonable. For multi-year projects, the 10% withholding will apply to the final year of funding. Principal Investigators with tardy deliverables will not be awarded future funding.

PROJECT COSTS

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

2. *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.

3. *General Administration Formula.* The general administration formula is used to reimburse governmental agencies for indirect project costs incurred in implementing the restoration program. The general administration formula is nine percent of each project's direct costs. 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. Agencies are entitled to 100% of their budgeted general administration funds regardless of how much of their budgeted direct project funds have been expended.

4. *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.

5. *Bonuses.* Bonuses for personnel working on Trustee Council funded activities are allowable costs. Agencies shall follow their standard operating procedures in

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

ACCOUNTING

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

2. *Source Documentation.* Adequate justification and supporting documentation shall be maintained for each project.

3. *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.

4. *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.

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

6. *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.

7. *Obligations (Encumbrances).* 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. 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. 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. 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.

8. *Reporting: Annual Financial Reports.* By January 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. 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.

LAPSE

1. *General.* Subject to the exceptions noted in sections 2 and 3 below, the unexpended and unobligated balance of a project shall lapse on September 30 of the fiscal year for which the project was approved. However, an undisclosed obligation may be established and/or paid during the Close-Out Period.

2. *Multiple-year Projects.* 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. On September 30 of the fiscal year specified by the Trustee Council, the unexpended and unobligated balance shall lapse.

3. *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.

4. Close-out Period. During the months of October, November and December (through December 31), agencies may pay from funds from the fiscal year just ended on September 30 an expense that was undisclosed during that fiscal year. In addition, agencies 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 of these procedures.

5. Expenses Discovered after the Close-out Period. Expenses discovered after the Close-out Period (i.e., after December 31) may be charged to the subsequent year's project budget if the project has multiple years of funding and sufficient funds are available . In the event there is no subsequent year's project budget, or in the event the agency 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. During the months of January through June, authority to adjust a prior year Annual Financial Report may be provided by the Executive Director. For expenses discovered after June, authority to adjust a prior year Annual Financial Report may be provided by the Trustee Council.

EQUIPMENT

1. *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.

2. *Title and Use*. Equipment shall be used for the project for which it was acquired.
   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.

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.

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.

CONTRACTS

1. *General*. Agencies 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 Federal

and State laws.

2. *Definitions.* 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. 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. The approval motion shall include the reason for selecting the contract recipient. If the contracting agency determines that an award to an entity different than that named by the Trustee Council would better serve the 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, for specific details.

6. *Special Considerations.* All notes and other data developed by the contractor shall remain the sole property of the contracting agency.

GRANTS

1. *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 program under Public Law 106-113 (1999).

AUDITS

1. *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.

2. *Definition.* The term audit includes both financial and performance audits.

3. *Readiness.* When an agency receives funding from the Trustee Council, the agency 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.

4. *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 from making a determination that an audit is required in addition to an agency's review of expenditure documentation and work produced by a contractor.

5. *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.

6. *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

NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION FUND

1. *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.

2. *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.

3. *Reports.* Quarterly, the Department of the Interior shall report interest income to the Executive Director. In addition, all 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.

AUTHORIZATION

1. *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.

2. *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.

3. *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.

4. *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.

5. *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.

6. *Return of Unobligated Balances*. On March 15 of each year, federal agencies must return to the Natural Resource Damage Assessment and Restoration Fund the unobligated balance for the fiscal year just ended. Concurrently, the agencies must return any 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 balance for the fiscal year just ended and the amount of funding recovered from prior year 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 the amount of funding recovered from prior year obligations to the Executive Director by March 31 of each year.

APPENDIX B: STATE INTERNAL PROCEDURES

EXXON VALDEZ OIL SPILL SETTLEMENT FUND

1. *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.

2. *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.

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

AUTHORIZATION

1. *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.

2. *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

a. 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 fiscal year and the amounts actually expended during the preceding fiscal year;
b. prepare and submit, under AS 37.07, a budget for the next fiscal year setting out, for each object or purpose of expenditure, the Trustees' estimate of the amounts that are, during the next fiscal year, to be funded by the trust and expended by state agencies; and
c. 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 fiscal year and that are not included in the budget submitted under (2) of this section.

3. *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.

4. *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).

APPENDIX C: INVESTMENT FUND(S)

1. *General.* The Trustee Council, through appropriate state and/or federal agencies, may contract for investment, custodial or depository services on a discretionary or non-discretionary basis, with the State and Federal governments, or with independent investment management firms, banks, financial institutions or trust companies by designation through appointments, contracts or letters of authority.

2. *Segregation.* All principal and interest shall be accounted for separately by the custodian.

3. *Reports.* The custodian shall provide to the Executive Director financial reports on a monthly basis. The monthly report shall reflect all activity associated with the Investment Fund(s) including the date and amount of each transaction, any pending transactions, interest received, purchases, sales and other transactional data on a day-to-day basis. In addition, the custodian shall provide a monthly report which sets forth the opening balance in the Investment Fund(s), associated transactions and a reconciliation to the final balance. The investment manager shall provide to the Executive Director a suite of financial and performance reports on a monthly basis. The monthly financial report shall contain an asset appraisal which sets forth all of the assets held by the Investment Fund(s). The report shall provide detailed information such as cost and market value, current yield and percentage of each investment and sector. In addition, the investment manager shall provide monthly and cumulative performance reports. The performance reports shall include a comparison to the benchmarks approved by the Trustee Council.

4. *Investments.* By unanimous consent, the Trustee Council shall determine the strategic asset allocation and bands. The Executive Director shall have discretion to move assets among asset categories provided that such actions are consistent with movement of the actual asset allocation within the variability bands of the Trustee Council's strategic asset allocation policy. The Executive Director shall make the necessary adjustments to the initial target allocation within 30 calendar days. The Executive Director shall report any asset shifts at the next Trustee Council meeting. Such reports shall include a description of the rationale for the shift.

5. *Performance.* The Trustee Council shall identify benchmarks to evaluate Investment Fund(s) performance. Performance shall be evaluated relative to the identified benchmarks and also relative to an appropriate peer group of competitive alternatives. On a biannual basis, performance shall be presented to the Trustee Council.

6. *Fees.* No fees shall be assessed by the custodian except as approved in advance by the Trustee Council.

2009 INJURED RESOURCES AND SERVICES LIST
RECOMMENDED CHANGES TO RECOVERY OBJECTIVES

Cutthroat Trout

The Science Panel suggests that, given the ecological similarities in summer diet and foraging ecology along shorelines between cutthroat trout, pink salmon and Dolly Varden, and the absence of ongoing injury to those other two species further research would be very unlikely to demonstrate any evidence of continuing differences due to the spill between oiled and unoiled areas. Thus, funding the additional research necessary to provide current growth rate and abundance data for this species is not a cost-effective scientific priority. The status is very likely recovered.

Recovery Status: Very Likely Recovered

Recovery Objective: Cutthroat trout will have recovered when growth rates within oiled areas are similar to those for unoiled areas, after taking into account geographic differences.

2006 Objective: No change.

Pigeon Guillemots:

The pigeon guillemot population continues to decline in both oiled and unoiled areas of Prince William Sound. Nest predation is a potential source of mortality that may be limiting recovery in some areas, implying that predator removals could prove an effective restoration option. To establish the recovery of this species to the recovery objective of increasing levels of abundance and productivity that would have existed without the spill, additional data on productivity needs to be gained to form a reasonable estimate At this time, the recovery status for pigeon guillemots should remain "not recovered."

Recovery Status: Not Recovered

Recovery Objective: Pigeon guillemots will have recovered when their population is stable. Sustained or increasing productivity within normal bounds will be an indication that recovery is underway.

2006 Update: Pigeon guillemots will have recovered when their population is stable or increasing. Sustained or increasing productivity within normal bounds will be an indication that recovery is underway.

Kittlitz's Murrelet

The Kittlitz's murrelet population continues to decline in oiled and unoiled areas. Natural recovery has not restored this resource to pre-spill levels or levels that would have existed had the spill not occurred. What little evidence is available reveals possible predator limitation, as well as environmental impacts within their feeding areas. It is likely that basic biological studies would be useful to understand what may be limiting recovery, but it is unlikely that further study will clarify whether there are still residual effects of the spill. The rarity of this species makes it difficult and expensive to study and due to its possible endangered status would be a governmental agency responsibility. The recovery status for the Kittlitz's murrelet remains unknown.

Recovery Status: Unknown

Recovery Objective: Kittlitz's Murrelets will have recovered when their population is stable. Stable or increasing productivity within normal bounds will be an indication that recovery is underway.

2006 Objective: No recovery objective can be identified for Kittlitz's murrelet at this time.

Marbled Murrelet

Marbled murrelet populations are declining throughout much of the spill . They have low intrinsic productivity and a slow population growth rate. There are no differences in population trends between oiled and unoiled areas; they are declining similarly in both areas. Marbled murrelets rely on forage fish such as Pacific herring and Pacific sand lance, which may be declining in the spill area due to various reasons including a potential link to EVOS. Their dietary preferences and foraging areas make significant contact with lingering oil unlikely. Exogenous factors such as climatic factors, decreases in habitat availability, and shifts in forage fish populations are the most likely drivers of murrelet population dynamics.

Marbled murrelets do not meet their original recovery objective of increasing or stable populations. Moreover, their decline could be attributable in part to a decline in a primary food source; high-lipid forage fish, particularly sand lance and Pacific herring. Based on available data and scientific understanding, the mechanistic linkage between the oil spill, reduction in high-lipid forage fishes and the decline in marbled murrelets remains uncertain. Because of the great variability of marbled murrelet population annual census in the years after the spill, it is unlikely that the loss of even as much as 7-12% of the PWS population (the estimated spill mortality) would have been detectable by census techniques. Therefore, the original recovery objective should be revised to recovery of the population to a level to what would have occurred if the spill had never occurred. Lack of critical data, and conflicting information lead us to recommend that the status of this species to remain "unknown." Further, it is unlikely that further research will clarify injury status.

Recovery Status: Unknown

Recovery Objective: Marbled murrelets will have recovered when their population has recovered to a level had the spill not occurred. Sustained or increasing productivity within normal bounds will be an indication that recovery is underway.

2006 Objective: Marbled murrelets will have recovered when their populations are stable or increasing. Sustained or increasing productivity within normal bounds (based on adults and juveniles on the water) will be an indication that recovery is underway.

Harlequin Ducks

The harlequin ducks will have recovered when the population is stable or increasing and oil exposure biomarkers and demographics are similar in oiled and unoiled areas during both breeding and non-breeding seasons. Recent analyses still show a pattern of higher P4501A induction in oiled than unoiled areas. A temporal trend towards convergence between oiled and unoiled populations in chemical biomarkers and over-winter survivorship indicates that harlequin ducks are recovering. However, a sustained increase in abundance numbers is needed in oiled areas for full recovery.

Recovery Status: Recovering

Recovery Objective: Harlequin ducks will have recovered when breeding- and nonbreeding-season demographics and biochemical indicators of hydrocarbon exposure in harlequins in oiled areas of Prince William Sound are similar to those in harlequins in unoiled areas.

2006 Objective: Harlequin ducks will have recovered when breeding- and nonbreeding-season demographics return to prespill levels and when biochemical indicators of hydrocarbon exposure in harlequins in oiled areas of Prince William Sound are similar to those in harlequins in unoiled areas.

Black Oystercatchers

Black oystercatchers will have recovered when population levels, reproduction, productivity and oil exposure biomarkers have reached levels that would have existed without the spill. Evidence, however, still shows a high rate of nest failure and the continued exposure to oil. Population trends indicate a continued status of "recovering."

Recovery Status: Recovering

Recovery Objective: Black oystercatchers will have recovered when the population, reproduction and productivity and oil exposure biomarkers are within normal bounds. An increasing population trend and comparable hatching success and growth rates of chicks in oiled and unoiled areas, after taking into account geographic differences, will indicate that recovery is underway.

2006 Objective: Black oystercatchers will have recovered when the population returns to prespill levels and reproduction and productivity are within normal bounds. An increasing population trend and comparable hatching success and growth rates of chicks in oiled and unoiled areas, after taking into account geographic differences, will indicate that recovery is underway.

Killer Whales

Killer whales will have recovered when population levels, reproduction and productivity are within normal bounds in spill affected pods of killer whales, as would have existed without the spill. The weighted average annual productivity rate of the AB resident pod is 3.3% . This pod is considered recovering. AT1 pod transient population of killer whales, however, continues to decline, and therefore, is considered not recovering. The progress toward recovery is slow as key breeding females have been lost. Although there is a continuing decline in the AT1 killer whale pod , the stabilized reproduction rate of AB pod whales indicates a killer whale status of "recovering." for the AB pod and "not recovering" for the AT-1 pod.

Recovery Status: Recovering

Recovery Objective: The recovery objective for killer whales is a return to a prespill number of 36 for the AB pod and a stable population trend in AT1 pod.

2006 Objective: The recovery objective for killer whales is a return to a prespill number of 36 for the AB pod.

Sea Otters

Sea Otters will have recovered when population levels, reproduction and productivity are within normal bounds in oiled and unoiled areas and have reached levels that would have existed without the spill. Recovery will also be substantiated when the biochemical indicators of hydrocarbon exposure are similar within the oiled and unoiled areas. Although there has been slow increase since 2005 in the sea otter population within the heavily oiled areas, there has been a greater rate of overall increase in the population within Prince William Sound. Therefore, the sea otters continue to be recovering.

Recovery Status: Recovering

Recovery Objective: Sea otters will have recovered when the population in all oiled areas returns to conditions that would have existed had the spill not happened, and when biochemical indicators of hydrocarbon exposure in otters in the oiled areas are similar to those in otters in unoiled areas. An increasing population trend and normal reproduction and age structure in western Prince William Sound will indicate that recovery is underway.

2006 Update: Sea otters will have recovered when the population in oiled areas returns to its prespill levels and distribution, and when biochemical indicators of hydrocarbon exposure in otters in the oiled areas are similar to

those in otters in unoiled areas. An increasing population trend and normal reproduction and age structure in western Prince William Sound will indicate that recovery is underway.

Clams

Clams are continuing to recover in the Sound, but there still a difference in abundance between oiled and washed, oiled and unwashed, and unoiled sites. Data have suggested that disturbance of the rock armor of beaches continues to impede recovery. If this is true then recovery may require geological re-armoring processes that operate on decadal scales. Current population trends indicate a status of recovering.

Recovery Status: Recovering

Recovery Objective: Clams will have recovered when population and productivity measures at oiled and washed sites are comparable to populations and productivity measures at unwashed sites, when there is no oil exposure, and when abundances of large clams can provide adequate, uncontaminated food supplies for predators and subsistence users.

2006 Objective: Clams will have recovered when population and productivity measures (such as size and distribution) at oiled sites are comparable to populations and productivity measures at unoiled sites, taking into account geographic differences.

Designated Wilderness

Lingering oil persists in designated wilderness areas, and quantitative studies of lingering oil outside of the Sound are lacking. However, in many areas absolute amounts of oil are diminishing, therefore, designated wilderness areas are recovering but have not fully recovered from the oil spill.

Recovery Status: Recovering

Recovery Objective: Designated wilderness areas will have recovered when EVO is no longer encountered in them and the public perceives that they are recovered from the spill.

2006 Objective: No change.

Intertidal Communities and Sediments

As the recovery of intertidal communities and sediments are intrinsically linked, the Science Panel recommends that the recovery objective for sediments be added to the recovery objective of both intertidal and subtidal communities.

Reestablishment of functioning intertidal communities and the recovery of sediments are progressing, and both should remain classified as recovering. However, the slow recovery of some soft-sediment intertidal invertebrates, the presence of lingering, bioavailable oil, the continuing oil exposure from sediments of obligate intertidal foragers that are known to eat clams, and the lack of recent data characterizing the intertidal community indicate that this resource has not fully recovered from the effects of the oil spill.

Recovery Status: Recovering

Recovery Objective: Intertidal communities will have recovered when such important species as Fucus have been reestablished at sheltered rocky sites, clams and mussels at soft or mixed sediment beaches are not contaminated by residual oil, the differences in community composition and organism abundance on oiled and unoiled shorelines are no longer apparent after taking into account geographic differences, and the intertidal and nearshore habitats provide adequate, uncontaminated food supplies for predators and subsistence users.

2006 Objective (Intertidal): Intertidal communities will have recovered when such important species as Fucus have been reestablished at sheltered rocky sites, the differences in community composition and organism abundance on oiled and unoiled shorelines are no longer apparent after taking into account geographic differences, and the intertidal and nearshore habitats provide adequate, uncontaminated food supplies for top predators.

2006 Objective (Sediments): Sediments will have recovered when there are no longer significant residues of Exxon Valdez oil on shorelines (both intertidal and subtidal) in the oil spill area. Declining oil residues and diminishing toxicity are indications that recovery is underway.

Subtidal Communities and Sediments

As the recovery of subtidal communities and sediments are intrinsically tied, the Science Panel recommends that the recovery objective for sediments be added to the recovery objective of both intertidal and subtidal communities.

In the early 90's, several benthic organisms using the subtidal zones showed trends towards recovery, and hydrocarbon concentrations had declined to near background concentrations in many areas. However, consistent, systematic surveys have not been conducted for many species. Further study is unlikely to resolve remaining uncertainties, however, given the length of time since evidence of injury was last documented, the lack of subtidal oil for many years, and the resiliency and short generation times for the species that had shown lower populations in the oiled areas, it seems likely that recovery has occurred.

Recovery Status: Very Likely Recovered

Recovery Objective: Subtidal communities and sediments will have recovered when community composition in oiled areas, especially in association with eelgrass beds, is similar to that in unoiled areas or consistent with natural differences between, sites such as proportions of mud and sand, and that the subtidal community and sediments found within are no longer contaminated by lingering oil.

2006 Update (subtidal): Subtidal communities will have recovered when community composition in oiled areas, especially in association with eelgrass beds, is similar to that in unoiled areas or consistent with natural differences between, sites such as proportions of mud and sand.

2006 Objective (Sediments): Sediments will have recovered when there are no longer significant residues of Exxon Valdez oil on shorelines (both intertidal and subtidal) in the oil spill area. Declining oil residues and diminishing toxicity are indications that recovery is underway.

Mussels

Recent data indicate that hydrocarbon concentrations in mussels are declining, even in armored beaches where elimination has been slow, and at many sites recently sampled sites that had been oiled concentrations are not different from background. While a decrease in tissue concentration addresses part of the recovery objective, in order to be fully recovered mussels must provide uncontaminated food to top predators, including human subsistence users.

Recovery Status: Very Likely Recovered

Recovery Objective: Mussels will have recovered when population and productivity at oiled sites are comparable to populations and productivity at unoiled sites, when chemical markers no longer indicate oil exposure, and when mussels can provide adequate, uncontaminated food supplies for predators and subsistence users.

2006 Objective: Mussels will have recovered when concentrations of oil in the mussels reach background concentrations, and mussels do not contaminate their predators.

Pacific Herring

Despite the numerous studies to understand the effects of oil on herring, the factors constraining population recovery are not well understood. A combination of factors, including disease, predation and poor recruitment appear to contribute to the continued suppression of herring populations in the Sound. In summary, Pacific herring have not met their recovery objective. No strongly successful year class has been recruited into the population and health indices data show that several pathogens are established in herring in the Sound. Therefore, Pacific herring are classified as not recovering.

Recovery Status: Not Recovered

Recovery Objective: The population of PWS Pacific herring will be considered recovered when the spawning biomass has been above the current regulatory fishery threshold of 43,000 tons for 6 to 8 years; two strong recruitments (> 220 million) of age-3 fish have occurred during those 6 to 8 years, and spawning occurs in at least three geographic regions of the Sound.

2006 Objective: Pacific herring will have recovered when the next highly successful year class is recruited into the population and when other indicators of population health (such as biomass, size-at-age, and disease expression) are within normal bounds in Prince William Sound.

Rockfish

Since the spill, few studies have provided information about rockfish abundance, species composition and the impacts of commercial fisheries. Although it is unlikely that most species and life-stages of rockfish are currently being exposed to lingering oil, the original extent of injury was not documented. While the current understanding of the long-term effects of the original spill can not be determined, rockfish are very likely recovered .

Recovery Status: Very Likely Recovered

Recovery Objective: Due to the continuing lack of data on rockfish, no recovery objective can be identified.

2006 Update: No recovery objective can be identified.

Human Services – Commercial Fishing

No non-herring spill-related district-wide fishery closures related to oil contamination have been in effect since 1989, and populations of pink and sockeye salmon are considered recovered from the effects of the spill.The Prince William Sound herring fishery has been closed for 11 of the 17 years since the spill and herring are not considered recovered. Therefore, commercial fishing, as a lost or reduced service, is in the process of recovering from the effects of the oil spill, but full recovery has not been achieved.

Recovery Status: Recovering

Recovery Objective: Commercial fishing will have recovered when the commercially important fish species have recovered and opportunities to catch these species are not lost or reduced because of the effects of the oil spill.

2006 Objective: No change.

Human Services – Passive Use

Until the public no longer perceives that lingering oil is adversely affecting the aesthetics and intrinsic value of the spill area it cannot be considered recovered. Because recovery of a number of injured resources is incomplete and lingering oil persists on beaches, the Trustee Council should consider services related to passive use to be recovering from the effects of the spill, but not yet recovered.

Recovery Status: Recovering

Recovery Objective: Passive uses will have recovered when people perceive that aesthetic and intrinsic values associated with the spill area are no longer diminished by the oil spill.

2006 Objective: No change.

Human Services – Recreation and Tourism

Even though visitation has increased since the oil spill, the Trustee Council's recovery objective requires that the injured resources important to recreation be recovered and recreational use of oiled beaches not be impaired. Lingering oil remains on beaches and in some localized areas this remains a concern for users. Moreover, several natural resources have not recovered from the effects of the spill. Therefore, recreation continues to recover from the effects of the spill, but is not yet recovered.

Recovery Status: Recovering

Recovery Objective: Recreation and tourism will have recovered, in large part, when the fish and wildlife resources on which they depend have recovered, and recreation use of oiled beaches is no longer impaired.

2006 Objective: No change.

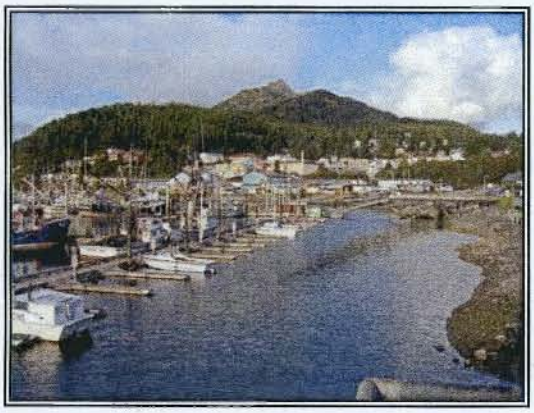
Human Use – Subsistence

Fears about food safety have diminished since the spill, but it is still a concern for subsistence users, especially related to clams and other marine invertebrates. Additionally, 2003 data indicate harvest levels and diversity of species used for subsistence purposes from villages in the spill area approximate pre-spill estimates. However, many subsistence resources injured by the spill, including clams, mussels, intertidal communities, herring and harbor seals, have not recovered from the effects of the spill and harvests of these resources remain lower than pre-spill levels. Furthermore, half of the households in the spill communities reported lower total subsistence uses than before the spill, subsistence users reported increased effort to harvest resources, and 72 percent of respondents said that the traditional way of life has not recovered from the spill. For these reasons, subsistence continues to recover from the effects of the oil spill, but has not yet recovered.

Recovery Status: Recovering

Recovery Objective: Subsistence will have recovered when injured resources used for subsistence are healthy and productive. In addition, there is recognition that people must be confident that the resources are safe to eat and that the cultural values provided by gathering, preparing, and sharing food need to be reintegrated into community life.

2006 Objective: No change.



Exxon Valdez Oil Spill Restoration Plan

2009 UPDATE INJURED RESOURCES AND SERVICES

DRAFT - December 31, 2008

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501
907-278-8012
www.evostc.state.ak.us

2009 UPDATE ON INJURED RESOURCES AND SERVICES

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2009 UPDATE ON INJURED RESOURCES AND SERVICES

INTRODUCTION

Purpose of the Injured Resources and Services List

In November 1994, the *Exxon Valdez* Oil Spill Trustee Council adopted an official list of resources and services injured by the Spill as part of its Restoration Plan[1]. The Injured Resources and Services List (List) serves three main purposes in the Restoration Program:

1. Initially, the List identified natural resource and human service injuries caused by the oil spill and clean-up efforts.

2. The List helped guide the *Restoration Plan* and was especially important in 1994 when the plan was first adopted. The List was created as guidance for the expenditure of public restoration funds under the Plan, and assisted the Trustees and the public with ensuring that money was expended on resources that needed attention. The List continues to serve that purpose today.

3. Finally, the status of injured resources on the List provides the Trustees and the public a way to monitor recovery of ecological functions and human services that depend on those resources.

Although the fish and wildlife resources that appear on the List experienced population-level or chronic injury from the spill, not every species that suffered some degree of injury was included. For example, carcasses of about 90 different species of oiled birds were recovered in 1989, but only 10 species of birds were included on the List.

Moreover, it should be noted that the analysis of resources and services in relation to their recovery status only pertains to amelioration of effects from the 1989 oil spill. When the Restoration Plan was first drafted, the distinction between effects of the oil spill and the effects of other natural or anthropogenic stressors on affected natural resources was not clearly delineated. At that time, the spill was recent; the impact to the spill area ecosystem was profound and adverse effects of the oil on biological resources were apparent. As time passes, the ability to distinguish effects of oil from other factors affecting fish and wildlife populations diminishes. Currently, natural and human perturbations may be hindering recovery of some resources initially injured by the spill. While those perturbations warrant consideration in defining and assessing recovery, they do not negate the responsibility of the Trustee Council to pursue restoration of spill-affected resources.

Restoration Goals and Objectives

The *Restoration Plan* guides the Trustee Council's restoration efforts with respect to resources and services in the spill-affected area (Figure 1)

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[1] *www.evostc.state.ak.us/Policies/restplan.htm*

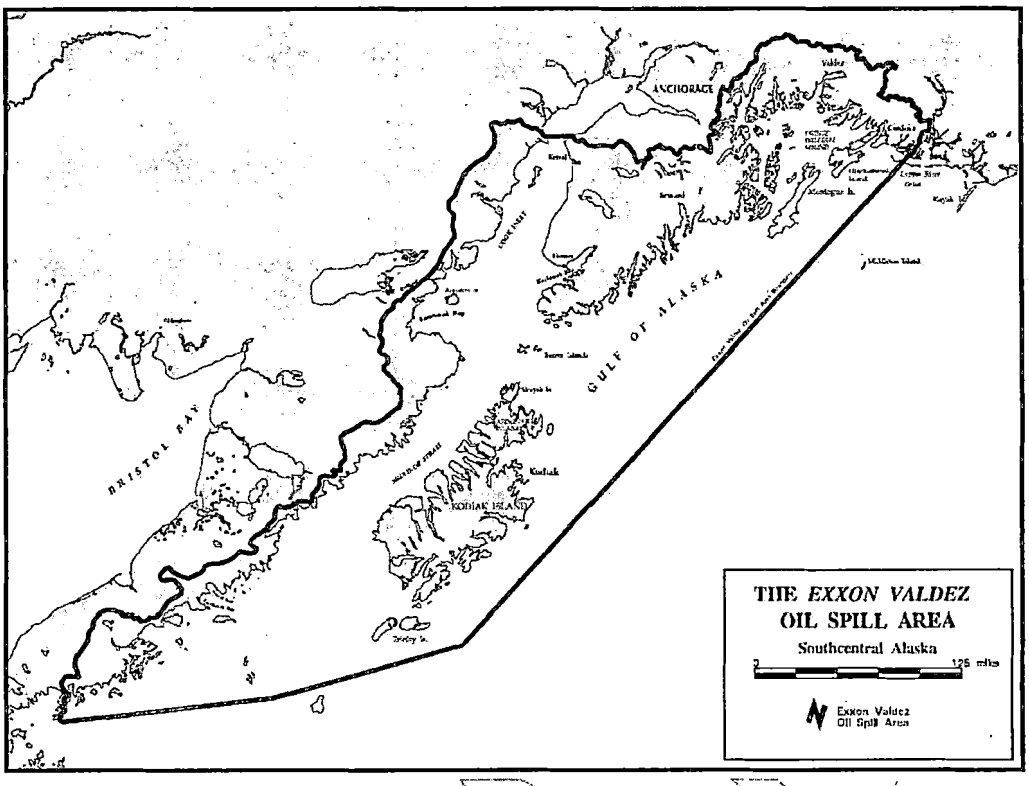

Figure 1: Map produced by: Alaska Department of Natural Resources, Land Records Information Service

It contains policies for making restoration decisions and describes how restoration actions will be implemented. As part of the *Restoration Plan*, the List was created to document injured resources that were of concern to the Trustee Council. The following benchmarks were established to assess the status of the resources and services injured by the oil spill:

- **Restoration Goal:** The overarching goal of the Restoration Program is the recovery of all injured resources and services, sustained by healthy, productive ecosystems to maintain naturally occurring diversity.

- **Recovery Goal of Injured Resources and Services:** The primary goal for all recovering injured resources and services is a return to conditions that would have existed had the spill not occurred.

- **Recovery Objective/s:** Specific, measurable parameters that, when achieved, signal the recovery of an injured resource or service.

- **Restoration Strategy:** The restoration strategy is a plan of action adopted by the Trustee Council to achieve recovery objectives.

It is difficult to predict conditions that would have existed in the absence of the spill. Therefore, the recovery objectives include measurable and biologically substantive parameters that can be used as proxies for these conditions. In some cases, multiple objectives are used for individual resources. For some resources, so little is known about the original or current injury or status that identifying a recovery objective has not been possible.

In the 2006 Update[2] to the List, the following factors were considered in the development of the Recovery Objectives established for injured resources:

- Return to pre-spill levels: Used where population estimates or indices were available prior to 1989. For species that are highly variable, these numbers could reflect a range of values. Where possible, these numbers account for the effects of other influences on injured populations, such as from climate change, although these other effects may interact with oil spill effects.

- Hydrocarbon exposure: Used where hydrocarbon exposure itself was part of the original basis for injury, where hydrocarbon exposure may limit recovery, or where hydrocarbon exposure in an injured resource may be a pathway to injury in other resources. Oil exposure may refer to background concentrations, which takes into account hydrocarbon exposure from natural oil seeps, natural coal deposits, and oil released from the Valdez petroleum plant as a result of the 1964 earthquake.

- Stable or increasing population: Used where resources were in decline before the spill or where ongoing declines unrelated to the spill may be occurring.

- Productivity: Reproductive success and population demographics are used in lieu of or to supplement data on population sizes. Measures include such indicators as eggs produced per female, young successfully reared, returns per spawning adult and growth rates.

In the 2009 List, the objectives were updated to address:

- Stressors other than oil that may be currently affecting a population.

- The likelihood that a resource has recovered given the amount of time that has lapsed since the spill.

- Changes to the environment in Prince William Sound since 1989 may make returning some resources to pre-spill levels unlikely.

- The addition of Barrow's goldeneyes to the List.

Recovery Status Categories:
The List has historically included four categories of recovery which are defined below. The categories represent a scale along which an injured resource can progress:

- **Not Recovering**: Resources that are not recovering continue to show little or no clear improvement from injuries stemming from the oil spill. Recovery objectives have not been met.

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[2] *http://www.evostc.state.ak.us/Publications/injuredresources.cfm*

- **Recovering:** Recovering resources are demonstrating substantive progress toward recovery objectives, but are still adversely affected by residual impacts of the spill or are currently being exposed to lingering oil. The amount of progress and time needed to attain full recovery varies depending on the species.

- **Recovered:** Recovery objectives have been met, and the current condition of the resource is not related to residual effects of the oil spill.

- **Recovery Unknown:** For resources in the unknown category, data on life history or the extent of injury from the spill is limited. Moreover, given the length of time since the spill, it is unclear if new or further research will provide information that will help in comprehensively assessing the original injury or determining the residual effects of the spill such that a better evaluation of recovery can occur.

Human services that rely on natural resources were also injured by the oil spill and can thus be placed in one of the above categories. Because the recovery status of injured services is inextricably linked to the state of the resource on which it depends, full recovery of the spill area can not occur until both resources and services are restored.

Update History: The *Restoration Plan* states that the List should be reviewed periodically and updated to reflect results from scientific studies and other information. A summary of how the list has changed since 1996 is available in Table 1.

A reassessment of the List is necessary to understand the consequences of the original spill and the effects of oil remaining in the environment. It also provides a way to identify areas where additional restoration activities are needed and documents each resource's progress toward its recovery objectives.

The List was first updated in September 1996. At that time, the bald eagle was upgraded from recovering to recovered. In March 1999, a major review of recovery objectives and status occurred and several more changes were made. River otters were then considered to be recovered, and five resources—black oystercatchers, clams, marbled murrelets, Pacific herring, and sea otters—were upgraded to recovering. One resource, the common loon, was moved from recovery unknown to not recovering. Five resources remained as recovery unknown. All four human services were classified as recovering.

Recovery continued to progress and more changes were made to the List in 2002. Five more species or resources were moved to the recovered category: archaeological resources, black oystercatchers, common murres, sockeye salmon and pink salmon. In addition, designated wilderness areas were moved from the recovery unknown to the recovering category; Pacific herring were moved back from the recovering to the not recovering category; subtidal communities were moved from the recovering to recovery unknown category; and killer whales were moved from not recovering to recovering. In all, seven resources were considered fully recovered from the effects of the oil spill; 16 resources and all four human services were not fully recovered; and the recovery of five resources was still considered unknown.

In 2006, the update acknowledged the recovery of common loons, cormorants, Dolly Varden, and harbor seals from the effects of the spill. Harlequin ducks were moved from not recovering

to recovering based on positive population trends, and marbled murrelets were moved from recovering to unknown.

Table 1: Historical and current overview of the status of injured resources and services during each reassessment year.

Resource	1996 Status	1999 Status	2002 Status	2006 Status	2009 Status
Archaeological Resources	Recovering	Recovering	Recovered	Recovered	Recovered
Bald Eagles	Recovered	Recovered	Recovered	Recovered	Recovered
Barrows goldeneyes	N/A	N/A	N/A	N/A	Recovering
Black Oystercatchers	Unknown	Recovering	Recovered	Recovering	Recovering
Clams	Unknown	Recovering	Recovering	Recovering	Recovering
Common Loons	Unknown	Not Recovering	Not Recovering	Recovered	Recovered
Common Murres	Recovering	Recovering	Recovered	Recovered	Recovered
Cormorants	Not Recovering	Not Recovering	Not Recovering	Recovered	Recovered
Cutthroat Trout	Unknown	Unknown	Unknown	Unknown	Unknown
Designated Wilderness	Unknown	Unknown	Recovering	Recovering	Recovering
Dolly Varden	Unknown	Unknown	Unknown	Recovered	Recovered
Harbor Seals	Not Recovering	Not Recovering	Not recovering	Recovered	Recovered
Harlequin Ducks	Not Recovering	Not Recovering	Not recovering	Recovering	Recovering
Intertidal Communities	Recovering	Recovering	Recovering	Recovering	Recovering
Killer Whales	Not Recovering	Not Recovering	Recovering	Recovering	Recovering
Kittlitz's Murrelets	Unknown	Unknown	Unknown	Unknown	Unknown
Marbled Murrelets	Not Recovering	Recovering	Recovering	Unknown	Unknown
Mussels	Recovering	Recovering	Recovering	Recovering	Recovering
Pacific Herring	Not Recovering	Recovering	Not recovering	Not recovering	Not recovering
Pigeon Guillemots	Not Recovering	Not Recovering	Not recovering	Not recovering	Not recovering
Pink Salmon	Recovering	Recovering	Recovered	Recovered	Recovered
River Otters	Unknown	Recovered	Recovered	Recovered	Recovered
Rockfish	Unknown	Unknown	Unknown	Unknown	Unknown
Sea Otters	Not Recovering	Recovering	Recovering	Recovering	Recovering
Sediments	Recovering	Recovering	Recovering	Recovering	Recovering
Sockeye Salmon	Recovering	Recovering	Recovered	Recovered	Recovered
Subtidal Communities	Recovering	Recovering	Unknown	Unknown	Unknown
Human Service	**1996 Status**	**1999 Status**	**2002 Status**	**2006 Status**	**2009 Status**
Commercial Fishing	Recovering[a]	Recovering	Recovering	Recovering	Recovering
Passive Use	Recovering[a]	Recovering	Recovering	Recovering	Recovering
Recreation & Tourism	Recovering[a]	Recovering	Recovering	Recovering	Recovering
Subsistence	Recovering[a]	Recovering	Recovering	Recovering	Recovering

[a] *Classified as "Lost or Reduced Service" in 1996 Update, meaning that the service was negatively indirectly impacted by the spill due to its connection with impacted natural resources*

Twenty years after oil spill, we are again evaluating the status of injured resources and services and providing a synopsis of the most current information available in the updated List. Based on the recommendations from the Science Panel and agency experts, the recovery objectives have been reviewed for each resource and service to ensure that the objectives are attainable and scientifically valid. Also, Barrows goldeneyes have been added to the list for the first time based on their continuing exposure to oil.

Recovery Status Determination

The recovery goal for injured resources is a condition that would exist in the absence of the *Exxon Valdez* oil spill (EVOS). It is important to understand that ecosystems are dynamic and the spill-affected area would have changed even without the spill. Given our limited ability to predict multi-year changes in marine ecosystems, it is difficult to know precisely what changes were inevitable had the spill not occurred. However, it is still possible to assess the recovery status of a particular resource by reviewing multiple sources of applicable information.

Types of information that were used to assess the recovery status of a particular resource or service included:

- initial magnitude of oil impacts to a population in the spill area
- comparisons of population demographic in oiled and reference areas
- survey data of community members in oiled and reference areas
- continued exposure to residual oil in the spill area as measured by the biomarker cytochrome P450 or tissue concentrations of petroleum hydrocarbons
- exposure potential as evaluated by the distribution of lingering oil; overlap in spatial distribution of lingering oil and a resource; and identification of an exposure pathway
- persistence of sublethal or chronic injuries
- intrinsic ability of the population to recover
- other natural or human-caused stressors

Even with such an evaluation, direct links cannot always be drawn between effects from the oil spill and the observed, current condition of a particular resource: in most cases the amount or type of data is insufficient to complete a cause and effect relationship. Specifically, we have little pre-spill data for many of the injured resources. Moreover, the physiological effects of oil on key species of wildlife and subsequent population consequences were not well understood at the time of the spill. As a result, few species exist for which we have complete knowledge of the original impacts of the oil spill. To mitigate the uncertainties inherent in evaluating recovery we reviewed current, relevant scientific information while acknowledging the limitations of assigning an ultimate cause and effect relationship using the existing data. The types of uncertainty found in the literature include:

1. *Variability in population estimates.* Because the patterns of animal distribution present challenges in getting accurate counts (especially of highly mobile fish, birds and marine mammals), most estimates of population size have wide ranges of variability associated with the data.

2. *Lack of pre-spill data.* Many of the resources affected by the spill had limited or no recent data on their status in 1989. Additionally, some of the available pertinent data were the result of limited sampling, which consequently produced wide confidence intervals around the population estimates.

3. *Interaction of spill and natural factors.* It is increasingly difficult to separate what may be lingering effects of the spill from changes that are natural or caused by factors unrelated to the oil spill.

4. *Scale.* The geographic scale of studies conducted over the years has varied among resources and this disparity must be considered when interpreting data and applying results to recovery status. Some studies were conducted at the large spatial scale to address population and ecosystem concerns, while other studies focused on localized exposure and effects of oil.

Ecosystem Perspective and Recovery

The List consists mainly of single species and resources, but it provides a basis for evaluating the recovery of the overall ecosystem; its functions and the services it provides to people. In fact, through the *Restoration Plan*, the Trustee Council adopted an ecological approach to restoration, and the studies and projects the Trustee Council sponsors have been ecologically-based.

The *Restoration Plan* defines ecosystem recovery as follows:

> *Full ecological recovery will have been achieved when the population of flora and fauna are again present at former or pre-spill abundances, healthy and productive, and there is a full complement of age classes at the level that would have been present had the spill not occurred. A recovered ecosystem provides the same functions and services as would have been provided had the spill not occurred.*

Although significant progress has been made, using this definition of recovery, the coastal and marine ecosystems in the oil spill region have not fully recovered at this time from the effects of the oil spill. For example, harlequin ducks still show signs of oil exposure and may be negatively affected by such exposure. A number of other species and communities are showing signs of recovery, but are still not fully recovered from the effects of the oil spill. Although full ecological recovery has not been achieved, the spill area ecosystem is making progress towards recovery 20 years after the *Exxon Valdez* oil spill.

INJURED RESOURCES

ARCHAEOLOGICAL RESOURCES

Injury

The oil spill area is believed to contain more than 3,000 sites of archaeological and historical significance. Twenty-four archaeological sites on public lands are known to have been adversely affected by clean-up activities or looting and vandalism linked to the oil spill. Additional sites on both public and private lands were probably injured, but damage assessment studies were limited to public land and not designed to identify all such sites.

Documented injuries included theft of surface artifacts, masking of subtle clues used to identify and classify sites, violation of ancient burial sites, and destruction of evidence in layered sediments. In addition, residual oil may have contaminated sites.

Recovery Objective

Archaeological resources are nonrenewable: they cannot recover in the same sense as biological resources. Archaeological resources will be considered to have recovered when spill-related injury ends, looting and vandalism are at or below pre-spill levels, and the artifacts and scientific data remaining in vandalized sites are preserved (e.g., through excavation, site stabilization, or other forms of documentation).

Recovery Status
Assessments of 14 sites in 1993 suggested that most of the archaeological vandalism that can be linked to the spill occurred early in 1989, before adequate constraints were put into place over the activities of oil spill clean-up personnel. Most vandalism took the form of "prospecting" for high yield sites. Once these problems were recognized, protective measures were implemented and successfully limited additional injury. Although some cases of vandalism were documented in the 1990s, there appears to be no spill-related vandalism at the present time.

From 1994-1997, two sites in Prince William Sound were partly documented, excavated, and stabilized by professional archaeologists because they had been so badly damaged by oiling and erosion. The presence of oil in sediment samples taken from four sites in 1995 did not appear to have been the result of re-oiling by Exxon Valdez oil. Residual oil does not appear to be contaminating any known archaeological sites.

In 1993, the Trustee Council provided part of the construction costs for the Alutiiq Archaeological Repository in Kodiak (www.alutiiqmuseum.com). This facility now houses Kodiak area artifacts that were collected during spill response. In 1999, the Trustee Council approved funding for an archaeological repository and local display facilities for artifacts from Prince William Sound and lower Cook Inlet. Local displays are open to the public in Port Graham, Cordova, Seward, Seldovia, and Tatitlek. The facility in Seward serves as the repository for the Chugach region.

Based on the apparent absence or extremely low rate of spill-related vandalism and the preservation of artifacts and scientific data on archeological sites, archaeological resources are considered to be recovered.

BALD EAGLES

Injury
The bald eagle is an abundant resident of marine and riverine shorelines throughout the oil spill area. Following the oil spill, a total of 151 eagle carcasses were recovered from the spill area. Prince William Sound provides year-round and seasonal habitat for about 6,000 bald eagles, and within the Sound it is estimated that about 250 bald eagles died as a result of the spill. There were no estimates of mortality outside the Sound, but there were deaths throughout the spill area. In addition to direct mortalities, productivity was reduced in oiled areas of Prince William Sound in 1989.

Recovery Objective
Bald eagles will have recovered when their population and productivity (reproductive success) have returned to pre-spill levels.

Recovery Status
Productivity (or reproductive success as measured by chicks per nest) was back to pre-spill levels in 1990 and 1991, and an aerial survey of adults in 1995 indicated that the population had returned to or exceeded its pre-spill level in the Sound.

In September 1996, the Trustee Council classified the bald eagle as recovered from the effects of the oil spill.

BARROW'S GOLDENEYES

Injury
Barrow's goldeneyes are sea ducks that winter in protected nearshore marine waters in Prince William Sound and feed in the intertidal zone, consuming mussels, aquatic insects, fish and fish eggs.

Some acute mortality of Barrow's goldeneyes was observed in the weeks and months immediately following the *Exxon Valdez* oil spill in March 1989. Total acute mortality of Barrow's goldeneyes is difficult to determine, given uncertainty in carcass identification and recovery rates, but sea ducks, generally, were vulnerable to acute mortality and constituted approximately 25percent of the carcasses recovered in Prince William Sound. Given the number of Barrow's goldeneyes present at the time of the spill, acute mortality was likely in the thousands.

Of more concern are longer-term effects due to either chronic exposure to lingering oil or indirect effects of trophic web disruption. Because Barrow's goldeneyes occur exclusively in intertidal and shallow subtidal habitats, they would be particularly vulnerable to effects of lingering oil. Similarly, reliance on intertidal invertebrate prey would suggest that Barrow's goldeneyes are particularly vulnerable to disruptions of intertidal communities. Barrow's goldeneyes have been shown to have higher levels of induction of cytochrome P4501A (CYP1A) in oiled areas compared to unoiled areas. Elevated CYP1A induction in Barrow's goldeneyes from oiled areas of Prince William Sound was documented in 1997 and 2005. While these do not necessarily demonstrate subsequent injury, the potential for individual- or population-level effects of exposure to residual oil is plausible.

Recovery Objective
Barrow's goldeneyes will have recovered when breeding- and nonbreeding-season demographics and biochemical indicators of hydrocarbon exposure in goldeneyes in oiled areas of Prince William Sound are similar to those of goldeneyes in unoiled areas.

Recovery Status
Within their wintering range, Prince William Sound is an important area, supporting between 20,000 and 50,000 wintering individuals. Survey data from the U.S. Fish and Wildlife Service indicated that winter numbers of goldeneyes on oiled areas were stable from 1990-1998, in contrast to significantly increasing numbers on unoiled areas during that same time period. That was interpreted as evidence of lack of recovery, as the prediction would be that lack of continued injury would result in parallel population trajectories and that recovery would be indicated by more positive trajectories on oiled areas. In the most recent published survey (through March 2005), slopes were parallel and stable over time, although this was due primarily to a decrease in goldeneye abundance on unoiled areas.

A study of Barrow's goldeneye habitat use in oiled and unoiled portions of Prince William Sound found that densities of birds in oiled areas were at expected levels, given the habitat, suggesting that the oil spill had not led to depressed numbers at the time of the study (1996 and 1997).

Interpretation of surveys and habitat selection is constrained by lack of full understanding

of Barrow's goldeneye demography, particularly rates of site fidelity and dispersal. These values have important implications for understanding the process of population recovery.

The continued induction of CYP1A through March 2005 and the only recent lack of difference between oiled and unoiled areas, suggest that the Barrow's goldeneyes have not yet recovered from the effects of the oil spill.

BLACK OYSTERCATCHERS

Injury

Black oystercatchers spend their entire lives in or near intertidal habitats and are highly vulnerable to oil pollution. They are fully dependent on the nearshore environment and forage exclusively on invertebrate species along shorelines. It is estimated that 1,500-2,000 oystercatchers breed in south-central Alaska. Only nine carcasses of adult oystercatchers were recovered following the spill, but the actual number of mortalities may have been several times higher.

In addition to direct mortalities, breeding activities were disrupted by the oil and clean-up activities. When comparing 1989 with 1991, significantly fewer pairs occupied and maintained nests on oiled Green Island, while during the same two years the number of pairs and nests remained similar on unoiled Montague Island. Nest success on Green Island was significantly lower in 1989 than in 1991, but Green Island nest success in 1989 was not lower than on Montague Island. In 1989, chicks disappeared from nests at a significantly greater rate on Green Island than from nests on Montague Island. Disturbance associated with clean-up operations also reduced productivity on Green Island in 1990. In general, the overt effects of the spill and clean-up had dissipated by 1991, and in that year productivity on Green Island exceeded that on Montague Island.

Recovery Objective

Black oystercatchers will have recovered when the population, reproduction and productivity and oil exposure biomarkers are within normal bounds. An increasing population trend and comparable hatching success and growth rates of chicks in oiled and unoiled areas, after taking into account geographic differences, will indicate that recovery is underway.

Recovery Status

Black oystercatchers are long-lived (15+ years) and territorial, occupying nests in rocky areas close to the intertidal zone and returning in successive years to nest again in the same vicinity. In the early 1990s, elevated hydrocarbons in feces were measured in chicks living on oiled shorelines. Deleterious behavioral and physiological changes including, lower body weight of females and chicks were also recorded. Because foraging areas are limited to a few kilometers around a nest, contaminations of mussel beds in the local vicinity was thought to provide a source of exposure. In 1998 the Trustee Council sponsored a study to reassess the status of this species in Prince William Sound. The data indicated that oystercatchers had fully reoccupied and were nesting at oiled sites in the Sound. The breeding phenology of nesting birds was relatively synchronous in oiled and unoiled areas, and no oil-related differences in clutch size, egg volume, or chick growth rates were detected. However, a higher rate of nest failure occurred on oiled Green Island: At the time this was thought to be the result of predation, not lingering effects of oil. Because the extent of shoreline with persistent contamination was limited and lingering oil

was patchy, it was concluded that the overall effects of oil on oystercatchers in the Sound had been minimal. However, the reasons that predation was higher at oiled Green Island than at Montague were not investigated. It is not clear whether predation was higher because there were higher numbers of predators, lower number of nests initiated or a behavioral change in the parents that would have led to lower nest protection.

Based on this study and one year of boat-based surveys (2000) of marine birds in Prince William Sound indicating that there were increases in numbers of oystercatchers in both the oiled and unoiled areas for that year, the black oystercatcher was identified as recovered. Since 2002, however, additional information has come to light indicating that designation may have been premature. A long-term (1989 – 2005) evaluation of marine bird population trends suggest that populations of black oystercatchers in the Sound have likely not recovered to pre-spill conditions.

Further, ongoing oil exposure to oystercatchers was documented in 2004 using a biochemical marker of exposure, cytochrome P450IA. Given our more recent understanding of the persistence of oil in sediments along shorelines that initially received heavy or moderate oiling, it is likely that black oystercatchers in oiled areas have suffered chronic exposure as has been shown for sea otters and harlequin ducks. Hydrocarbon exposure in 2004 is likely considerably less than in the early 1990's, but at this time, we do not know if there are any significant physiological or population level consequences from chronic exposure.

Therefore, because population trends do not indicate recovery over 18 years of surveys, because a high rate of nest failure occurred in the oiled study area in the late 1990s, and because in 2004, continuing exposure of black oystercatchers to oil was reported, this species is listed as recovering.

CLAMS

Injury

Clams are widely distributed throughout the oil spill area. They can be found in a variety of substrates and are most abundant in the lower intertidal and subtidal zones. Clams are important prey for various fish and wildlife resources including sea otters, some sea birds, sea ducks and others.

The magnitude of the immediate impacts of oil on clam populations varied depending on species of clam, degree of oiling and location. Although direct mortality of some clam species like littlenecks and butter clams were assessed for several years after the spill, other more sensitive species, (e.g., *Macoma* and *Mya* spp) were not the focus of much study, and the immediate impact of the oil to these species remains unknown. In 1990 and 1991, growth of littleneck clams at oiled sites was less than at reference sites, and growth rate was directly proportional to hydrocarbon concentrations. Additionally, mortality was higher and growth rates lower in clams transplanted from oiled areas to clean areas, five to seven years after the spill.

Clean-up technologies were detrimental to clam populations, including hot water, high pressure washing, manual and mechanical scrubbing and physical removal of oiled sediments. Hot water washing caused thermal stress, oil dispersal into the water column, animal displacement and burial, and the transportation of fine grain sediment from the upper intertidal into the lower

intertidal zone. Early assessments reported that clean-up activities resulted in reductions in clam abundance and distribution on treated (oiled-but-treated) beaches up to three years after the spill.

Recovery Objective
Clams will have recovered when population and productivity measures at oiled and washed sites are comparable to populations and productivity measures at unwashed sites, when there is no oil exposure, and when abundances of large clams can provide adequate, uncontaminated food supplies for predators and subsistence users.

Recovery Status
Studies have indicated that abundances of some species of clams were lower on treated beaches through 1996. Densities of littleneck and butter clams were depressed through 1997 on cleaned mixed-sedimentary shores where fine sediments had been washed down the beach during pressured water treatments.

As part of an investigation of sea otter populations conducted from 1996-1998, researchers compared clam densities between oiled sites on Knight Island and unoiled sites on Montague Island. They reported an increase in mean size of littlenecks and butter clams at Knight Island, where numbers of sea otters, a major predator of clams were significantly reduced. Absolute densities of littlenecks and butter clams were not different between oiled and unoiled sites; however, oiled sites had fewer juvenile clams and lower numbers of other clam species. In 2002, differences in species richness, diversity and abundance of several species were still measurable between cleaned (oiled and treated) and untreated (oiled but untreated) beaches. Moreover, as of 2005, several wildlife species that use the intertidal zone and feed on clams (e.g., harlequin ducks and black oystercatchers) are still being exposed to oil. These resources are included on the injured resources list and although the exact route of oil contamination has not been established for these birds, it is likely they are ingesting oil with their prey.

Some overlap occurs between areas where lingering oil and populations of littleneck and butter clams co-exist. Given the burrowing behavior of these animals, it is likely they would be exposed to oil as they dig into the subsurface sediments known to contain oil. In fact, it has been demonstrated that littleneck clams exposed for a year to the surface layer of contaminated sediments did not accumulate oil, but if the clams were buried in sediments mixed with oil, accumulation did occur.

Clam populations found on oiled but untreated beaches have likely recovered from the effects of the spill. However, several factors continue to impact clam populations on oiled and treated beaches: Abundances and distribution differences are still measurable between cleaned and untreated sites; Lingering oil occurs in habitats with clams, and exposure of clams to oil could result in upper trophic level predators eating contaminated prey and other species on the injured resources list are still being exposed to oil and are known to forage on clams.

Based on all of the evidence summarized above, clams continue to recover, but are not yet fully recovered from the effects of the oil spill.

COMMON LOONS

Injury

Carcasses of 395 loons of four species were collected following the spill, including 216 common loons. Current population sizes in the spill area are not known for any of these species, but it is estimated that the 216 collected common loons represented between 720 – 2,160 total individuals that died as a result of the initial oiling event. Common loons in the spill area may number only a few thousand, including only hundreds in Prince William Sound. Common loons injured by the spill probably included a mixture of wintering and migrating birds. The specific breeding areas used by the loons affected by the spill are not known.

Recovery Objective

Common loons will have recovered when their population returns to pre-spill levels in the oil spill area. An increasing population trend in Prince William Sound will indicate that recovery is underway.

Recovery Status

Boat-based surveys of marine birds in Prince William Sound give some insight into the recovery status of the loons affected by the oil spill. Pre-spill counts of loons exist only for 1972-1973 and 1984-1985. After the spill, contrasts between oiled and unoiled areas of the sound indicated that loons as a group were generally doing better in unoiled areas than in oiled areas. Thus, the survey data suggested that the oil spill had a negative effect on numbers of loons (all species combined) in the oiled parts of the Sound.

Common loons exhibited declines in population numbers and habitat usage in oiled areas in 1989 but not in 1990. There was a weak negative effect of oiling on population numbers again in 1993, but not in 1996 or 1998. Based on the boat surveys carried out through 2000, there were indications of recovery, because in that year the highest counts ever recorded for common loons in PWS. In addition, July 2000 counts were the third highest of the 11 years since 1972, although these increases were limited to the unoiled portion of the Sound. Loons are a highly mobile species with widely variable population numbers and the pre-spill data were limited, thus this one year of high counts in the unoiled areas was insufficient to indicate that recovery had started.

Population surveys conducted from 1989 - 2005 found increasing winter population trends in common loon densities in oiled areas. The summer counts do not show a consistent positive relationship, however the summer counts of loons are usually low and variable because they are predominately found on their breeding grounds in other areas during the summer. Common loons have an intrinsically low population growth rate and relatively large numbers of carcasses were recovered after the spill, yet post spill winter population counts of common loons have met or exceeded available pre-spill counts for all years measured since the spill, except 1993.

Given the long-term positive changes in winter population information, common loons are considered recovered from effects of the oil spill.

COMMON MURRES

Injury

About 30,000 carcasses of oiled birds were picked up in the first four months following the oil spill, and 74 percent of them were common and thick-billed murres (mostly common murres). Many more murres probably died than actually were recovered. Based on surveys of index breeding colonies at such locations as the Barren Islands, Chiswell Islands, Triplet Islands, Puale Bay, and Ugiaushak Island, the spill area populations may have declined by about 40 percent following the spill. In addition to direct losses of murres, there is evidence that the timing of reproduction was disrupted and productivity decreased. Interpretation of the effects of the spill, however, is complicated by incomplete pre-spill data and by indications that populations at some colonies were in decline before the oil spill.

Recovery Objective

Common murres will have recovered when populations at index colonies have returned to pre-spill levels and when reproductive success (productivity) is sustained within normal bounds. Increasing population trends at index colonies will be an indication that recovery is underway.

Recovery Status

Postspill monitoring at the breeding colonies in the Barren Islands indicated that productive success was within normal bounds by 1993, and it has stayed within these bounds each breeding season since then. During the period 1993-1997, the murres nested progressively earlier by two to five days each year, suggesting that the age and experience of nesting birds were increasing, as might be expected after a mass mortality event. By 1997, numbers of murres at the Barren Island had increased, probably because three- and four-year old nonbreeding sub-adult birds that were hatched there in 1993 and 1994 were returning to their natural nesting colony. Although counts were low in 1996, the counts in 1997 at this index site brought the colony size to pre-spill levels.

The population size coupled with normal reproductive success (productivity), indicate that recovery has been achieved for common murres.

CORMORANTS

Injury

Cormorants are large fish-eating birds that spend much of their time on the water or perched on rocks near the water. Three species of cormorants are typically are found within the oil spill area. Carcasses of 838 cormorants were recovered following the oil spill, including 418 pelagic, 161 red-faced, 38 double-crested, and 221 unidentified cormorants. From this sample, direct oil spill related mortality was estimated at between 2,900 and 8,800 deaths. In 1996, the U.S. Fish and Wildlife Service Alaska Seabird Colony Catalog, however, listed counts of 7,161 pelagic cormorants, 8,967 red-faced cormorants, and 1,558 double-crested cormorants in the oil spill area. These are direct counts at colonies, not overall population estimates, but they suggest that population sizes are small. In this context, it appears that injury to all three cormorant species was significant.

Counts on the outer Kenai Peninsula coast suggested that the direct mortality of cormorants due to oil resulted in fewer birds in this area in 1989 compared to 1986. In addition, there were statistically-significant declines in the estimated numbers of cormorants (all three species combined) in the oiled portion of Prince William Sound based on pre and postspill boat surveys in July 1984-85 compared to 1989-91. It is not known what the counts and trends of cormorants would have been in the absence of the oil spill.

Recovery Objective
Pelagic, red-faced, and double-crested cormorants will have recovered when their populations return to pre-spill levels in oiled areas. An increasing population trend in Prince William Sound will indicate that recovery is underway.

Recovery Status
Marine bird surveys were conducted in ten of the 16 years between 1989-2005. For cormorants, trends for both summer and winter populations were increasing in the oiled area of Prince William Sound. Moreover, population estimates for cormorants in summer 2004 ranged from 9,000 – 11,000 birds, which falls within the range of 10,000 - 30,000 estimated in 1972. **Therefore, although population estimates of cormorants are highly variable throughout their range, the recovery objectives have been met and cormorants are considered to be recovered.**

CUTTHROAT TROUT

Injury
Anadromous streams throughout the spill zone were oiled following the spill in 1989, and oil was sequestered in the intertidal sediments at stream mouths and along shorelines. Subsequently, it was documented that cutthroat trout emigrating within the oiled areas in 1989 -1990 grew more slowly than those in the unoiled areas. When trout leave their freshwater spawning areas they feed primarily in the nearshore environment, thus it is likely cutthroats were exposed to oil in this environment. The difference in growth rates between trout in oiled versus unoiled streams persisted through 1991. It was hypothesized that the slower rate of growth in oiled streams was the result of reduced food supplies or direct exposure to oil, and there was concern that reduced growth rates resulted in reduced survival.

Recovery Objective
Cutthroat trout will have recovered when growth rates within oiled areas are similar to those for unoiled areas, after taking into account geographic differences.

Recovery Status
Limited information exists regarding the current status of cutthroat trout. Recent exposure to lingering oil is unlikely, because most of the bioavailable oil appears to be confined to subsurface intertidal areas, and not dissolved in the water column. Moreover, distribution of cutthroat trout is patchy throughout the Sound, thus access to oil is restricted. However, the Sound is the northern edge of cutthroat trout range and dispersal during marine migration is restricted, thereby increasing their susceptibility to habitat alteration and pollution. Cutthroat trout populations in the Sound are small and geographically isolated from each other: These characteristics suggest that recovery of a population would depend less on mixing with nearby aggregates than on the productivity of the endemic population and the extent to which it was

injured by the spill. Confounding factors such as sport fishing and habitat alteration of spawning streams (e.g., through logging) may also inhibit successful recruitment of young into a population and subsequent increase in numbers.

Finally, growth rate data has not been collected since the early 1990s, thus the recovery objective has not been demonstrated. The recovery status of cutthroat trout remains unknown.

DESIGNATED WILDERNESS AREAS

Injury

The spill deposited oil into the waters and tidelands adjoining areas designated as Wilderness or Wilderness Study Areas by Congress or the Alaska State Legislature. During the intense clean-up seasons of 1989 and 1990, thousands of workers and hundreds of pieces of equipment were at work in the spill zone. This activity was an unprecedented imposition of people, noise, and activity on the area's undeveloped and normally sparsely occupied landscape. Although human activity levels on these wilderness shores have returned to normal, lingering oil still occurs at some locations. The spill-affected areas were: designated wilderness in the Katmai National Park, wilderness study areas in the Chugach National Forest and Kenai Fjords National Park, and Kachemak Bay Wilderness State Park.

Recovery Objective

Designated wilderness areas will have recovered when oil is no longer encountered in them and the public perceives that they are recovered from the spill.

Recovery Status

Six moderately to heavily oiled sites on the Kenai and Katmai coasts were surveyed in 1994, at which time some oil mousse persisted in a remarkably unweathered state on boulder-armored beaches at five sites. These sites were visited again in 1999, and oil was found along park shorelines of the Katmai coast. Surveys carried out in 2001 and 2003 to determine the surface and subsurface distribution of oil in Prince William Sound found lingering oil on shorelines within designated wilderness study areas. Finally, in 2005 the sites surveyed in 1999 were again sampled. Although surface cover of oil had declined, the subsurface oil persisted in amounts similar to those found in 1999. Moreover, the oil at those sites was compositionally similar to samples collected 11-days after the spill.

Lingering oil persists in designated wilderness areas, and quantitative studies of lingering oil outside of Prince William Sound are lacking. However, in many areas absolute amounts of oil are diminishing. Therefore, designated wilderness areas are recovering but have not fully recovered from the oil spill.

DOLLY VARDEN

Injury

Dolly Varden are widely distributed in the spill area. Adults spawn in natal streams and most overwinter in contiguous freshwater lakes. Migration into the marine environment occurs in the summer where the fish spend time feeding in nearshore waters. Many fish were in freshwater when the oil spill occurred but emigrated in and out of the spill area later in the season.

Concentrations of hydrocarbons in the bile of Dolly Varden were some of the highest of any fish sampled in 1989. Like the cutthroat trout, there is evidence from 1989-90 that Dolly Varden, in a small number of oiled index streams in Prince William Sound, grew more slowly than in unoiled streams. It was hypothesized that the slower rate of growth in oiled streams was the result of reduced food supplies or exposure to oil, and there was concern that reduced growth rates would result in reduced survival.

Recovery Objective Dolly Varden will have recovered when growth rates within oiled streams are comparable to those in unoiled streams, after taking into account geographic differences.

Recovery Status
The growth differences between Dolly Varden in oiled and unoiled streams did not persist into the 1990-91 winter, but no growth data have been gathered since 1991. In addition, by 1990 the concentrations of hydrocarbons in bile had dropped substantially and a biochemical marker of oil exposure had a diminished.

In a 1991 restoration study sponsored by the Trustee Council, some tagged Dolly Varden moved considerable distances among streams within Prince William Sound, suggesting that mixing of overwintering stocks takes place during the summer in saltwater. Follow up studies indicate that Dolly Varden are abundant throughout the Sound, and genetically similar among geographically different aggregates. Frequent genetic exchange among groups of fish implies that mixing occurs, and outside populations are available to enhance depleted stocks. Moreover, fishing pressure on Dolly Varden is likely not as intense as that on coastal cutthroat trout. Populations are larger, the fish are more widely spread throughout the Sound and larger numbers can better tolerate harvest. Finally, current exposure to lingering oil is unlikely because most of the bioavailable oil is confined to subsurface intertidal areas and not dissolved in the water column.

Given the available evidence, Dolly Varden are considered to be recovered from effects of the oil spill.

HARBOR SEALS

Injury
Harbor seal numbers were declining in the Gulf of Alaska, including in Prince William Sound, before the oil spill. *Exxon Valdez* oil affected harbor seal habitat, including key haul-out areas and adjacent waters, in Prince William Sound and as far away as Tugidak Island, near Kodiak. Estimated mortality as a direct result of the oil spill was about 300 seals in oiled parts of Prince William Sound. In some parts of the Sound, 80 percent of the seals had oil on them in May 1989 and remained oiled until their molt in August. Some of the haul-out sites were oiled through the pupping season, and many pups became oiled shortly after birth. Based on aerial surveys conducted at trend-count haulout sites in central Prince William Sound before (1988) and after (1989) the oil spill, seals in oiled areas declined by 43 percent, compared to 11 percent in unoiled areas.

Recovery Objective
Harbor seals will have recovered from the effects of the oil spill when their population is stable or increasing.

Recovery Status
Harbor seal populations in the Sound were declining before the oil spill and the decline continued after the spill occurred. Factors contributing to this decline may involve environmental changes that occurred in the 1970s in which the amount and quality of prey resources were diminished. It is possible that the changes in the availability of high quality forage fish such as Pacific herring and capelin altered the ecosystem such that it may now support fewer seals than it did prior to the late 1970s. Other sources of mortality that may be contributing to lower seal numbers could include predation, subsistence hunting, and commercial fishery interactions (e.g., entanglement and drowning in nets).

Satellite tagging studies sponsored by the Trustee Council and genetic studies carried out by the National Marine Fisheries Service indicate that harbor seals in the Sound are largely resident throughout the year and have limited movement and interbreeding with other subpopulations in the northern Gulf of Alaska. This suggests that recovery must come largely through recruitment and survival within resident populations.

Based on annual counts from haulouts concentrated in the south-central region of the Sound, seal numbers stabilized from 1996 – 2005 and likely increased between 2001- 2005. From 1990-2005, seal numbers at sites that were not oiled decreased at a greater rate than oiled sites, indicating no localized effects of the spill. However, the entire spill zone was not surveyed, and trends may have been influenced by movements of seals from oiled to unoiled sites after the spill and a return to more oiled sites in recent years. This hypothesis has not been studied directly. **Collective evidence from the last ten years indicates that harbor seal population numbers are stabilizing or increasing. Therefore, harbor seals are considered recovered from effects of the oil spill.**

HARLEQUIN DUCKS

Injury
Harlequin ducks spend most of their time in intertidal and shallow subtidal habitats where much of the oil was initially stranded. In Prince William Sound, about 150 harlequin duck carcasses were collected immediately after the spill in 1989. From these recovered birds, it was estimated that 1,000 harlequins were killed by the initial oiling event, which represented about 7 percent of the wintering population. In addition to acute effects, harlequin ducks were one of the few species for which chronic injury related to long-term exposure to lingering oil was documented.

Recovery Objective
Harlequin ducks will have recovered when breeding- and nonbreeding-season demographics and biochemical indicators of hydrocarbon exposure in harlequins in oiled areas of Prince William Sound are similar to those in harlequins in unoiled areas.

Recovery Status
Winter populations of harlequin ducks in Prince William Sound have ranged from a high of 19,000 ducks in 1994 to a low of around 11,000 ducks in March of 1990, one year after the spill. The 2000 estimate of wintering harlequin ducks in the Sound was approximately 15,000.

Several post-spill studies were designed to measure the extent and severity of injuries to the Prince William Sound harlequin duck population from the oil spill and assess recovery. Through 1998, oil spill effects were still evident although the extent and magnitude of the injury remained

unclear. Supporting studies provided evidence of continuing injury to harlequins through the following mechanisms: 1) invertebrate recovery in upper intertidal and subtidal areas remained incomplete for some species, thereby impacting potential prey base for harlequins; 2) oil persisted in intertidal areas of Prince William Sound where it was identified as a source of contamination of benthic invertebrates; 3) the possibility of external oiling of feathers remained due to lingering surface oil; 4) a biochemical marker of oil exposure (cytochrome P450) was greater in tissues of harlequin ducks captured in oiled areas than in reference areas and 5) overwinter female survival was lower in oiled than reference areas.

More recent studies indicate improving conditions. From 1997 – 2005, age composition and population trends were compared in harlequin ducks between oiled and unoiled areas of the Sound. No difference in population trends was observed between areas. Although populations in the oiled area were no longer declining as they were in the mid 1990s, a positive trend was not observed. Overall, more males than females occurred Sound-wide which is consistent with other Pacific populations of harlequin ducks. The ratio of immature to adult males was similar between areas, thus indicating similar recruitment into both populations. However, there remains a disproportionately lower number of female ducks in the oiled areas. From 2000 – 2002, measurements of cytochrome P450 activity and female survival rates were converging between oiled and unoiled areas. However, in 2005 and 2008 the P450 biomarker was elevated in ducks from the oiled areas. Finally, lingering oil still remains in habitats used by harlequins, thereby maintaining the possibility of chronic effects related to continued exposure.

Evaluation of population trends, survival measures, and indicators of exposure through 2008 indicates a positive relationship among these parameters within harlequin duck populations in the Sound. The evidence suggests that harlequin ducks are recovering, but have not fully recovered from the effects of the oil spill.

INTERTIDAL COMMUNITIES

Injury

Over 1,400 miles of coastline were oiled by the spill in Prince William Sound, on the Kenai and Alaska peninsulas, and in the Kodiak Archipelago. Heavy oiling affected approximately 220 miles of this shoreline. It is estimated that 40-45 percent of the 11 million gallons of crude oil spill by the Exxon Valdez washed ashore in the intertidal zone. For months after the spill in 1989, and again in 1990 and 1991, both oil and intensive clean-up activities had significant impacts on the flora and fauna of this environment.

Initial impacts to the intertidal zone occurred at all tidal levels and in all types of habitats throughout the oil spill area. Direct assessment of the spill effects included sediment toxicity testing, documenting abundance and distribution of intertidal organisms and sampling ecological parameters of community structure. Dominant species of algae and invertebrates directly affected by the spill included common rockweed, speckled limpet, several barnacle species, blue mussels, periwinkles, and oligochaete worms. At lower elevations on gravel and mixed sand/gravel beaches, the abundance of sediment organisms and densities of clams declined. Large numbers of dead and moribund clams were documented on treated beaches, but these effects were likely due to a combination of oil toxicity and hot water washing. Intertidal fish were also affected. In a study conducted in different habitats, density and biomass of fish at oiled sites showed declines relative to reference sites in 1990.

Recovery Objective
Intertidal communities will have recovered when such important species as *Fucus* (marine algae/seaweed) have been reestablished at sheltered rocky sites, clams and mussels at soft or mixed sediment beaches are not contaminated by residual oil, the differences in community composition and organism abundance on oiled and unoiled shorelines are no longer apparent after taking into account geographic differences, and the intertidal and nearshore habitats provide adequate, uncontaminated food supplies for predators and subsistence users.

Recovery Status
By 1991, in the lower and middle intertidal zones, algal coverage and invertebrate abundances on oiled rocky shores had returned to conditions similar to those observed in unoiled areas. However, large fluctuations in the algal coverage in the oiled areas caused a subsequent alteration in community structure. The *Fucus* canopy was initially eliminated in most of the areas that underwent extensive cleaning, thereby removing the protection provided by this alga to intertidal organisms from predation, desiccation and abrasion. This early eradication of *Fucus* led to instability of this alga's subsequent populations because the single-aged stands present after recolonization of the habitat were susceptible to large synchronous die-offs. Until a broader distribution of mixed-aged stands is established, this cycle may continue for many generations. Meanwhile, full recovery of *Fucus* is crucial for the recovery of intertidal communities at oiled sites, because many intertidal organisms depend on the shelter this seaweed provides.

As of 1997, *Fucus* had not yet fully recovered in the upper intertidal zone on shores oriented towards direct sunlight, but in many locations, recovery of intertidal communities had been substantial. In other habitat types, such as estuaries and cobble beaches, many species did not show signs of recovery when they were last surveyed in 1991. Studies on the effects of clean-up activities on oiled and washed beaches showed some invertebrates, like molluscs and annelid worms were still much less abundant than on comparable unoiled beaches through 1997. It is undetermined how much recovery has occurred in these locations since 1997, because further work has not been conducted.

Lingering oil is still present in some intertidal areas within the spill zone. Recent studies indicate that at beaches with pockets of buried lingering oil, high amphipod mortality is associated with elevated hydrocarbon concentrations. Moreover, the recovery objective states that the intertidal zone must provide uncontaminated food to top predators, including human subsistence users. As recently as 2005, some bird species which rely exclusively on the intertidal zone (harlequin ducks, Barrow's goldeneye and black oystercatchers) were still being exposed to hydrocarbons. Although the route of oil exposure has not been established, it is possible they are consuming contaminated prey during feeding.

Reestablishment of functioning intertidal communities is progressing, and they are classified as recovering. However, the slow recovery of some soft-sediment intertidal invertebrates, the presence of lingering, bioavailable oil, the continuing oil exposure of obligate intertidal foragers that are known to eat clams, and the lack of recent data characterizing the intertidal community indicate that this resource has not fully recovered from the effects of the oil spill.

KILLER WHALES

Injury

More than 160 killer whales in eight resident (fish eating) pods regularly use Prince William Sound/Kenai Fjords as part of their ranges. Transient (marine mammal eating) groups are observed in the Sound less frequently, but some (the AT1 population) use the Sound year-round. After the spill, the loss of individual whales from the resident AB pod was of particular concern. At the time of the spill, this group numbered 36 animals, and from 1989 - 1990, fourteen whales disappeared. During that time no young were recruited into the population. Members of the transient AT1 population were also observed in the area of the spill and adjacent to the tanker as it was leaking oil. Two stranded whales were found in 1990, but their cause of death was not determined.

The original link between the AB pod losses and the oil spill was largely circumstantial. No carcasses of any resident whales were discovered. However, whales were observed surfacing in Exxon Valdez oil slicks following the spill in 1989 and nearly all of the deaths occurred at the time of the spill or the following winter. It is likely that petroleum or petroleum vapors were inhaled by whales, and it is also possible that they ate contaminated fish. The mortality rate for the AB pod was 19 percent in 1989 and 21 percent in 1990, compared to an expected natural mortality rate of 2.2 percent or less.

The AT1 population also suffered losses subsequent to the spill. The AT1 population centers its range around the Sound and Kenai Fjords. From 1984 – 1989, their numbers were stable at 22 regularly observed individuals, but in a retrospective analysis it was determined that nine whales disappeared shortly after the spill. Because transients may occasionally leave their groups and swim with other transient whales, it could not be immediately determined if these whales were dead. However, in the subsequent 15 years these individuals were not seen by researchers with any other transient groups and they had not reappeared with their original group. Thus, they were considered deceased. It was hypothesized that these whales died from inhaling toxic oil vapors or as a result of eating oiled harbor seals.

Initially it was difficult to confirm deaths of individual whales from the AT1 population. However, since 1990, 14 whales have gone missing from the AT1 group and are now almost certainly deceased (five of the carcasses were found on beaches). During that same period there has been no recruitment of calves into this group of transients. The timing and magnitude of missing individuals directly following the spill and the fact that the ATI pod is a year-round resident of the Sound suggests that oil may have caused a decline immediately after the spill.

Recovery Objective

The recovery objective for killer whales is a return to a pre-spill number of 36 for the AB pod and a stable population trend in AT1 pod.

Recovery Status

From 1990–1995 seven calves were born within the AB pod: however, additional mortalities occurred and by 2005, the number of whales was only 27. Killer whales are long-lived and slow to reproduce. Female killer whales give birth about every five years, and are likely to produce only four to six calves throughout their life. Moreover, a disproportionate number of females were lost at the time of the spill, and population modeling has demonstrated that the spill impacted the AB pod primarily through the loss of young and reproductive females. Unexpected

mortalities in the years since the spill have also impacted this group. These factors indicate that the recovery rate of this population after a large loss of individuals will be slow.

Transient killer whales, such as the AT1 pod, largely prey on marine mammals, especially harbor seals. From data collected at haul-outs in the south-central region of the Sound, it appears that harbor seals numbers may have increased over the past five years. It is unclear how the population dynamics of harbor seals influence transient whale populations, but changes in the availability of such an important prey species could impact survival of individuals and reproductive success within groups. Research sponsored by the Trustee Council on contaminants in killer whales in the Sound indicates that individuals of the AT1 group are carrying elevated levels of PCBs, DDT, and DDT metabolites in their blubber. Although the presence of these contaminants is not related to the oil spill, the high concentrations found in these transients are comparable to levels that cause reproductive problems in other marine mammals. Accordingly, it is likely that the population dynamics of this group are being influenced by factors other than residual oil which may further their ability to rebound from the initial injury from the spill.

Killer whales have not met their recovery objective; however numbers of whales in the AB pod have increased from 22 to 29. Therefore, they are considered recovering from the effects of the spill.

KITTLITZ'S MURRELETS

Injury

The Kittlitz's murrelet is found only in Alaska and portions of the Russian Far East. A large percentage of the world population, which may number only a few tens of thousands, breed in Prince William Sound. The Kenai Peninsula coast and Kachemak Bay are also important concentration areas for this species.

Seventy-two Kittlitz's murrelets were positively identified among the bird carcasses recovered after the oil spill. Nearly 450 more Brachyramphus murrelets were not identified to the species level, and it is reasonable to assume that some of these were Kittlitz's. In addition, many more murrelets probably were killed by the oil than were actually recovered. Estimates of the total number of Kittlitz's murrelets that died as a result of the spill vary from 255 – 2,000; it has been suggested that this represents 5 – 10 percent of the world's population.

Recovery Objective

Kittlitz's Murrelets will have recovered when their population is stable. Stable or increasing productivity within normal bounds will be an indication that recovery is underway.

Recovery Status

Few studies have been conducted on Kittlitz's murrelets, however they are known to nest in areas of glacial outcroppings, and they are thought to reside within the Sound from May until September/October. Kittlitz's murrelets have an intrinsically low population growth rate, thus recovery from an acute loss is likely to be slow.

The Kittlitz's murrelet is a candidate species for listing as threatened or endangered under the federal Endangered Species Act. They declined 99 percent from 1972 to 2004 and 88 percent from 1989 – 2004. While this decline likely started prior to the spill, the rate of decline was 18

percent per year from 1972, but beginning in 1989 that rate increased to 31 percent. The recovery status of Kittlitz's is complicated because confounding factors influence their current population growth. The decline may be attributable in part to a decline in a primary food source; high-lipid forage fish, like sand lance and Pacific herring. However, other factors with no potential connection to the oil spill-e.g., habitat loss, likely play a significant role as well. For example, most of the tidewater glaciers in the Sound associated with these birds are receding, and this is apparently causing a concurrent shift in murrelet distribution. **Because of the uncertainties surrounding the original extent of injury and the current limited availability of life history data, the Kittlitz's murrelets remain in the unknown category.**

MARBLED MURRELET

Injury

Marbled murrelets are found throughout the northern Gulf of Alaska and are known to concentrate in Prince William Sound. Carcasses of nearly 1,100 Brachyramphus murrelets were found after the spill, and about 90 percent of the murrelets that could be identified to the species level were marbled murrelets. Since they are a small bird and not easily seen, many more murrelets probably were killed as a result of the oil than were found. Estimates vary but between 2,900 and 14,800 individuals were killed by the initial oiling and this represented 6 – 12 percent of the marbled murrelets in the spill area. In addition to direct mortality, foraging activity and behavior was likely disrupted during the clean-up activities.

Recovery Objective

Marbled murrelets will have recovered when their population has recovered to a level had the spill not occurred. Sustained or increasing productivity within normal bounds will be an indication that recovery is underway.

Recovery Status

Marbled murrelets were declining in the Sound before the oil spill, and the decline has continued since the spill. It is listed as a threatened species in Washington, Oregon, California and British Columbia. Marbled murrelets have low intrinsic productivity and a slow population growth rate. Therefore, recovery from an acute loss will likely take many years.

Summer populations in the Sound declined from an estimated 304,000 birds in 1972 to 97,000 shortly after the spill. Population trends from 1989 – 2005 do not indicate increasing numbers of marbled murrelets. Comparing summer population trend data of marbled murrelets between oiled and unoiled areas is difficult because of widespread nesting distributions and overlapping foraging ranges. Moreover, declines in marbled murrelet breeding populations are occurring in both oiled and unoiled areas. Similar trends throughout the Sound suggest that factors, other than or in addition to the oil spill are influencing murrelet populations. Marbled murrelets rely on forage fish such as Pacific herring and sand lance, which are declining in the spill area for various reasons including a potential link to the oil spill. Although a correlation between the availability of forage fish and the production of young murrelets appears to exist, there is conflicting evidence that links declines in prey resources with the oil spill. However, other factors with no potential link to the spill, such as climate change, decreases in habitat availability and mortalities from the gill net fisheries are probably influencing marbled murrelet population dynamics. Although lingering oil exists in the Sound, the dietary preference and foraging areas of marbled murrelets do not provide much opportunity for current exposure.

Marbled murrelets do not meet their specific recovery objective of increasing or stable populations. Moreover, their decline could be attributable in part to a decline in a primary food source; high-lipid forage fish, like sand lance and Pacific herring. Based on available data, we cannot make a direct link among the decline in forage fish, the effects of the spill and the decline in marbled murrelets. Therefore, the recovery status for marbled murrelets is unknown.

MUSSELS

Injury

Mussels are a keystone species in the nearshore environment throughout the spill area and are locally important for subsistence users. They provide prey for harlequin ducks, black oystercatchers, juvenile sea otters, river otters and many other species. Mussel beds are also important components of intertidal habitats because they provide physical stability and habitat for other organisms in the intertidal zone. Although mussels were coated with oil from the *Exxon Valdez*, dense mussel beds were purposely not disturbed during clean-up operations so the stability and habitat they provided would be preserved. However, some unconsolidated groups of mussels were subjected to hot water high pressure washing.

In 1989, after the spill, concentrations of oil in mussel tissue from the oiled area increased rapidly. These concentrations were typically far higher than in mussels from nonoiled areas (or in mussels sampled from 1977-1979). The chemical composition of this oil was consistent with *Exxon Valdez* oil. Long-term mussel contamination occurred where substantial amounts of oil was trapped in sediment; primarily within coarse-textured habitats, including heavily oiled beaches exposed to considerable wave and storm energy (e.g., Sleepy Bay). In 1991, high concentrations of relatively unweathered oil were found in the mussels and in underlying byssal mats and sediments in certain dense mussel beds. No differences in abundance or biomass were documented in sheltered rocky and estuarine habitats. However, in coarse-textured habitats along the Kenai Peninsula, mussel populations were still affected.

Recovery Objective

Mussels will have recovered when population ands productivity at oiled sites are comparable to populations and productivity at unoiled sites, when chemical markers no longer indicate oil exposure, and when mussels can provide adequate, uncontaminated food supplies for predators and subsistence users.

Recovery Status

The primary route by which mussels accumulate oil is through ingestion of petroleum hydrocarbons in the water. Much of the lingering oil in the Sound and the Gulf of Alaska is sequestered in the subsurface sediments. Mussels are found both as epibiota, attached to the surface substrates, and also partially embedded in coarse sediment, where they could come into close contact with oiled sediments. It is possible that mussels could filter particulate and dissolved hydrocarbons from the water if the oil is re-suspended during storm surges, wave action or when underlying sediments are disturbed by predators. The current distribution of oil within a mussel bed is determined by water flow, amount of oil present, sediment grain size, and disturbance history.

After the spill, hydrocarbons accumulated in mussels for about a decade at sites where oil was retained in sediments. Remaining oil was biologically available for many years after the spill, but the frequency of occurrence and average hydrocarbon concentrations in mussel tissue has declined with time. In most instances concentrations of oil in mussels from the most heavily oiled beds in Prince William Sound were largely indistinguishable from background by 1999. However, concentrations in sediment underlying the mussel beds remained elevated.

Recent data indicate that hydrocarbon concentrations in mussels are declining, even in armored beaches where elimination has been slow, and at many sites concentrations are not different from background. While a decrease in tissue concentration addresses part of the recovery objective, in order to be fully recovered mussels must provide uncontaminated food to top predators, including human subsistence users. As recently as 2008, some bird species which rely exclusively on the intertidal zone (harlequin ducks, Barrow's goldeneye and black oystercatchers) were still being exposed to hydrocarbons. The route of oil exposure has not been established for these birds, however, it is possible that they are consuming contaminated prey or foraging in contaminated sediment during feeding. For many of these species mussels are a known prey item, and they could be foraging in contaminated sediments underlying mussel beds. **Because it cannot be verified that predators are not being exposed to oil while foraging in mussel beds, mussels are considered to be recovering from the effects of the oil spill.**

PACIFIC HERRING

Injury

Pacific herring are an ecologically and commercially important species in the PWS ecosystem. They are central to the marine food web; providing food to marine mammals, birds, invertebrates and other fish. Herring are also commercially fished for food, bait, sac-roe and spawn on kelp.

Pacific herring spawned in intertidal and subtidal habitats in Prince William Sound shortly after the oil spill. All age classes and a significant portion of spawning habitats and staging areas in the Sound were contaminated by oil. Juvenile and adult herring typically come to surface at night to feed and would have had increased exposure probability at this time. Lesions and elevated hydrocarbon levels were documented in some adult Pacific herring from the oiled areas. Laboratory studies showed abnormalities and possible depressed immune functions in Pacific herring exposed to oil. Significant adult mortality was not observed in 1989, but this would not be unexpected given the heavy predation or scavenging by different groups of predators. Egg mortalities and larval deformities were also documented in the 1989 year class, but population level effects of the spill were never clearly established.

Prior to the spill, herring populations in the Sound were increasing as documented by record harvests in the late 1980s. However, four years after the spill a dramatic collapse of the fishery occurred, and the herring population has never rebounded. Herring populations are dominated by occasional, very strong year classes that are recruited into the overall population. The 1988 pre-spill year-class of Pacific herring was large in Prince William Sound, and as a result, the estimated peak biomass of spawning adults in 1992 was high. Despite the expectation that this large spawning event would lead to high numbers of fish, the population exhibited a density-dependent reduction in size of individuals, and in 1993 there was an unprecedented crash of the adult herring population in PWS. The overall 1993 harvest was about 14 percent of the 1992

harvest, and the 1989 year class was one of the smallest cohorts ever to return as spawning adults.

Recovery Objective
The population of PWS Pacific herring will be considered recovered when the spawning biomass has been above the current regulatory fishery threshold of 43,000 tons for 6 to 8 years; two strong recruitments (> 220 million) of age-3 fish have occurred during those 6 to 8 years, and spawning occurs in at least three geographic regions of the Sound.

Recovery Status
The herring fishery in the Sound has been closed for 15 of the 20 years since the spill. The population began increasing again in 1997 and the fishery was opened briefly in 1997 and 1998. However, the population increase stalled in 1999, and recent research suggests that the opening of the fishery in 1997 and 1998 stressed an already weakened population and contributed to the 1999 decline. The fishery has been closed since then and no trend suggesting healthy recovery has occurred.

One of the primary factors currently limiting recovery of herring in the Sound seems to be disease. Two pathogens, a virus and a fungal infection are prevalent in herring populations among several age classes. Conditions which made herring susceptible to these two diseases (viral hemorrhagic septicemia and Icthyophonus hoferi infection) are unknown, but it appears they have been impacting herring for over a decade. These diseases do not usually distress fish populations for such a long duration, and this cycle seems to be unique to the herring of Prince William Sound.

Lingering oil exists in the Sound, however there does not appear to be much overlap between current herring spawning areas and sites known to harbor residual oil. In 2006, some herring spawn was observed in areas of the Sound that were oiled however, the spatial extent was limited, and this was the first year in decades that it has been reported. Therefore, it is not likely that lingering oil is directly affecting spawning adults, eggs or larvae.

Low genetic diversity does not appear to be a limitation within herring populations. It was suggested that historic overfishing coupled with the population crash of 1993 could have resulted in a population with low genetic diversity. Similar genetic structure could limit a population's ability to tolerate disease or recover from acute losses, but the genetic diversity of Prince William Sound herring is no different from other northwest populations.

Multigenerational toxicity and effects from original contact with oil does not seem plausible, however this hypothesis has not been directly investigated.

Other factors may have contributed to the crash of 1993. Some evidence implies that zooplankton production in the 1990s was less than in the 1980s, thereby causing food to be limited at the time of a peaking population. This hypothesis is offered some support by the fact that the average size-at-age of herring had been decreasing since the mid-1980s as population numbers were rising. Poor nutrition may also increase susceptibility of herring to disease.

Predation also plays a role in herring population dynamics, as they are a primary forage fish within the Prince William Sound ecosystem. It is plausible that the small herring population is

fighting an on-going disease problem and is further being kept in check by predators such as whales, seals, sea lions and seabirds.

Despite the numerous studies directed at understanding the effects of oil on herring, the causes constraining population recovery are not well understood. A combination of factors, including disease, predation and poor recruitment appear to contribute to the continued suppression of herring populations in the Sound. In summary, PWS Pacific herring have not met their recovery objective. No strongly successful year class has been recruited into the population and health indices suggest that herring in the Sound are not fit. Therefore, the Pacific herring are classified as not recovering.

PIGEON GUILLEMOTS

Injury

Although pigeon guillemots are widely distributed in the North Pacific region, they do not occur anywhere in large concentrations. An estimated 2,000 - 6,000 guillemots, representing 10-15 percent of the spill area population, died from acute oiling. Additionally, an increase in nest predation of pigeon guillemot chicks and incubating adult birds occurred in the Sound after the spill. Researchers speculated that immediately after the spill, predators such as river otters and minks preyed more heavily on nesting guillemots due to heavy oiling and subsequent reduction of their customary shellfish prey.

Recovery Objective

Pigeon guillemots will have recovered when their population is stable. Sustained or increasing productivity within normal bounds will be an indication that recovery is underway.

Recovery Status

Pigeon guillemot populations were likely declining prior to the spill and this decline has continued through 2008. The causes of the decline are unclear and the extent to which the spill has been a factor has not been determined. From 1989 to 1991, pigeon guillemot abundance decreased more in oiled areas than in unoiled areas, and this accelerated decrease persisted in most years through 2001. Summer surveys along both oiled and unoiled shorelines of the Sound have indicated that numbers of guillemots continued to decline through 2005. March surveys reveal no significant trends in abundance although the data appear to suggest a decline at this time of year as well.

As of 1999, adult pigeon guillemots in the oiled areas were still being exposed to oil as indicated by elevation of a biochemical marker of exposure, cytochrome P450. No differences were found between P450 activity in chicks from oiled and unoiled sites. The difference in P450 activity between adults and chicks is probably due to the fact that pigeon guillemot chicks are fed primarily fish, while adults eat a combination of fish and invertebrates. Invertebrates are more likely to sequester petroleum compounds, whereas fish metabolize them. Data collected in 2004 indicated that there was no difference in P450 activity in adult pigeon guillemots collected in oiled and unoiled parts of the Sound.

Lingering oil occurs in habitats used by pigeon guillemots. They feed on fish and invertebrates by diving and probing the substrate with their bills. Because their diet includes benthic organisms living in the intertidal zone, they could encounter subsurface oil while foraging.

However, guillemots do not use the intertidal zone exclusively and can travel several miles offshore to feed. Thus, their exposure to lingering oil is likely intermittent.

Reduction in forage fish, specifically herring and sand lance, has been implicated in declines of pigeon guillemots. The extent to which the oil spill resulted in the depletion of these species could indirectly injure guillemots and other seabirds by removing the food resources on which they depend. Other factors, such as predation and interactions with commercial fisheries, might be contributing to the negative population trend; however comprehensive studies including these variables have not been conducted.

Pigeon guillemot populations are not recovering in the spill area. In fact, populations have been steadily declining throughout the Sound since the spill. The reduction of Pacific herring as a prey species, coupled with the potential for direct exposure of pigeon guillemots to lingering oil in localized intertidal areas, supports a conclusion that pigeon guillemots remain in the category of not recovering from the effects of the spill.

PINK SALMON

Injury

Up to 75 percent of wild pink salmon in Prince William Sound spawn in the intertidal portions of streams. Eggs deposited in gravel and developing embryos were chronically exposed to hydrocarbon contamination from the water column and from leaching oil deposits on adjacent beaches. When juvenile pink salmon migrate to saltwater, they spend several weeks foraging for food in nearshore habitats. Thus, juvenile salmon entering seawater from both wild and hatchery sources were likely exposed to oil as they swam through contaminated waters and fed along oiled beaches. Two primary types of injury impacted early life stages of pink salmon: 1) growth rates in both wild and hatchery-reared juvenile pink salmon from oiled parts of the Sound were reduced; and 2) increased embryo mortality was documented in oiled versus unoiled streams.

Recovery Objective

Pink salmon will have recovered when population indicators, such as juvenile growth and survival, are within normal bounds and when ongoing oil exposure, which may cause injury to pink salmon embryos (eggs), is negligible.

Recovery Status

In the years preceding the spill, returns of wild pink salmon in Prince William Sound varied from a maximum of 23.5 million fish in 1984 to a minimum of 2.1 million in 1988. Many factors, such as the timing of spring plankton blooms and changes in water circulation patterns throughout the Gulf of Alaska are likely to have a great influence on year-to-year returns in both wild and hatchery stocks of pink salmon. Since the spill, returns of wild pinks have varied from a high of about 12.7 million fish in 1990 to a low of about 1.9 million in 1992. In 2001 the return of wild stock fish was estimated to be 6.7 million fish.

The decade preceding the oil spill was a time of peak productivity for pink salmon in the Sound. In 1991 and 1992, it appears that wild adult pink salmon returns to the Sound's Southwest District were reduced by 11 percent; however wild salmon returns are naturally highly variable. Furthermore, the methods used to estimate this decrease could not be used to produce reliable injury estimates across multiple generations of salmon. An analysis of escapement data from 1968-2001 did not show any differences in annual escapements between oiled and unoiled parts

of the Sound. Therefore, population-level effects from the spill did not impact wild pink salmon or were short-lived.

Sound-wide population levels appear to be within normal bounds. In addition, reduced juvenile growth rates in Prince William Sound occurred only in the 1989 season. Since then, juvenile growth rates have been within normal bounds.

Higher embryo mortality persisted in oiled streams when compared to unoiled streams through 1993: These differences were not detected from 1994 - 1996, but higher embryo mortality was again reported in 1997. It could not be determined if the reemergence of elevated embryo deaths was due to the effects of lingering oil (perhaps newly exposed by storm-related disturbance of adjacent beaches), or due to other natural factors (e.g., differences in the physical environment). Although patches of lingering oil still persist in or near intertidal spawning habitats in a few of the streams used by pink salmon in southwestern Prince William Sound, the amounts were considered negligible based on 1999 and 2001 studies. In 1999, dissolved oil was measured in six pink salmon streams that had been oiled in 1989. Only one of the six streams had detectable concentrations of oil, and they were about a thousand times lower than concentrations reported as toxic to developing pink salmon embryos. **Based on these results, continuing exposure of pink salmon embryos to lingering oil is negligible and unlikely to limit pink salmon populations. Given the fact that pink salmon population levels and indicators such as juvenile growth and survival were within normal bounds, pink salmon were considered recovered from the effects of the oil spill in 1999.**

RIVER OTTERS

Injury

River otters have a low population density in Prince William Sound. Twelve river otter carcasses were found following the spill, but the actual total mortality is not known. Studies conducted during 1989-91 identified several differences between river otters in oiled and unoiled areas in the Sound, including biochemical alterations, reduced body size, and increased home-range size. The lack of comparable pre-spill information precluded any effort to determine if these differences were the result of the oil spill.

Recovery Objective

The river otter will have recovered when biochemical indicators of hydrocarbon exposure or other stresses and indices of habitat use are similar between oiled and unoiled areas of Prince William Sound, after taking into account any geographic differences.

Recovery Status

Although some of the differences (e.g., values of blood characteristics) between river otters in oiled and unoiled areas in Prince William Sound were apparent through 1996, they did not persist in 1997 and 1998. **In 1999, the Trustee Council considered river otters to be recovered, because the recovery objectives had been met and indications of possible lingering injury from the oil spill were not present.**

ROCKFISH

Injury
Dead rockfish were observed throughout the Sound immediately following the spill, but an absolute count was never documented. Necropsies of five fish indicated that oil ingestion was the cause of death. Additionally, hydrocarbon concentrations in dead fish from oiled areas were higher than those from unoiled areas. Closures to salmon fisheries apparently caused increasing fishing pressure on rockfish, which may have adversely affected local populations.

Recovery Objective
Due to the continuing lack of data on rockfish, no recovery objective can be identified.

Recovery Status
From 1989 – 1991, higher petroleum hydrocarbon concentrations were measured in rockfish from oiled areas when compared to unoiled areas. Interpretation of these data is limited, however, because oil accumulation differs by species and by age of the fish, and these variables were not fixed across sites. Other Council-funded studies have been conducted on rockfish since the spill, including 1) an examination of larval growth of fish, (including rockfish) in 1989; 2) a genetics investigation designed to identify species of rockfish larvae and young in the Gulf of Alaska and 3) a microscopic examination of fish tissues to identify lesions associated with oil exposure. These studies were inconclusive as none of them directly linked exposure of *Exxon Valdez* oil to any of the endpoints that were measured.

It is unlikely that rockfish are currently being exposed to lingering oil because known pockets of lingering oil rarely occur in their preferred habitat. Documented lingering bioavailable oil is in the subsurface sediments of the intertidal zone, and rockfish mostly occur in differing habitats of subtidal areas and in pelagic environments. From 1999 – 2000, no differences were measured in physiological responses to oil in rockfish from oiled and unoiled areas.

Since the spill, few studies have provided information about rockfish abundance, species composition and the impacts of commercial fisheries. Although it is unlikely that most species and life-stages of rockfish are currently being exposed to lingering oil, the original extent of injury was not documented. **Therefore, the current understanding of the long-term effects of the original spill can not be determined. The recovery status of rockfish remains unknown.**

SEA OTTERS

Injury
Sea otters were originally found throughout the north Pacific including Japan, Russia, the United States and Canada. By the late 1800s, they had been eliminated from most of their range due to over-harvest by Russian and American fur traders. Sea otters came under international protection in the early 1900s and since then, their numbers have rebounded. Today, sea otters can only be harvested for subsistence purposes. Surveys of sea otters in the 1970s and 1980s indicated a healthy and expanding population in most of Alaska, including Prince William Sound.

Hundreds of otters became coated with oil in the days following the spill, and 871 carcasses were collected throughout the spill area. Estimates of the total number of sea otters lost to acute

mortality vary, but range as high as 40 percent (2,650) of the approximately 6,500 sea otters inhabiting the western areas of the Sound. In 1990 and 1991, higher than expected proportions of prime-age adult sea otters were found dead in western Prince William Sound. Higher mortality of recently weaned juveniles in oiled areas was documented through 1993. Continuing studies of mortality rates, based largely on sea otter carcass recoveries, suggest that relatively poor survival of otters in the oiled area has persisted for well over a decade.

Recovery Objective
Sea otters will have recovered when the population in all oiled areas returns to conditions that would have existed had the spill not happened, and when biochemical indicators of hydrocarbon exposure in otters in the oiled areas are similar to those in otters in unoiled areas. An increasing population trend and normal reproduction and age structure in western Prince William Sound will indicate that recovery is underway.

Recovery Status
No apparent population growth occurred for Prince William Sound sea otters through 1991. After 1993, the population in the western Sound began increasing at a rate approximately one-half of the pre-spill rate of increase. From 1993–2000, the number of otters increased by 600 animals which represents an annual growth rate of 4 percent. However, in areas that were heavily oiled, such as northern Knight Island, sea otter populations have remained well below pre-spill numbers, and population trends continued to decline through 2005. Moreover, the demographics within this group apparently are not stable as many of the females are below reproductive age and young, non-territorial males have moved into and out of the population.

The lack of recovery may reflect the extended time required for population growth for a long-lived mammal with a low reproductive rate, but likely reflects the effects of chronic exposure to hydrocarbons, or a combination of both factors. Food limitation does not appear to be a factor limiting recovery in the Knight Island group, because food resources are at least as plentiful there as they are at unoiled Montague Island. Productivity is also similar between oiled and unoiled sites. Exposure of sea otters to lingering oil is plausible because their foraging sites and prey species occur in habitats harboring oil. Additionally, biochemical responses (cytochrome P450) of oil exposure were elevated in animals from oiled sites through 2002. By 2004 – 2005, the response of this biomarker was similar in animals from oiled and unoiled areas. However, additional years of data will need to be gathered to determine if the similarity is true convergence, and the apparent diminishing exposure to oil is a long-term trend.

Sea otter recovery is underway for much of western Prince William Sound, and sea otters are generally increasing in much of the spill area. However, the data from otters in heavily oiled Knight Island reflect a population that is not rebounding. Factors affecting this population could include residual or continuing oil effects, predation, subsistence use or a combination of multiple causes. **Therefore, sea otters continue to be in the recovering category.**

SEDIMENTS

Injury
The Exxon Valdez spilled approximately 11 million gallons of crude oil into Prince William Sound, and much of this oil washed up on shores and was deposited in intertidal and subtidal zones of the spill area. Intertidal shorelines captured approximately 40 – 45 percent of the oil,

and up to 13 percent of the oil settled in subtidal habitats. Using a variety of methods, manual removal eliminated some of the oil from the intertidal zone early in the response phase, and within a few months of the spill, 89 percent of the moderately to heavily oiled beaches had been treated. Clean-up activities also occurred in 1990 and 1991. According to Shoreline Clean-up Assessment Team (SCAT) surveys, by 1992, approximately 10 km of the original estimated 583 km beaches with surface oiling remained uncleaned. The SCAT surveys were focused on documenting surface oiling as a way to direct clean-up activities. Therefore, subsurface and subtidal oil was not as closely monitored.

Recovery Objective
Sediments will have recovered when there are no longer significant residues of Exxon Valdez oil on shorelines (both intertidal and subtidal) in the oil spill area. Declining oil residues and diminishing toxicity are indications that recovery is underway.

Recovery Status
Approximately 10 acres of Exxon Valdez oil remains in surface sediments of Prince William Sound, primarily in the form of highly weathered, asphalt-like or tar deposits. In 2003, it was estimated that 20 acres of unweathered, lingering oil may still be present in subsurface, intertidal areas of the Sound, which could represent up to 100 tons of remaining oil. Most of this oil is found in protected, unexposed bays and beaches. Subsurface oil was not subjected to the original clean-up activities, and because this oil is trapped beneath a matrix of cobbles, gravel and finer sediments, it is not easily exposed to natural weathering processes.

The most recent studies documenting residual oil occurred on those beaches that were considered heavily or moderately oiled in 1989: Beaches reported as lightly oiled were not surveyed. Moreover, beaches outside of the Sound were not included, so the amount and extent of residual oil in the entire spill zone is not known, but one estimate suggests as much as 200 tons of oil may still exist. Several studies have evaluated the extent of lingering oil on armored oiled beaches along the outer Kenai Peninsula coast, the Alaska Peninsula, and Kodiak Archipelago: These studies looked at the same sites repeatedly at intervals from 1992 - 2005. By 1995, little visible oiling was observed in the study area on Kodiak. Overall, by 1995, hydrocarbon concentrations in sediments at the Gulf of Alaska sites were generally lower than for sites in Prince William Sound, but at some locations substantial concentrations persisted. Through 2005, surface oil was not frequently observed in these areas, and subsurface oil was present as mostly unweathered mousse.

In 1989, chemical analysis of oil in subtidal sediments was conducted at a small number of index sites in Prince William Sound. In the subtidal areas, petroleum hydrocarbon concentrations were highest at depths of 1 - 60 feet (below mean low water) and diminished out to depths of 300 feet. It is likely that oil in subtidal sediments have decreased substantially since the spill. In 2001, several sites that were sampled after the spill were re-visited, and no oil was found in the subtidal sediment from these locations.

Seventeen years after the spill, lingering oil has persisted in the intertidal zones of Prince William Sound and on northwest shorelines of the spill area. The presence of subsurface oil continues to compromise wilderness and recreational values, expose and potentially harm living organisms, and offend visitors and residents, especially those who engage in subsistence activities along still-oiled shorelines. Although much of the oil has diminished over time, pockets of unweathered oil exist, and natural degradation of this oil is very slow. Moreover, some

obligate intertidal foraging bird species are still being exposed to oil. **Therefore, sediments are considered to be recovering, but not yet recovered from the effects of the spill.**

SOCKEYE SALMON

Injury

Commercial salmon fishing was closed in Prince William Sound and in portions of Cook Inlet and near Kodiak in 1989 to avoid the possibility of contaminated salmon being sold at market. As a result, there were higher-than-desirable numbers (i.e., "overescapement") of spawning sockeye salmon entering the Kenai River and Red and Akalura lakes on Kodiak Island. Initially, these high escapements produced an overabundance of juvenile sockeye that overgrazed the zooplankton, and altered planktonic food webs in the nursery lakes. As a result, growth rates were reduced during the freshwater stage of the salmon's life cycle, which led to a decline in returns of spawning adults. The net result was an initial loss of sockeye production.

Recovery Objective

Sockeye salmon in the Kenai River system and Red and Akalura lakes will have recovered when adult returns-per-spawner are within normal bounds.

Recovery Status

Although sockeye freshwater growth tends to return to normal within two or three years following an overescapement event, there are indications that the populations are less stable for several years. The overescapement following the spill resulted in lower sockeye productivity, (as measured by return per spawner) in the Kenai River watershed from 1989-92. However, production of zooplankton in both Red and Akalura lakes on Kodiak Island quickly rebounded from the initial effects overgrazing. By 1997, Red Lake had responded favorably in terms of smolt and adult production and was at or near pre-spill production of adult sockeye. At Akalura Lake there were low juvenile growth rates in freshwater during the period 1989-92, and these years of low growth correspond to low adult escapements during the period 1994-97. Starting in 1993, however, the production of smolts per adult increased sharply and the smolt sizes and age composition suggested that rearing conditions had improved. It is possible that overescapement also affected lakes on Afognak Island and on the Alaska Peninsula. However, analysis of sockeye freshwater growth rates of juveniles from Chignik Lake on the Alaska Peninsula did not identify any impacts associated with a 1989 overescapement event. On the basis of catch data through 2001 and in view of recent analyses of return per spawner estimates presented to the Alaska Board of Fisheries in 2001, the return-per-spawner in the Kenai River system is within historical bounds. **Therefore, it is highly unlikely that the effects that reverberated from the overescapements in 1989 continue to affect sockeye salmon, and in 2002, this species was considered to be recovered from the effects of the oil spill.**

SUBTIDAL COMMUNITIES

Injury

Subtidal habitats encompass all of the seafloor below the mean lower low water tide line to about 800 meters, although deeper habitats are often referred to as the deep benthos. For purposes of this List and evaluating oil spill effects, the impacted subtidal zone generally ranges from the lower intertidal zone to a depth of about 20 meters. Communities in the near subtidal areas are typically characterized by dense stands of kelp or eelgrass and comprise various invertebrate

species, such as amphipods, polychaete worms, snails, clams, sea urchins and crabs. Subtidal habitats provide shelter and food for an array of nearshore fishes, birds, and marine mammals.

It is estimated that up to 13 percent of the oil that was spilled deposited in the subtidal zones. The direct toxicity of the oil, as well as subsequent clean-up activities caused changes in the abundance and species composition of plant and animal populations below lower tides. Initial injuries were evident for several oil-sensitive species. Infaunal amphipods, a prominent prey species in subtidal communities, were consistently less abundant at oiled than at unoiled sites. Reduced numbers of eelgrass shoots and flowers were also documented and may have resulted from increased turbidity associated with clean-up activities. Two species of sea stars and helmet crabs also were less abundant at oiled sites when compared to oiled areas. However, stress tolerant organisms, including polychaete worms, snails and mussels were more abundant at oiled sites. It has been suggested that these species may have benefited from organic enrichment of the area from the oil or from reduced competition or predation because other, more sensitive species were depleted.

Recovery Objective
Subtidal communities will have recovered when community composition in oiled areas, especially in association with eelgrass beds, is similar to that in unoiled areas or consistent with natural differences between, sites such as proportions of mud and sand, and that the subtidal community and sediments found within are no longer contaminated by lingering oil.

Recovery Status
Invertebrate assemblages within eelgrass beds and adjacent areas of soft sediment, were compared at oiled and unoiled sites from 1990-1995. It was hypothesized that reduction in eelgrass and kelp could alter the habitat structure of subtidal communities and continue to impact resident species because food and shelter resources were removed from the environment. By 1995, some benthic species within eelgrass habitats of the oiled areas had recovered. However, important species such as amphipods, certain bivalves, crabs and sea stars were not as abundant at oiled sites as they were in unoiled areas. It was difficult to interpret the findings of these studies, because it was not possible to distinguish between natural conditions and differences in habitat characteristics caused by the spill or subsequent clean-up activities.

More recently, a census of marine life throughout the Gulf of Alaska measured biodiversity indices of plants and animals in the intertidal and shallow subtidal zones. Measurements of species abundance, richness and eveness were compared among areas in Prince William Sound, Kodiak Island and Kachemak Bay. Generally, community structure was significantly different between intertidal and subtidal areas with intertidal communities comprising more species and being more variable than subtidal communities. However, direct comparisons between oiled and unoiled sites were not evaluated for each community, and comparisons in these communities at a smaller scale are not known.

Concentrations of oil in subtidal areas declined by 1995, but were still slightly elevated over unoiled sites. In 2001, at a few random sites adjacent to heavily or moderately oiled intertidal areas, little or no oil was found in the subtidal sediments. However, a systematic sampling of sediments from subtidal areas in the entire spill zone has not been conducted.

In the early 90s, several benthic organisms using the subtidal zones showed trends towards recovery, and hydrocarbon concentrations had declined in many areas. **However, consistent,**

systematic surveys have not been conducted for many species, and the recovery status of subtidal communities remains unknown.

HUMAN SERVICES

COMMERCIAL FISHING

Injury

Commercial fishing was injured as a result of the spill's direct impacts to commercial fish species (see individual resource accounts) and through subsequent emergency fishing closures. Fisheries for salmon, herring, crab, shrimp, rockfish and sablefish were closed in 1989 throughout Prince William Sound, Cook Inlet, the outer Kenai coast, Kodiak and the Alaska Peninsula. Shrimp and salmon commercial fisheries remained closed in parts of Prince William Sound through 1990.

Recovery Objective

Commercial fishing will have recovered when the commercially important fish species have recovered and opportunities to catch these species are not lost or reduced because of the effects of the oil spill.

Recovery Status

In the 1994 Restoration Plan, the Trustee Council specifically recognized the declines in pink salmon and Pacific herring populations, and considered the reduction in these two fisheries as the biggest contributors to injury of the commercial fishing service in the spill area. Therefore, many restoration activities were focused towards these resources. The strategy for restoring commercial fishing included funding projects that accelerated fish population recovery, protected and purchased important habitat and monitored recovery progress. By 2002, the Trustee Council considered pink salmon and sockeye salmon to be recovered from the oil spill. However, recovery was not considered complete for Pacific herring and the recovery status of this resource remains 'not recovering' (see individual resource accounts).

Income from commercial fishing dramatically declined immediately after the spill, and for a variety of reasons, disruptions to income from commercial fishing continue today, as evidenced by changes in average earnings, ex-vessel prices and limited entry permit values. Natural variability in fish returns and a number of economic changes in the commercial fishing industry since 1989 probably mean that many of these changes in income are not directly attributable to the spill. However, these factors also make discerning spill-related impacts difficult. Economic changes confronting the industry include the increased world supply of salmon (due primarily to farmed salmonids) and corresponding reduced prices, entry restrictions in certain fisheries (such as Individual Fishing Quotas, for halibut and sablefish), allocation changes (e.g., a reduction in the allocation of Cook Inlet sockeye salmon to commercial fishermen), reduction in processing capacity, and spatial limitations of groundfish fisheries in the spill areas in conjunction with sea lion management. Finally, competition among commercial, recreational, and subsistence fishers influence management decisions of these shared resources.

No spill-related district-wide fishery closures related to oil contamination have been in effect since 1989, and populations of pink and sockeye salmon are considered recovered from the effects of the spill. However, the Prince William Sound herring fishery has been closed for 15 of

the 20 years since the spill and herring are not considered recovered. **Therefore, commercial fishing, as a lost or reduced service, is in the process of recovering from the effects of the oil spill, but full recovery has not been achieved.**

PASSIVE USE

Injury

Passive use is the service provided by natural resources to people that will likely not visit, contact, or otherwise use the resource. Thus, injuries to passive use are tied to public perceptions of injured resources. Passive use is the appreciation of the aesthetic and intrinsic values of undisturbed areas and the value derived from simply knowing that a resource exists. The oil spill occurred in what many Americans viewed as an undisturbed area and caused visible injury to shorelines, fish and wildlife. The loss to passive use following the oil spill was estimated by the State of Alaska at $2.8 billion. Using a contingent valuation approach, this was the median value that those surveyed were willing to pay to prevent a catastrophe similar to the Exxon Valdez Oil Spill from happening again.

Recovery Objective

Passive use will have recovered when people perceive that aesthetic and intrinsic values associated with the spill area are no longer diminished by the oil spill.

Recovery Status

The Trustee Council determined that passive use injuries occurred as a result of the oil spill because natural resources including scenic shorelines, wilderness areas, and popular wildlife species, from which passive uses are derived, were injured. The key to the recovery of passive use is providing the public with current information on the status of injured resources and the progress made towards their recovery.

Two vital components of the Trustee Council's restoration effort are the research, monitoring, and general restoration program and the habitat protection and acquisition program. Extensive work has been done to restore and monitor resources and communicate these findings to the public. The research, monitoring, and general restoration program is funded each year through the annual work plan, which documents the projects that are currently funded to implement restoration activities for injured resources and services. The habitat protection program preserves habitat important to injured resources through the acquisition of land or interests in land. As of 2006, the Council has protected more than 630,000 acres of habitat, including more than 1,400 miles of coastline and over 300 streams valuable for salmon spawning and rearing.

Other public information efforts in which the Council is currently engaged follows:

- The Trustee Council's web site (www.evostc.state.ak.us) offers detailed information regarding past, current, and future restoration efforts
- The Trustee Council prepares a number of documents for distribution to the public including:
    - The Invitation for Proposals, which solicits restoration project ideas from the scientific community and the public
    - The Annual Work Plan (described above)

  - Updates to the Restoration Plan (1996, 1999, 2002, & 2006) which periodically provides new information on the recovery status of injured resources and services.
- Project final reports are available to the public at the Trustee Council's Website, through the Alaska Resource Library and Information Services (ARLIS) in Anchorage as well as at several other libraries in the State, at the Library of Congress, and through NTIS (National Technical Information Service). In addition, the Council supports researchers in publishing their project results in peer-reviewed scientific literature, which expands their audience well beyond Alaska.
- The Council supports an annual marine science symposium, which is open to the public that provides a venue in which to report the progress of restoration in the spill area.
- Public Input: The Public Advisory Committee (PAC) is an important means of keeping stakeholders and others informed of the progress of restoration and providing the public's opinions to the Trustee Council as they make decisions. Additionally, public meetings are held periodically throughout the spill area. All meetings of the Council are widely advertised and opportunity for public comment is always provided.

Until the public no longer perceives that lingering oil is adversely affecting the aesthetics and intrinsic value of the spill area it cannot be considered recovered. **Because recovery of a number of injured resources is incomplete, the Trustee Council considers services related to passive use to be recovering from the effects of the spill.**

RECREATION AND TOURISM

Injury

Recreation and tourism in the spill area dramatically declined in 1989 in Prince William Sound, Cook Inlet and the Kenai Peninsula. Injuries to natural resources led resource managers to limit access to hunting and fishing areas, and users such as kayakers were prevented from enjoying those beaches that harbored visible oil. Recreation was also affected by changes in human use in response to the spill, because areas that were unoiled become more heavily used as activity was displaced from the oiled areas.

Recovery Objective

Recreation and tourism will have recovered, in large part, when the fish and wildlife resources on which they depend have recovered, and recreation use of oiled beaches is no longer impaired.

Recovery Status

Recreation and tourism accounted for 26,000 jobs, generated $2.4 billion in gross sales and contributed $1.5 billion to Alaska's economy in 2003. The number of visitors to Alaska has increased in the years since the spill and it is expected that the recreation and tourism industry in south-central Alaska will grow approximately 28 percent per year through 2020. By 2001, over $10 million had been spent on repair and restoration of recreational facilities in the spill area, and damage caused by the spill or clean-up efforts at the Green Island cabin and Fleming Spit campsites were repaired.

Telephone interviews conducted in 1999 and 2002 of people who used the spill area for recreation before and after the spill, indicated that, although oil remained on beaches, it did not deter them from using the area. However, they continued to report diminished wildlife sightings in Prince William Sound, particularly in heavily oiled areas such as around Knight Island. They

also reported seeing fewer seabirds, killer whales, sea lions, seals, and sea otters than were generally sighted before the spill, but also reported observing increases in the number of seabirds over the last several years. Key informants with experience along the outer Kenai coast reported diminished sightings of seabirds, seals, and sea lions. However, they indicated that the possible presence of residual oil has no effect on recreational activities along the outer Kenai coast, the Kodiak Archipelago, and the Lake Clark and Katmai national park coastlines. Changes in the amount of wildlife observed could be due to a variety of factors, including the spill.

Recreation and tourism rely on both consumptive and non-consumptive uses of natural resources. Although these activities have increased since the spill, several resources have not yet recovered from the spill and beaches used for recreation contain lingering oil. Resources that are important to recreation and tourism, but are still not considered recovered from the spill or their recovery is unknown include harbor seals, Kittlitz's and marbled murrelet, pigeon guillemot, clams, mussels, harlequin ducks, sea otters and killer whales. Sportfishing resources for which the recovery status is unknown are cutthroat trout and rockfish. However, the salmon species that were injured (pink and sockeye salmon) are recovered from the effects of the spill.

Even though visitation has increased since the oil spill, the Trustee Council's recovery objective requires that the injured resources important to recreation be recovered and recreational use of oiled beaches not be impaired. Lingering oil remains on beaches and in some localized areas this remains a concern for users. Moreover, several natural resources have not recovered from the effects of the spill. **Therefore, the Council finds recreation and tourism to be recovering from the effects of the spill, but not yet recovered.**

SUBSISTENCE

Injury

Fifteen predominantly Alaskan Native communities (with a total population of about 2,200 people) in the oil spill area rely heavily on harvests of subsistence resources, such as fish, shellfish, seals, deer, and waterfowl. Oil from the spill disrupted subsistence activities for the people of these villages and approximately 13,000 other subsistence permit holders in the area. Oil affected the subsistence harvests through a variety of mechanisms including reduced availability of fish and wildlife due to injury, concern about possible health effects of eating oiled fish and wildlife, and disruption of the traditional lifestyle due to clean-up and related activities.

Recovery Objective

Subsistence will have recovered when injured resources used for subsistence are healthy and productive and exist at pre-spill levels. In addition, there is recognition that people must be confident that the resources are safe to eat and that the cultural values provided by gathering, preparing, and sharing food need to be reintegrated into community life.

Recovery Status

After the spill, subsistence harvest declined between 9 – 77 percent in 10 villages within Prince William Sound, Cook Inlet and Kodiak. Villages in Tatitlek and Chenega reduced their harvest by 56 and 57 percent, respectively. Outside of the Sound, harvest declined in Akhiok (on the lee side of Kodiak Island) by nine percent, but by 77 percent in Ouzinkie, which is on the northern

side of the island. The primary reason that harvest declined so dramatically was the fear that oil had contaminated the resources and made them unfit to eat.

Harvest levels have generally increased in many communities since the spill, but results of harvest surveys have been variable. By 2003, they were generally higher than pre-spill levels in the communities in Cook Inlet, but lower in Kodiak and Prince William Sound (except for Cordova). Even though the harvest levels in the PWS communities were not as high as pre-spill estimates, they were within the range of other Alaska rural communities. Harvest composition was also altered by the spill. In the first few years following the spill, people harvested more fish and shellfish than marine mammals because of the reduced number of marine mammals and the perception that these resources were contaminated and unsafe to eat.

Both safety concerns and the reduced availability of shellfish contributed to a decline in harvest levels. From 1989-94, subsistence foods were tested for evidence of hydrocarbon contamination, with no or very low concentrations of petroleum hydrocarbons found in most subsistence foods. However, concerns about oil contamination remained, and there was a belief that the increase in paralytic shellfish poisoning (PSP) was linked with *Exxon Valdez* oil. By 2003, most subsistence users expressed confidence in foods such as seals, finfish and chitons. However, the safety of certain shellfish, such as clams was still met with skepticism.

Subsistence use is a central way of life for many of the communities affected by the spill, thus the value of subsistence cannot be measured by harvest levels alone. The subsistence lifestyle encompasses a cultural value of traditional and customary use of natural resources. Following the oil spill, there was concern that the spill disrupted opportunities for young people to learn cultural subsistence practices and techniques, and that this knowledge may be lost to them in the future. In a 2004 survey of the spill area communities, 83 percent of respondents stated that their "traditional way of life" had been injured by the oil spill and 74 percent stated that recovery had not occurred.

Many factors may contribute to the changes observed in subsistence harvests and the lifestyle surrounding this tradition. Demographic changes in village populations, ocean warming, increased competition for subsistence resources by other people (e.g., sport fishing charters), predators (e.g., sea otters), and increased awareness of PSP and other contaminants may play a role in resource availability, food safety, and participation in traditional practices.

Fears about food safety have diminished since the spill, but it is still a concern for some users. Additionally, harvest levels from villages in the spill area are comparable to other Alaskan communities. However, many subsistence resources injured by the spill, including clams and mussels, have still not recovered from the effects of the spill. **For these reasons, subsistence continues to recover from the effects of the oil spill, but has not yet recovered.**

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FY 2010 Invitation

Exxon Valdez Oil Spill Trustee Council

Federal Fiscal Year 2010

Invitation for Proposals

DRAFT January 5, 2009

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501
907-278-8012 / fax: 907-276-7178
www.evostc.state.ak.us

Exxon Valdez Oil Spill Trustee Council

Implementation of the *Exxon Valdez* Oil Spill Restoration Plan

FY 2010
Invitation for Proposals

Exxon Valdez Oil Spill Trustee Council
441 West 5th Avenue, Suite 500
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907-278-8012 phone/907-276-7178 fax
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DRAFT January 5, 2009

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If you believe you have been discriminated against in any program, activity, or facility please write:

- ADF&G ADA Coordinator, P.O. Box 115526, Juneau, AK 99811-5526.
- The department's ADA Coordinator can be reached via phone at the following numbers: (VOICE) 907-465-6077, (Statewide Telecommunication Device for the Deaf) 1-800-478-3648, (Juneau TDD) 907-465-3646, or (FAX) 907-465-6078.
- U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington, VA 22203.
- Office of Equal Opportunity, U.S. Department of the Interior, Washington DC 20240.

Eligibility Criteria
Individuals, private industry, government agencies and other interested parties, regardless of nationality or insitutional affiliation, are entitled to submit a proposal in response to this Invitation. All proposals will be evaluated based on the same criteria regardless of the source of the proposal.

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I. Schedule

The schedule for the receipt, review and approval of FY10 proposals is shown below.

February 27, 2009 .....Invitation for Proposals issued
April 24, 2009 .....FY10 Proposals Due by 5:00 PM
May 29, 2009 .....Panel reviews completed
June 12, 2009 .....Draft Work Plan available for review
August 2009 .....Funding decision made by Trustee Council

The *Exxon Valdez* Oil Spill Trustee Council operates on a federal fiscal year. The FY10 fiscal year begins on October 1, 2009 and ends on September 30, 2010.

II. Background and Purpose of the FY10 Invitation for Proposals

In 1989, the *T/V Exxon Valdez* spilled 11 million gallons of crude oil into Prince William Sound (PWS). In 1991, the U.S. District Court approved a civil settlement that required Exxon to pay the United States and the State of Alaska $900 million to restore the natural resources injured by the spill and the reduced or lost services (including human uses) that those resources provide (Natural Resource Services). A Trustee Council (Council) of three federal and three state members administers this joint settlement fund.

A Restoration Plan[1] was adopted by the Council in 1994 that provides long-term guidance for restoring the resources and services injured by the oil spill. It contains policies for making restoration decisions, describes how restoration activities will be implemented, and includes an Injured Resources and Services (IRS) list that provides a focus for restoration. The IRS list has been updated several times since 1994. The most recent update took place in 2006.[2]

The Council sets restoration priorities and annually determines which projects will be funded. Restoration projects are solicited through this Invitation for Proposals (Invitation). The Invitation is open to individuals, private industry, government agencies and other interested parties interested in submitting proposals for restoration work identified in the Invitation. Proposals selected for funding will comprise a portion of the Council's annual workplan.

The Council is committed to the focus areas above and to moving the program forward in an effective and fiscally-responsible manner. For FY10, the Council will be focusing its efforts on three main categories: Lingering Oil, Integrated Herring Restoration Program, and Reduction of Marine Pollution.

A. Funding, Duration, and Scope

Funding - The Council established an Investment Fund and adopted an endowment approach for management of the Fund. This approach establishes annual spending limit goals thus ensuring the Fund's value over time. Yearly spending includes the annual

[1] http://www.evostc.state.ak.us/Policies/restplan.cfm
[2] http://www.evostc.state.ak.us/Publications/InjuredResources.cfm

work plan, continuing multi-year projects and administrative costs, including the science and data management, public information and project management. The Council is not placing a direct cap on the amount of money available for projects within the FY10 work plan. However, projects must reflect reasonable and prudent cost management and budgets should be precise and accurate. Cost effectiveness will be an important consideration for the Council as the members deliberate project funding.

Duration - Award periods for proposals commencing in 2009 may range from one year to three years. Regardless of project length, applicants must achieve an outcome and product within the requested award period, including data analysis and submission of quarterly reports, a draft final report and a peer-reviewed, final report of research results. Proposers should plan for sufficient time and funding to complete report writing, peer review, and publication of final reports.

Scope - For the categories outlined within this Invitation, the Council is seeking completed proposals using the instructions provided in Section VIII, Instructions for Submitting a Proposal.

B. Projects Continuing from Prior Fiscal Years

A few projects currently receive funding from previous multi-year awards. **Principal investigators (PIs) who have already been authorized by the Trustee Council to continue their projects in FY10 need not submit a proposal package.** Projects that are currently underway may submit proposal amendments detailing any additional work required to complete or expand a project's scope. If needed, an amendment for an ongoing project will be considered only if a current annual report has been received and accepted by the Trustee Council office. Amendments to existing proposals may be submitted to the Science Director, and should include a reference to the previously funded project. All amendments will receive full review by a Science Panel, the Science Director, and the Executive Director. Recommendations for additional funding will be made to the Council for a final decision. Information on how to submit a project amendment can be found on the Trustee Council's website.

C. Community Involvement

The Trustee Council is committed to working with communities in the oil spill-affected area and encourages proposers to involve local communities to the greatest degree possible consistent with the objectives of the proposal.

Every successful proposal is required to develop a community involvement plan that specifies how relevant coastal communities, concerned commercial and sport fishers, subsistence users, local scientists, public schools and universities, will be informed and engaged in the project. The community involvement section of the proposal should address the following questions, if applicable: How will affected communities be informed about the project and be given an opportunity to provide their input? How will research findings and other project information be communicated to local communities? To what extent will local hire be used for the acquisition of such things as vessels,

technicians, and equipment? To what extent will traditional and local knowledge be incorporated into the project?

The degree to which the activities of each proposed project allow involvement with local communities and incorporation of local knowledge will vary, but interaction with communities is required. Reviewers will give additional consideration to proposals that demonstrate meaningful community involvement and/or make use of local and traditional ecological knowledge. Any collection or use of traditional knowledge should follow the "Protocols for Including Indigenous Knowledge in the EVOS Restoration Process."[3] Additional guidelines to protect the sensitivity of local knowledge are included in "A History of Trustee Council Tribal and Community Involvement."[4]

For ideas as to education and outreach please refer "Education and Public Outreach: A Guide for Scientists,"[5] produced by the NSF-funded Centers for Ocean Sciences Education Excellence and published by the Oceanography Society. Additional sources of information on how to incorporate local and native communities are the Community Involvement, Environmental Education, and Community Outreach in the EVOS Restoration Process Report.[6]

D. Additional Considerations

The Council also wishes to maximize resources by building on past and ongoing efforts and to integrate proposals being considered for funding in FY10. Proposers are encouraged to collaborate in the development of proposals and describe efforts to integrate project data collection, analysis, and findings consistent with proposal objectives.

III. Introduction to the FY10 Invitation for Proposal

The Council recognizes that a tremendous amount of work has been accomplished over the nineteen years of research, monitoring and restoration activities that have been directed at addressing the goals of the 1994 Restoration Plan. The Council has considered the results of previous synthesis efforts funded in 2006 and has determined that for fiscal year 2010 Council efforts will focus on:

- **Lingering Oil: Distribution and processes in the nearshore environment**
- **Restoration of Prince William Sound Pacific herring**
- **Marine pollution affecting injured resources and services**
- **Restoration of Injured Resources and Services**

[3] http://www.evostc.state.ak.us/Files.cfm?doc=/Store/AnnualReports/1997-97052B1-Annual.pdf
[4] http://www.evostc.state.ak.us/Universal/Documents/Publications/Trib_Comm_Inv.pdf
[5] http://www.tos.org/epo_guide/
[6] http://www.evostc.state.ak.us/Files.cfm?doc=/Store/FinalReports/2008-080575-Final.pdf&

To be considered responsive to this Invitation, proposals must:

a. demonstrate a clear linkage to injured natural resources and/or natural resource services;
b. be focused within the oil spill-affected area;
c. respond to one or more of the categories described in this Invitation; and
d. describe community involvement

NOTE: Current PI's must comply with all reporting requirements for previously-funded projects in order to receive funding for newly-awarded projects.

Specific requests are outlined below and are based upon previous Council-sponsored work. Information on the status of Council-funded projects is available on the Council's website[7] as it becomes available, or you can contact the Council office directly for more information at (907) 278-8012. The Council does not wish to duplicate efforts and encourages the use of existing materials and collaboration with other ongoing efforts. **Proposals should explicitly state how the project could lead to the *restoration* of injured natural resources and/or natural resource services.**

Reviewers will give additional consideration to proposals that have resource management applications. The development of tools, technologies and information that can help resource managers and regulators improve management of marine resources and address problems that may arise from human activities are a critical part of this invitation. Use this section to describe how your proposal might result in knowledge or products that would contribute to meeting this goal. Do not simply provide a statement that a proposal is expected to have resource management applications without demonstrating that one or more representatives of a resource management agency have been contacted prior to proposal submission and have agreed to work with the proposers in developing the resource management components of the proposal. Resource management agency contacts should be identified in this section.

IV. Project Invitation by Category

LINGERING OIL

Since 2001, our understanding of the amount of oil remaining in PWS and its location has grown increasingly sophisticated. For instance, we now know that much of the remaining oil is found at a lower level in the intertidal zone than thought for the first 12 to 13 years after the spill.

It is estimated that 11 – 35 acres of intertidal beaches have remnant lingering oil. However, one of the assumptions underlying these estimates is that nearly all of the remaining oil is located in beaches that were heavily or moderately oiled in 1989. However, because some nearshore organisms inhabiting less oiled areas of Western Prince William Sound are still being exposed to oil, it is possible that organisms are being exposed to sources of oil that have not been identified.

[7] www.evostc.state.ak.us

Questions remain about the geomorphology and geochemistry of the beaches on which lingering oil deposits are found. The physical and chemical processes in beaches with remaining oil need to be understood better, as these processes will determine the potential success of any future attempts at remediation. Moreover, the distribution of oil in these beaches relative to the distribution of local fauna will also determine how accessible the oil is to organisms. Therefore, it is important to gain a better understanding of the fine-scale processes occurring in the beaches that harbor lingering oil.

Currently, the Council is funding three studies that will provide information on the distribution and processes affecting lingering oil. Project 070801 (Assessment of the Area Distribution and Amount of Lingering Oil in PWS and GOA) by Michel will model the distribution of lingering oil in the spill area.

Project 080840 (Biodegradability of Lingering Oil) by Venosa will provide important information that will help evaluate the persistence of the lingering oil on PWS beaches and evaluate potential methods for biodegradation.

Project 070836 (Factors Limiting the Degradation Rate of EVOS Oil) by Boufadel will provide information about the factors influencing the degradation of oil in PWS. The Council also has funded a number of studies aimed at determining the effects of lingering oil on the nearshore environment and the species that forage there, including sea otters, harlequin ducks and Barrow's goldeneyes.

It is possible that the currently funded projects, or information developed by other entities, will identify information gaps that will need to be filled during the coming fiscal year. The Trustee Council thus anticipates that it may be desirable to fund additional projects later in the fiscal year. Therefore the Council seeks additional proposals related to the distribution of lingering oil, understanding the reasons behind its failure to biodegrade, its effects on the nearshore environment and the species that forage there and ways in which it can be remediated that are based on developing knowledge regarding lingering oil. The Council also will consider proposals that measure the exposure to and the effects of recovering or not recovered resources to lingering oil, particularly in the nearshore ecosystem. **Because these proposals will build upon work not yet completed, they may be submitted at any time during the coming fiscal year.**

INTEGRATED HERRING PROGRAM

THIS WOULD COME FROM THE IHRP

REDUCTION OF MARINE POLLUTION

Most coastal communities in the spill area have a limited ability to collect and properly dispose of wastes, such as oily bilge water, used engine oil, paints, solvents, and lead-acid batteries. Improper disposal of these wastes in community landfills adversely affects the quality of nearby marine waters through runoff and leaching. In some cases, these wastes are discharged directly into marine waters. Chronic marine pollution places stress on fish and wildlife resources, possibly delaying recovery of resources injured by the oil spill. In fact, with regard to the

worldwide mortality of seabirds, the effects of chronic marine pollution are believed to be at least as important as those of large-scale spills.

The Council has funded several projects to prepare waste management plans and a portion of the implementation phase of Projects 02514/Tuner - Lower Cook Inlet Waste Management Plan, 99304/Stevens - Kodiak Island Borough Master Waste Management Plan, 97115/Winchester - Sound Waste Management Plan and Restoration, and 95417/Roetman - Waste Oil Disposal Facilities. These projects resulted in the acquisition of waste oil management equipment and the construction of environmental operating stations for the drop-off of used oil, household hazardous waste and recyclable solid waste in Cordova, Valdez, Chenega Bay, Tatitlek and Whittier, Kodiak and lower Cook Inlet.

The Council seeks proposals to further reduce pollution in the marine environment. Applications should describe the extent to which the proposed project will reduce marine pollution in the environment and how this reduction will contribute to the recovery of one or more injured natural resources and/or natural resource services. Proposers should refer to the Council's policy regarding normal agency management before formulating project proposals.

RESTORATION OF INJURED RESOURCES AND SERVICES

While proposals addressing specific topics are being requested, the Council understands that there may be project ideas that would assist in moving injured resources and services toward restoration. Please refer to the 2006 Update of the Injured Resource and Services List to learn more about the restoration objectives for each individual resource and service. While the Council welcomes these proposals, the highest consideration will be given to integrated, multi-disciplinary projects.

V. Considerations Applicable to Project Proposals

The 1994 Restoration Plan includes restoration policies, appropriate actions, goals, objectives and strategies specific to each of the injured natural resources and natural resource services previously discussed. All restoration project proposals must include methods and employ project designs consistent with the 1994 Restoration Plan and the consequent Injured Resource and Services updates. Proposals are encouraged to consider and include if possible the following elements in their proposals for injured resources and services:

A. Monitoring/Population Modeling

In some instances, new studies of specific resources may not aid in resolving questions regarding continuing injury. Nonetheless, long-term evaluation of injured species should occur to determine when populations in oiled and unoiled areas could be declared recovered or until it is determined that further remediation or enhancement activities are warranted.

Monitoring is also important for resources whose recovery status is currently difficult to assess. For example, recovery status for intertidal communities is challenging because monitoring in both oiled and unoiled areas has not been conducted consistently in these

areas since the spill. Thus, monitoring of some resources in this habitat type could continue at an intensity designed to track changes over time and among areas.

B. Integration

Proposals that group resources and services should include the rationale and benefits of grouping injured resources or services into a single integrated project. Integrated projects are encouraged to involve aspects of multiple categories. For example, multi-species data sets from common areas (e.g., Knight Island) could be integrated with studies conducted on physical processes of lingering oil. Combining studies could provide economies of scale for logistics, chemical analyses and data analyses. Proposers may be asked to revise their proposals to integrate with other projects prior to final Trustee Council consideration or approval.

C. Data Management and Synthesis

The Council will consider proposals that facilitate recovery, utilization and/or enhancement of long-term data series within the oil spill affected areas that can assist the Trustee Council in defining restoration projects and incorporating long-term monitoring programs directly towards restoration.

All investigators are required to work with the Council's Data Management staff to identify and permanently archive datasets (data and metadata) that may be useful for future scientific analysis, and to submit metadata for such datasets to the Council's data archive. As with the acceptance of any public funding source, data collected in the course of a Council-funded project is the property of the *Exxon Valdez* Oil Spill Trustee Council and must be provided at the conclusion of the project. The data policy has been recently updates and a copy of the new data policy can be found at:
http://www.evostc.state.ak.us/Policies/data.cfm

D. Reporting Policies

All projects will be required to provide quarterly, annual, and final reports. Detailed reporting procedures can be found at:
http://www.evostc.state.ak.us/Policies/reporting.cfm

Quarterly Reports – Quarterly reports must be provided to the assigned agency Project Manager within 30 days of the end of the quarter. A quarterly report will include the tasks identified in the proposal for each quarter with a summary of the progress made on each.

Quarter 1: Oct. 1 - Dec. 31
Quarter 2: Jan. 1 - March 31
Quarter 3: April 1 - June 30
Quarter 4: July 1 - Sept. 30

Annual reports – Annual reports are due no later than September 1 of each year for which a project receives funding to determine if continuing funding is appropriate. If a project is multi-year, PIs should prepare a brief annual report each year until the project

is completed. The annual report will provide a summary of the work completed over the fiscal year as well as a discussion of any preliminary findings.

Final reports – Draft final reports are due no later than April 15 of the year following the work on a funded project. A final report for a project must be a comprehensive report addressing all the objectives identified over the course of the entire study and shall address the original objectives of the study as identified in the approved proposal and account for any changes in the objectives. All draft final reports are subject to a peer review process.

Please note an updated data and reporting policy that requires 10% of the total project cost to be withheld until all project data and all hard copies of the project's final report are received and accepted by the Executive Director. Details can be found in the Procedures for the Preparation and Distribution of Reports[8].

Note: If a proposer is requesting funding for publication of project results in a peer-reviewed journal please provide the subject/title of each manuscript, the name of the peer-reviewed journal(s) to which the manuscript will be submitted and the date when the manuscript will be submitted. The Trustee Council expects publication of project results in peer-reviewed journals as soon as scientifically appropriate and logistically possible. The Council has adopted a policy regarding an acknowledgment and disclaimer to be used in publishing results of projects it has supported. For more information, see the Procedures for the Preparation and Distribution of Reports on the EVOSTC website[9].

E. Project Funding Requirements

Proposals will be accepted for both single-year and multi-year projects. Applicants should include project and budget information that accurately reflects the time commitment necessary to complete their work. Funding for multi-year projects will be reviewed each fiscal year to ensure that the scope of work is progressing and that the project is still meeting the needs of the Trustee Council. **Regardless of project length, one fiscal year must be budgeted for the preparation and writing of the project's final report. Project scope cannot extend into the report writing fiscal year unless clearly defined in the project proposal timeline and milestones.** In the timeline and budget for the report writing year, please include time and resources necessary to: 1. prepare data for transfer to the Council's office; 2. incorporate all peer review comments; 3. print and bind the final report and; 4. attend and present findings at the Alaska Marine Science Symposium held in Anchorage, Alaska.

VI. Evaluation of Proposals

A. Policy and Legal Review

[8] http://www.evostc.state.ak.us/Policies/reporting.cfm
[9] http://www.evostc.state.ak.us/Policies/reporting.cfm

To be eligible for funding, proposals must be designed to restore, replace, enhance or acquire the equivalent of natural resources injured as a result of the oil spill or the reduced or lost services provided by these resources. In addition, proposals must be consistent with the policies contained in the Restoration Plan adopted by the Trustee Council in November 1994 (available at http://www.evostc.state.ak.us or upon request from the Anchorage Restoration Office). Trustee Council staff will also review each proposal for responsiveness to this invitation, completeness and for adherence to the format and instructions contained in this document. A legal and policy review of each proposal and Project Summary submitted pursuant to this Invitation will be conducted by the Alaska Department of Law and the U.S. Department of Justice.

B. Technical and Programmatic Review

All proposals are subject to independent scientific and/or technical review. Proposals and their technical reviews will be examined by appropriate review panels for programmatic suitability. Proposals will be evaluated according to the following criteria and each proposal will be rated on a scale of excellent to poor for each of the selection criteria.

1. *Project Design/Conceptual Soundness* - Evaluation of the applicant's understanding of the problem and the project's feasibility; how well a project builds on past or ongoing research, the extent to which the project will help achieve restoration objectives.

2. *Timeline and Milestones* - Evaluation of the project's timeline and milestones in relation to the scope submitted. Projects with detailed timelines and milestones will be rated higher than those with vague or unclear timelines and milestones.

3. *Project Management and Implementation Plan* - Evaluation of the proposed management and implementation of the project, including project team qualifications (education, experience, publications, related work efforts, proposed time commitment, past performance), and availability of facilities or other requirements necessary for project success are available to the proposers.

4. *Cost Effectiveness of the Proposal* - Evaluation of the appropriateness of the project's cost versus the scope identified. Funding from other sources will be considered.

5. *Collaboration/Coordination Efforts* - Evaluation of how well the proposal integrates with both past and ongoing work and provides an interdisciplinary approach.

6. *Community Involvement* - Determination if the proposer has demonstrated substantial progress toward appropriate consultations and collaboration with local communities.

Note: Proposers may be asked to respond to technical review comments on the proposal or to revise the proposal to address concerns of scientific, technical or programmatic reviews, or to revise the proposal to integrate with other proposals or projects.

C. Science Panel Review
All project proposals will be reviewed by a nine-member Science Panel with funding recommendations made to the Executive Director. The recommendations will be included in the fiscal year work plan.

D. Public Advisory Committee Review
The Trustee Council's Public Advisory Group representing a cross-section of interest groups affected by the oil spill will also review proposals.

E. Public Comment and Funding Decision
The Council's Executive Director will use the recommendations of the Science Panel, the Public Advisory Group and staff to develop a draft work plan containing proposals recommended for Trustee Council consideration as well as any recommended collaboration, coordination and suggested modifications of proposed projects or project scope. This recommendation will be circulated for public comment as the FY10 Draft Work Plan.

F. Trustee Council Decision
All proposals will be forwarded to the Trustee Council for their consideration. The Trustee Council will take into consideration the Executive Director's recommendation, the Science Panel's recommendations and the recommendations of the Public Advisory Group in making its decision as to which proposals will be funded in FY10. Unanimous agreement of all six Council members is required to fund a proposal. Please note that the Trustee Council is not legally bound to abide by recommendations of peer reviewers, science advisors, the Public Advisory Committee or the Executive Director. It is anticipated that funding decisions forFY10 will be made at a Trustee Council meeting in the August 2009.

VII. Instructions for Non-Trustee Council Agency Proposals

If you represent a private organization, a non-profit group or a university from a state other than Alaska, you should submit your proposal through the Broad Agency Announcement (BAA) process, as well as to the Trustee Council. In most instances, requirements of state and federal law preclude Council funds from being awarded directly to such organizations. Rather, a competitive solicitation process is required. This solicitation can occur before the Council approves funding for a project through a BAA issued by the National Oceanic and Atmospheric Administration (NOAA). Using the BAA approach, if the Council approves funding for your project, you can begin contract negotiations with NOAA without the further competitive solicitation that is required if you do not apply through the BAA.

As part of this invitation, NOAA is issuing a BAA on behalf of the Council, and is requesting proposals for any of the topics identified in this invitation. To submit your proposal through the BAA process, submit an electronic copy, as well as one paper copy, of your proposal to NOAA at the address below by **5:00 p.m. Pacific Daylight (Seattle) time on XXXXX**. This is in addition to the copies of the proposal that must be submitted to the Council. Include the words "submitted under the BAA" as part of your project's title. Faxed proposals will not be accepted.

More information is contained in the Broad Agency Announcement itself (**BAA #XXXXX**), available from NOAA:

Ms. Sharon Kent
NOAA, WASC, Acquisition Management Division, WC31
7600 Sand Point Way NE
Seattle, WA 98115-6349
Telephone (207) 526-6035
Sharon.S.Kent@noaa.gov

Proposals submitted to NOAA under the BAA will be evaluated by the Trustee Council at the same time as other proposals submitted to the Trustee Council.

VIII. Instructions for Submitting a Proposal

A. What to Submit

The Trustee Council encourages electronic submission of proposals. Please upload a copy of your proposal package to the following website:

http://www.evostc.state.ak.us/proposals/newproposal.cfm

If you do not have access to the internet please submit one paper copy and one electronic copy of the proposal package to:

Restoration Specialist
Exxon Valdez Oil Spill Trustee Council
441 West 5th Avenue, Suite 500
Anchorage, AK 99501-2340
dfg.evos.projects@alaska.gov
Phone: 907-278-8012 or 1-800-478-7745

Electronic versions of the narrative sections of the proposal must be composed using Microsoft Word 2002 (XP) or lower or WordPerfect 9.x or lower, with figures and tables embedded. Please submit Word or WordPerfect documents in one file, labeling them as follows:

Surname of lead PI_FY09_Proposal (e.g., Smith_FY09_Proposal)
Surname of lead PI_FY09_Proposal (e.g., Smith_FY09_Budget)

Proposal Format Specifications:

- Times Roman, 12-point
- one-inch margins on all sides
- page numbers
- footer including proposal title and name of lead PI
- summary page must be a stand alone page
- extraneous cover sheets (i.e., often included with applications from universities) are allowed, but must not be integrated into the proposal package

FY10 Invitation: Proposal Application Materials

Please submit the following materials. Templates are attached and are available electronically at http://www.evostc.state.ak.us.

- Signature Form
- Proposal Summary Page
- Project Plan (including references and literature cited)
- CV's/Resumes
- Budget Justification
- Budget Forms

Signature Form

A signed form indicating willingness to abide by the Trustee Council's data and report requirements must be submitted with each proposal.

Proposal Summary Page (one page maximum)

The summary page includes project title, project period, proposer(s) name, affiliation, email address for all principal investigators (PIs), study location, key words, a project abstact (a summary of the proposed work in 150 words or less), the amount of EVOS funding requested (including nine percent for general administration), and the amount of non-EVOS funds contributing to the proposed project.

Project Plan

The project plan must completely describe the work to be performed, including a statement of the problem the proposal is designed to address, relevance to the restoration of injured resources and services, project objectives, procedural and statistical methods, description of the project area, coordination with other efforts, timeline and milestones, responsiveness to key Trustee Council strategies, and expected publications, reports and conference participation. **The project plan is limited to 15 consecutively numbered pages formatted as described.** The page limit includes figures and tables. References and literature cited should be attached to the project plan, but do not fall within the 15-page limit. The research plan should include a footnote with the proposal title and lead PI's name.

CVs/Resumes

The resumes of all principal investigators and other senior personnel involved in the proposal must be provided. **Each resume is limited to two consecutively numbered pages** and must include the following information:

- A list of professional and academic credentials, mailing address, and other contact information **(including e-mail address)**.
- A list of up to five of your most recent publications most closely related to the proposed project and up to five other significant publications. Do not include additional lists of publications, lectures, etc.
- A list of all persons (including their organizational affiliations) in alphabetical order with whom you have collaborated on a project or publication within the last four years. If there have been no collaborators, this should be indicated.

Budget Justification
For each fiscal year, and for each budget category (personnel, travel, contractual, commodities, and equipment), list the total amount requested and explain the basis for the request in terms of specific project objectives and activities. Funds from non-EVOS sources, including in-kind contributions, must also be described. In addition, if you are employed by a government agency that has a legislative mandate for the type of work you propose to do, you must explain why the proposed costs are not being covered by your agency's budget. If you are employed by a non-Trustee agency, you must include an explanation of how the indirect costs were calculated. **This justification must not exceed two consecutively numbered pages.**

Detailed Budget Form
Submit a budget form outlining expenditures estimated to be necessary for implementing the objectives described in your proposal. This form will be reviewed in conjunction with the budget justification. You may be asked to respond to budget review questions or to revise budgets to address budgetary concerns.

Data Management and Quality Assurance/Quality Control ("QA/QC") Statement
Any project involving collecting or processing data, conducting surveys, taking environmental measurements, and/or modeling must provide a statement describing the data acquisition and quality assurance/control processes that will be used to ensure the integrity of the data and match data types to project objectives. This statement must present the information listed below and reference the specific page and paragraph number of the research plan containing the information, or state that the item does not apply to the proposed research. If you are employed by an entity that has published its QA/QC procedures, please cite where the information may be obtained in lieu of a statement. **This statement must not exceed three consecutively numbered pages.**

1. Describe the study design, including sample type(s) and location requirements, all statistical analyses that were or will be used to estimate the types and numbers of physical samples required or equivalent information for studies using survey and interview techniques.

2. Discuss the general characteristics of the data that your project is going to be collecting/ producing, such as units of measurement, sample sizes, sampling techniques, specific equipment used for taking measurements/counts, procedures for collecting samples and recording measurements, etc.

3. Discuss criteria and procedures for determining acceptable data quality in terms of the activities to be performed, hypotheses to be tested, and analytical instruments to be used. Describe the procedures that will be used in the calibration and performance evaluation of all analytical instruments and all methods of analysis to be used during the project.

4. Define each algorithm to be used to convert signals from sensors to observations. Examples of algorithms of interest would be the conversion of pressure to depth and the conversion of integrated voltages to biomass at depth. When conversion algorithms are lengthy (i.e., computer programs) substitute a source location, such as an ftp site, for the full text. In the case of proprietary conversion algorithms, identify

the proprietor and describe how the accuracy of conversion is verified under calibration (see #3 above).

5. Describe the procedures for the handling and custody of samples, including sample collection, identification, preservation, transportation, and storage.

6. Discuss the procedures for data reduction and reporting, including a description of all statistical methods, with reference to any statistical software to be used, to make inferences and conclusions. Discuss any computer models to be designed or utilized with associated verification and validation techniques

Budget Instructions for Proposals
Budgets will be reviewed for consistency with proposal objectives and for adherence to the budget instructions that follow. It is the responsibility of the proposer to submit a budget that is both reasonable and justifiable. Proposers may be asked to respond to budget review questions, or to revise their budgets to address budgetary concerns. General costs may be submitted until final project negotiations are complete. The scope of the proposal may be modified during negotiations to include more than a single resource or service if applicable.

Instructions
A budget form detailing the amount of funding requested from the Trustee Council for each federal fiscal year must be submitted as part of the proposal package. The form is in addition to the budget justification that is also required as part of the proposal package.

There are two sets of budget forms. Use only the set that applies to you. One set is used for proposals submitted through Trustee agencies. A second set is for those submitted through non-Trustee organizations.

Blank forms (Excel format) are available on the EVOSTC website at
http://www.evostc.state.ak.us/Proposals/Downloadables/FY09_budget_Froms.xls
For assistance completing budget forms, please contact the EVOSTC Administrative Manager via email (lynette.schroeder@alaska.gov)or phone at (907) 278-8012.

Notes:
- Fiscal Year: The Trustee Council operates on the federal fiscal year (FY). TheFY10 budget covers the period October 1, 2008 through September 30, 2009. Your budget must address all fiscal years for which funds are requested.
- Project Number: The EVOS Trustee Council office assigns numbers to proposals.
- Rules for Numbers: Show costs in thousands of dollars (e.g. show $86,423 as $86.4. When the number "5" follows the digit to be rounded, round to the higher amount. (e.g. round $26,752 to $26.8).
- Positions: Report the number of positions as full-time equivalent positions (FTE), by converting the number of months to a decimal. For example, show six months (half of a year) as .5 FTE.
- Indirect Costs: Indirect costs are costs incurred for common or joint purposes that cannot be specifically identified with a particular project. Examples of indirect costs are lease costs,

copying, phones, faxes, internet access, equipment maintenance, vehicle leasing, training, payroll and personnel functions, clerical support, administrative supervision, accounting, auditing and mail and messenger services. These items should be budgeted for separately only if they are incurred because of a specific project and documentation of the expense is maintained.

- Trustee Agencies (Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, Alaska Department of Natural Resources, National oceanic and Atmospheric Administration, US Forest Service and US Department of the Interior) should cover these costs through the Trustee Council's general administration (GA) formula. The GA Rate is 9% of each project's total direct costs.

- Non-Trustee organizations should cover these costs through their indirect cost rate. These rates will be reviewed on a project-by-project basis. However, proposers affiliated with the University of Alaska must use the indirect rate agreed to by the University for Trustee Council-funded projects. The agreement provides for an indirect cost rate of 25% of total direct costs (TDC). TDC includes all direct costs except (1) equipment for which ownership resides with the University and (2) subcontract costs in excess of $25,000. Regarding subcontracts, the indirect rate is 25% of the first $25,000 of each subcontract, plus 5% of each subcontract's costs in excess of $25,000 and less than $250,000, plus 2% of each subcontract's costs in excess of $250,000.

- Direct Costs: Direct costs are costs specifically identified with a particular project. Examples of direct costs are compensation of employees for the time spent executing the project, acquisition of materials or equipment for purposes outlined in the research plan, project-specific travel and contractual services specified in the research plan. For most projects, the following direct costs should be included:

- NEPA (National Environmental Policy Act) Compliance: All projects funded by the Trustee Council must comply with NEPA. Due to the nature of many EVOS-funded projects, most projects receive a categorical exclusion (CE). However, for a few projects, an environmental assessment (EA) may be required. If a project will likely require an EA, include the costs for preparing the EA in the project budget.

- Community Involvement: Include funds for the PI or his/her representative to exchange information with local communities as appropriate.

- Report Writing: A final report is due April 15 of the final year of the project. PIs may be required to provide an oral briefing of their findings to the Trustee Council. Final reports are required upon project completion. Identify in the description field on the appropriate budget forms any funds that have been included for report writing and preparation. See the Procedures for the Preparation and Distribution of Reports on the EVOS TC website.

- Manuscript Preparation and Publication: The Trustee Council may contribute a maximum of $1,000 in page costs per project and 1.5 months of personnel time per manuscript toward

publication of study results in the peer reviewed literature. Specify in your research plan the subject/title of each manuscript, the name of the peer reviewed journal(s) to which you plan to submit and anticipated date of submission.

Budget Form Explanations
Download budget forms and detailed instructions from:
http://www.evostc.state.ak.us/Policies?Downloadables/budget_forms.xls

- Trustee Agency Form, Multi Trustee Agency Summary, Form 2A
  Use this form if multiple Trustee agencies are cooperating on a project. If only one Trustee agency is involved, this form is not required.

- Trustee Agency Form, Summary, page 1 of 4, Form 3A
  This form summarizes the proposed expenditures contained on the Trustee Agency Detail forms.

- Trustee Agency Form, page 2 of 4, Personnel & Travel Detail, Form 3B
  "Personnel" means compensation of employees, including benefits, for the time and effort devoted to the execution of the project. "Travel" means the cost of transportation by public conveyance and per diem. All travel must be budgeted at round-trip economy rates.

- Trustee Agency Form, pages 3 of 4, Contractual and Commodities Detail, Form 3B
  "Contractual" covers such items as vessel charters, equipment rental or lease, professional services, communications and printing. "Commodities" are expendable supplies with an estimated life of less than one year and a unit value of less than $1,000.

- Trustee Agency Form, page 4 of 4, Equipment Detail, Form 3B
  "Equipment" means non-expendable items having an estimated life of more than one year and a unit value greater than $1,000. Equipment previously purchased by the Trustee Council should be used to the maximum extent possible. Before requesting funds for new equipment, contact your Trustee Agency project manager to determine if suitable equipment is already available. Equipment items with an original per unit cost of $5,000 or more belong to the acquiring Trustee agency on behalf of the Council. At the end of the project, the Council's Executive Director shall determine if such equipment shall be used for another Council project or if the item shall remain with the acquiring agency. For more information, download the Financial Procedures from the EVOSTC website.

- Non-Trustee Organization Form, page 1 of 4, Summary Form 4A
  This form summarizes the proposed expenditures contained on the Non-Trustee Organization Detail forms.

- Non Trustee Organization Form, page 2 of 4, Personnel & Travel Detail, Form 4B
  "Personnel" means compensation of employees, including benefits, for the time and effort devoted to the execution of the project and includes tuition for students. "Travel" means the cost of transportation by public conveyance and per diem. All travel must be budgeted at round-trip economy rates.

- Non-Trustee Organization Form, page 3 of 4, Contractual & Commodities Detail, Form 4B.
  "Contractual" covers such items as vessel charters, equipment rental or lease, professional services, communications and printing. "Commodities" are expendable supplies with an estimated life of less than one year and a unit value of less than $1,000.

- Non Trustee Organization Form, page 4 of 4, Equipment Detail, Form 4B
  "Equipment" means non-expendable items having an estimated life of more than one year and a unit value greater than $1,000. Equipment previously purchased by the Trustee Council should be used to the maximum extent possible. Before requesting funds for new equipment, contact your Trustee Agency project manager to determine if suitable equipment is already available. All equipment purchased remains the property of the Trustee Agency until the end of the project, at which time the agency may, under certain circumstances, transfer the equipment title to the contractor. If the original per unit cost of the equipment was $5,000 or more, the Council's Executive Director has the authority to direct that the equipment be transferred to another Trustee Council-funded project, rather than remaining with the Trustee Agency or being transferred to a contractor.

PROPOSAL SIGNATURE FORM

THIS FORM MUST BE SIGNED BY THE PROPOSED PRINCIPAL INVESTIGATOR AND SUBMITTED ALONG WITH THE PROPOSAL. If the proposal has more than one investigator, this form must be signed by at least one of the investigators, and that investigator will ensure that Trustee Council requirements are followed. Proposals will not be reviewed until this signed form is received by the Trustee Council Office.

By submission of this proposal, I agree to abide by the Trustee Council's data policy (*Trustee Council Data Policy**, adopted March 17, 2008) and reporting requirements *(Procedures for the Preparation and Distribution of Reports***, adopted June 27, 2007).

PROJECT TITLE: _____

Printed Name of PI: _____

Signature of PI: _____ Date: _____

Email: _____ Phone: _____

Mailing Address _____

City, State, Zip _____

Printed Name of PI: _____

Signature of PI: _____ Date: _____

Email: _____ Phone: _____

Mailing Address _____

City, State, Zip _____

Printed Name of PI: _____

Signature of PI: _____ Date: _____

Email: _____ Phone: _____

Mailing Address _____

City, State, Zip _____

* www.evostc.state.ak.us/Policies/data.cfm

** www.evostc.state.ak.us/Policies/reporting.cfm

FY10 INVITATION
PROPOSAL SUMMARY PAGE

Project Title:

Project Period: (Please use the federal fiscal years of October 1 – September 30)

Primary Investigator(s): (List each investigator and their affiliation)

Study Location: (Be specific as possible)

Abstract:

Estimated Budget:
EVOS Funding Requested:
(breakdown by fiscal year and must include 9% GA)

Non-EVOS Funds to be used:
(breakdown by fiscal year)

Date:

(NOT TO EXCEED ONE PAGE)

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Identify the problem the project is designed to address. Describe the background and history of the problem. Include a scientific literature review that covers the most significant previous work history related to the project.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

Discuss how the project will evaluate the hypotheses or questions posed in the Invitation. Describe the results you expect to achieve during the project, the benefits of success as they relate to the topic under which the proposal was submitted, and the potential recipients of these benefits. Discuss the utility of the research proposed for addressing the objectives described in the invitation.

II. PROJECT DESIGN

A. Objectives

List the objectives of the proposed research, the hypotheses being tested during the project, and briefly state why the intended research is important.

B. Procedural and Scientific Methods

For each objective listed in A. above, identify the specific methods that will be used to meet the objective. In describing the methodologies for collection and analysis, identify measurements to be made and the anticipated precision and accuracy of each measurement and describe the sampling equipment in a manner that permits an assessment of the anticipated raw-data quality.

If applicable, discuss alternative methodologies considered, and explain why the proposed methods were chosen. In addition, projects that will involve the lethal collection of birds or mammals must comply with the Trustee Council's policy on collections, available at www.evostc.state.ak.us/Proposals/policies.htm.

C. Data Analysis and Statistical Methods

Describe the process for analyzing data. Discuss the means by which the measurements to be taken could be compared with historical observations or with regions that are thought to have similar ecosystems. Describe the statistical power of the proposed sampling program for detecting a significant change in numbers. To the extent that the variation to be expected in the response variable(s) is known or can be approximated, proposals should demonstrate that the sample sizes and sampling times (for dynamic processes) are of sufficient power or robustness to adequately test the hypotheses. For environmental measurements, what is the measurement error associated with the devices and approaches to be used?

D. Description of Study Area

Where will the project be undertaken? Describe the study area, including if applicable decimally-coded latitude and longitude readings of sampling locations or the bounding coordinates of the sampling region (e.g., 60.8233, -147.1029, 60.4739, -147.7309 for the north,

east, south and west bounding coordinates). The formula for converting from degree minute seconds to decimal degrees is: degrees + (minutes/60) + (seconds/3600) so 121°8'6" = 121. + (8/60) + (6/3600) = 121.135

E. Coordination and Collaboration with Other Efforts

Indicate how your proposed project relates to, complements or includes collaborative efforts with other proposed or existing projects funded by the Trustee Council. Describe any coordination that has taken or will take place (with other Council funded projects, ongoing agency operations, activities funded by other marine research entities, etc.) and what form the coordination will take (shared field sites, research platforms, sample collection, data management, equipment purchases, etc.). If the proposed project requires or includes collaboration with other agencies, organizations or scientists to accomplish the work, such arrangements should be fully explained and the names of agency or organization representatives involved in the project should be provided. If your proposal is in conflict with another project, note this and explain why.

III. SCHEDULE

A. Project Milestones

For each project objective listed above (II.A.), specify when critical project tasks will be completed. Project reviewers will use this information in conjunction with annual project reports to assess whether projects are meeting their objectives and are suitable for continued funding. Please format your information like the following example.

Objective 1. Develop sediment-core chronologies in lake-productivity indicators.
To be met by September 2010

Objective 2. Compare sediment data corresponding to the past few decades to salmon population statistics.
To be met by December 2010

Objective 3. Reconstruct time-series of lake productivity, input of marine-derived nutrients, and salmon escapement.
To be met by April 2011

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.

FY 07, 1st quarter (October 1, 2009-December 31, 2009)

October: *Project funding approved by Trustee Council*

FY 07, 3rd quarter (April 1, 2010-June 30, 2010)

April 30: *Core Upper Russian Lake*
May 30: *Core Delight Lake*

FY 07, 4th quarter (July 1, 2010-September 30, 2010)
September 1: *Core Hidden Lake*

FY 08, 1st quarter (October 1, 2010-December 31, 2010)
December 15: *Finish lab analyses of all three lakes*

FY 08, 2nd quarter (January 1, 2011-March 31, 2011)
(dates not yet known) *Annual Marine Science Symposium (applicable only to final year of project)*

FY 08, 3rd quarter (April 1, 2011-June 30, 2011)
April 15 *Submit final report. This will consist of a draft manuscript for publication to the Trustee Council Office.*

FY 08, 4th quarter (July 1, 2011 – September 30, 2011)
June 30 *Respond to peer review comments.*
July 30 *Secure final approval, acceptance of final report*
September 30 *Publication of final report complete, delivered to ARLIS*

APPENDIX A – COMMUNITY CONTACT INFORMATION

The following contact information is intended to be used by applicants to find initial contacts in the communities:

Native Village of Afognak
Nancy Nelson, Chairperson
115 Upper Mill Bay Rd. Suite 201
Kodiak, AK 99615
907-486-6357
melissa@afognak.org

Native Village of Akhiok
Rolin M Amodo, President
P.O. Box 5030
Akhiok, AK 99615-5030
907-836-2313

Chenega IRA Council
Larry Evanoff, President
PO Box 8079
Chenega Bay, AK 99574-8079
(907) 573-5132
chenegaira@aol.com

Chignik Lake Village Council
Virginia Aleck, President
P.O. Box 33
Chignik Lake, AK 99548
907-845-2212
chigniklakecouncil@yahoo.com

Chignik Bay Tribal Council
Roderick Carlson, President
P.O. Box 50
Chignik Bay, AK 99564
907-749-2445
cbaytc@aol.com

Native Village of Chignik Lagoon
Clemens Grunert, President
P.O. Box 09
Chignik Lagoon, AK 99565
907-840-2281
clvc101@aol.com

City of Cordova
Tim Joyce, Mayor
P.O. Box 1210
Cordova, AK 99574
907-424-6200
cityclerk@cityofcordova.net

Traditional Village of Eyak
Robert Henrichs, President
P.O. Box 1388
Cordova, AK 99574-1388
907-424-7738
reception@nveyak.org

City of Homer
James C. Hornaday, Mayor
491 East Pioneer Ave.
Homer, AK 99603
907-235-8121
clerk@ci.homer.ak.us

Native Village of Karluk
Alicia Reft, President
P.O. Box 22
Karluk, AK 99608
907-241-2218

Kodiak Island Borough
Jerome Selby, Mayor
710 Mill Bay Road
Kodiak, AK 99615
907-486-9301
njavier@kodiakak.us

City of Kodiak
Carolyn Floyd, City Clerk
710 Mill Bay Road
Kodiak, AK 99615
907-486-8636
clerk@city.kodiak.ak.us

Larsen Bay Tribal Council
Mary Nelson, President
P.O. Box 50
Larsen Bay, AK 99624
907-847-2207/2276

City of Larsen Bay
Allen Panamaroff Sr., Mayor
P.O. Box 8
Larsen Bay, AK 99624-0008
907-847-2211
cityoflarsenbay@aol.com

Nanwalek IRA Council
Emilie Swenning, President
P.O. Box 8028
Nanwalek, AK 99603-8028
907-281-2274
nanwalek@yahoo.com

Port Lions Traditional Tribal Council
Ivan D. Lukin, President
P.O. Box 69
Port Lions, AK 99550
907-454-2234
NVOPL@starband.net

Native Village of Tatitlek
Sue Johnson, President & CEO
P.O. Box 171
Tatitlek, AK 99677
907-325-2311
suejohnson1@starband.net

Old Harbor Tribal Council
Conrad Peterson, President
P.O. Box 62
Old Harbor, AK 99643
907-286-2215
ohtribal@hotmail.com

Ouzinkie Tribal Council
Daniel Ellanak, President
P.O. Box 130
Ouzinkie, AK 99644
907-680-2259
ouzclerk@starband.net

City of Seldovia
Richard Wyland, Mayor
Drawer B
Seldovia, AK 99663
907-234-7643
info@cityofseldovia.com

City of Seward
Clark Corbridge, Mayor
P.O. Box 167
Seward, AK 99664
907-224-4046
clerk@cityofseward.net

Seldovia Village Tribe IRA
Crystal Collier, CEO
Drawer L
Seldovia, AK 99663
907-234-7898
svt@svt.org

City of Soldotna
David Carey, Mayor
177 North Birch Street
Soldotna, AK 99669
907-262-9107
tfahning@ci.soldotna.ak.us

City of Valdez
Bert Cottle, Mayor
P.O. Box 307
Valdez, AK 99686
907-835-4313
spierce@ci.valdez.ak.us

City of Whittier
Lester Lunceford, Mayor
P.O. Box 608
Whittier, AK 99693
907-472-2327
admin@ci.whittier.ak.us

Exxon Valdez Oil Spill Trustee Council

Prince William Sound Integrated Herring Restoration Program

DRAFT – December 31, 2008

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501
907-278-8012
www.evostc.state.ak.us

Integrated Herring Restoration Program
DRAFT– December 31, 2008

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Integrated Herring Restoration Program
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TERMINOLOGY

Recovery – the return of the PWS herring population to some defined level. This can occur naturally or through restoration activities.

Restoration – the recovery of the PWS herring population through human actions.

Intervention –describes the activity that attempts to either increase PWS herring birth rates or reduce PWS herring mortality.

Enhancement – the result of restoring the herring population through intervention in a habitat that is capable of sustaining it.

Integrated program – is an ecosystem-based program organized around common goals and hypotheses determined and implemented through involvement by impacted communities and scientists to develop a teamwork that creates cost-efficiencies, open communication, and inter-related activities that inform each other to achieve the program goals.

Supplemental production – the release of cultured herring to increase the existing herring population.

Intensive aquaculture – the incubation of herring eggs and rearing of herring using traditional hatcheries and artificial environments.

Extensive aquaculture – using natural habitats (bays) to incubate herring eggs or to rear herring.

Recruitment - the process of older juveniles becoming sexually mature and joining the adult population. This definition is specific to Northeast Pacific herring.

Gamete - sperm or unfertilized ova prior to release from adult fish.

Egg – fertilized ovum, adhesive and sessile with developing embryo, and hatching in ~ 3 weeks.

Larva – recently hatched embryo, living off yolk sac (~5 days) and feeding on small (~100 μm) zooplankton, living in surface waters (primarily top 20 m) and part of the zooplankton community, although most abundance in nearshore habitats. In general, larvae are long and thin, with little resemblance to adult forms.

Metamorphic – process of change between larval and juvenile forms (pigmentation beginning, physical change).

Juvenile – the stages between the larvae and sexually mature adult. Young juveniles begin to assume the adult form and develop silvery-colored scales. In general, separate cohorts begin to aggregate together and form schools. The young juvenile stages are retained in nearshore

habitats, but may venture into offshore (continental shelf) areas during their second or third years. The duration of the juvenile stages usually ends at age 3 or 4 when the fish are sexually maturing and joining adult schools.

Adult – the sexually mature stage, beginning at age 3 or 4 (36 – 48 months of age). Adults may form sub-populations that may, or may not migrate to shelf waters for summer feeding. In general, adult herring form dense aggregations during winter months and remain relatively immobile and feed opportunistically.

Mass marking – the ability to place a physical or chemical mark on large numbers of fish in order to determine their place of origin.

In-situ – taking place in the original environment; not moved.

Carrying capacity - the maximum population of a particular organism that a given environment can support without detrimental effects.

Otolith - calcareous particles found in the inner ear.

Infection – invasion of host cells or tissues by a pathogenic agent.

Disease - an abnormal condition of a host that impairs normal physiological function. Diseases can be of either infectious or non-infectious etiology.

> *Infectious disease* - a disease caused by a communicable, pathogenic agent. The most common classes of pathogenic agents include viruses, bacteria, fungi, protozoans, multicellular parasites, and prions.
>
> *Non-infectious disease* – a disease caused by factors other than infectious agents. Non-infectious diseases may be caused by environmental factors (e.g. skin cancer), contaminants (e.g. mercury poisioning), genetic disorders (e.g. Parkinson's Disease), etc.

Epizootic – 1) The occurrence of a disease in an animal population, clearly in excess of its normal expectancy, and derived from a common or propagated source; 2) An epidemic among animals; 3) Outbreak (jargon).

Herd immunity – the concept of resistance among a group to a disease to which a large proportion of the members are immune.

Pathology - the study of the essential nature of diseases, and especially of the structural and functional changes produced by them in the host.

Integrated Herring Restoration Program
DRAFT– December 31, 2008

I. Introduction

The *Exxon Valdez* Oil Spill (EVOS) Trustee Council has classified the Prince William Sound (PWS) population of Pacific herring (*Clupea pallasi*) as a resource that has not recovered from the effects of the 1989 oil spill. The PWS herring population was increasing prior to 1989 with record harvests reported just before the spill. The 1989 year class was one of the smallest cohorts of spawning adults recorded and by 1993 the fishery had collapsed with only 25% of the expected adults returning to spawn. The PWS fishery was closed from 1993 – 1996 but reopened in 1997 and 1998 based on an increasing population. Numbers again declined in 1999 and the fishery remains closed today. Reasons for the population collapse and failure to recover remain largely unknown.

The main goal of this plan is to determine what, if anything can be done to successfully recover Pacific herring in PWS from the effects of the *Exxon Valdez* Oil Spill. In order to determine what steps can be taken, this plan will examine the reasons for the continued decline of herring in the Sound, identify and evaluate potential recovery options, and recommend a course of action for achieving restoration.

Recovery Objective: Based on the current information on Pacific herring in Prince William Sound, the Herring Steering Committee recommends the following recovery objective:

Restore the herring population in Prince William Sound (PWS) to a "recovered" (see below) status via a collaborative process between science and impacted communities:

- develop a collaboration between science and impacted communities
- determine the reasons for the lack of recovery of the PWS herring population
- determine the social, economic and ecological feasibility of intervention
- monitor and evaluate the success of restoration efforts
- improve accuracy of population predictions with more reliable information

The population of PWS Pacific herring will be considered recovered when:

1. the spawning biomass has been above 43,000 metric tons for 6 to 8 years;
2. there have been two "strong" recruitments of age 3 fish in those 6 to 8 years, where strong is $\geq$ 220 million fish (or log deviation $\geq$ 5.67);
3. spawning occurs in at least three geographic regions of PWS (e.g. North, East and West).

1. Why Herring, Why Now?

Twenty years have passed by since the Exxon Valdez Oil Spill but herring numbers are too low to sustain a commercial fishery. More importantly, perhaps, is the fact that herring are an integral part of every inshore ecosystem on the northwest coast of North America and the Prince William Sound ecosystem cannot be considered to be recovered from the effects of the oil spill until herring abundance has been restored.

Herring are vital to many different species, humans included. They are an important species for transferring energy from zooplankton to upper level predators such as whales, sea birds and larger fish. It is this vital placement in the food chain and the complex interactions between their food sources, zooplankton, and their predators that makes the examination of herring restoration very challenging. Additionally; population, community, and ecosystem-level resonations of enzootic and epizootic disease cycles contribute to a very dynamic set of conditions that make it difficult to recommend strategies. Each step in the PWS herring population life cycle and the concomitant interaction with either food or predator could be the "bottleneck" point or limiting factor(s) prohibiting their recovery. Herring have not recovered naturally and it is time to make a concentrated and coordinated effort to identify the most likely limiting factors and to identify enhancement opportunities based upon rigorous science.

Scientific research has been conducted on all the injured species in PWS and injured services have also been examined in great detail. Several recovering species have direct links to herring and are a tangible measure of the importance of this keystone species to a full recovery of all species and the ecosystem as a whole. All recovering human services are in some way linked to the recovery of herring with commercial fishing having, perhaps, the most far-reaching implications. The economic effects of commercial fishing losses are felt across entire communities, from the fishes themselves to the related service industries.

There is urgency to examining herring restoration at this point in time while there is still a viable, remnant stock from which to work. Additionally, momentum and a partnership have developed between the scientists and the affected communities to further this effort.

2. The *Exxon Valdez* Oil Spill and Pacific Herring

The PWS herring population was increasing prior to 1989, with record harvests reported just before the oil spill (Figure 1).

After the oil spill, the 1989 year class of herring was one of the smallest cohorts of spawning adults recorded and by 1993 the fishery had collapsed with only 25% of the expected adults returning to spawn.

The population collapse stopped the commercial fishery, and ignited debate about the cause. Some are convinced that the spill was the cause; others believe it was caused by natural systems (Rice and Carls 2007). Unfortunately, we will never know with certainty what the cause was or when it started, as there is a conflict between data interpretations (Hulson et al. 2008, Thorne and Thomas 2008). Highly virulent pathogens are currently endemic to Pacific herring populations, unhealthy fish were detected at the same time as the crash, and multiple stressors (including exposure to PAH's) can certainly exacerbate some chronic infections to epizootic disease; however, disease surveillances did not occur in the previous years. Hydro-acoustic estimates of over wintering populations were initiated in 1993, after the decline in population was detected, and hence are not available during or prior to the decline or crash. The spill certainly affected the 1989 year class, as eggs and as larvae, resulting in one of the

poorest recruitments ever observed. While oil continues to linger on some beaches in PWS, lingering exposures to new year classes is not suspected because there is little or no overlap of present day spawning sites with lingering oil. There is no known mechanism for continued oil exposures to this species. Direct oil effects were no longer detectable after 1990 in herring (Pearson, Elston et al. 1999; Carls, Marty et al. 2002) and strong recruitment of the 1988 year-class (in 1991) suggested that oil effects were restricted to the 1989 year class. No plausible oil-related mechanisms have been developed to explain a delayed response after intervening years of no response. Understanding the cause of the population decline or crash, and when it started, is no longer possible with certainty.

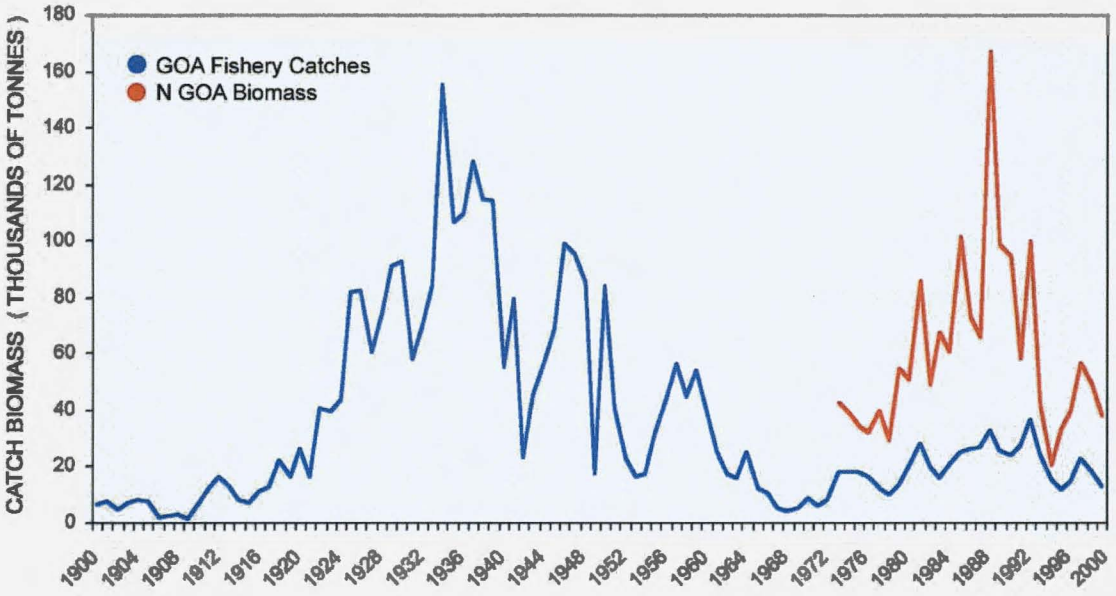


Fig. 1. Pacific herring fishery catches in the Gulf of Alaska (blue line) and estimated annual biomass of herring in PWS (red line) (Brown, 2007).

While oil continues to linger on some beaches in PWS, lingering exposures to new year classes is not suspected because there is little or no overlap of present day spawning sites with lingering oil. There is no known mechanism for continued oil exposures to this species. Direct oil effects were no longer detectable after 1990 in herring (Pearson et al. 1999; Carls et al. 2002) and strong recruitment of the 1988 year-class (in 1991) suggested that oil effects were restricted to the 1989 year-class. No plausible oil-related mechanisms have been developed to explain a delayed response after intervening years of no response. Understanding the cause of the population decline or crash, and when it started, is no longer possible with certainty.

3. Basic Herring Biology

The Pacific herring is one of 180 species of fish classified within the family Clupeidae and the order Clupeiformes. They occur in waters of the continental shelf from northern Baja California to arctic Alaska, westward to Russia and south to Japan and the west

coasts of Korea. They also occur along the Arctic Ocean from the White Sea eastward to Ob Inlet (Hay 1985) (Figure 2).

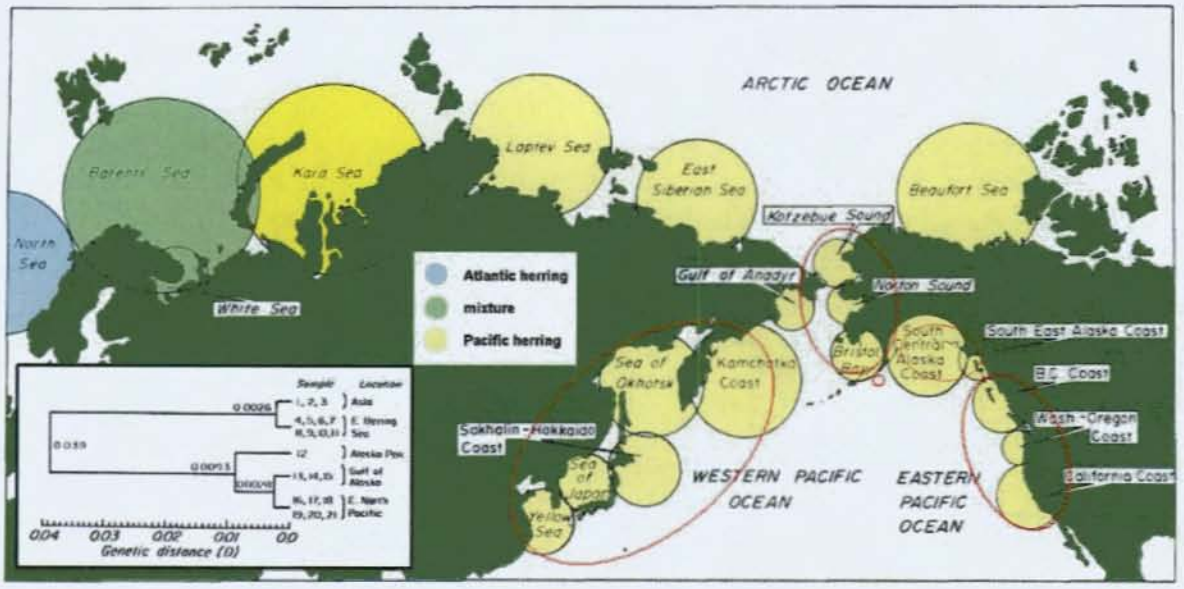


Fig.2. Global distribution of Pacific herring (adapted from Hay 1985)

The four Pacific herring life stages, eggs, larvae, juveniles and adults, are all found in PWS in various seasons and locations (Brown and Carls 1998). Spawning in PWS typically takes place in April and the spawning season varies from five days to three weeks. Pacific herring typically spawn along the same beaches each year, although the volume of eggs and shoreline distances varies (Brown and Carls 1998; Carls et al. 2002). For example, from 1994 to 1997, the annual spawning beach length ranged from 23.3 to 68.5 km (Willette et al. 1998). Figure 3 shows Pacific herring spawning beds located throughout PWS based upon 1973 - 2006 data from the Alaska Department of Fish and Game (Moffitt 2006 pers. comm.)

During spawning, the eggs attach to eelgrass, rockweed (*Fucus* sp), and kelp in shallow subtidal and intertidal areas. The eggs hatch in May, approximately 24 days after spawning depending on temperature (Hart 1973; Brown and Carls 1998). After hatching, the larval herring migrate to the surface, congregate nearshore and continue to grow. Initially, the larvae have yolks that will last a few days, are poor swimmers and currents significantly affect their distribution. The larvae become juveniles in July, about 10 weeks after hatching. In the fall, the juveniles move into deeper water. However, nearshore habitat remains important for at least the first year, and they may spend up to two years in nearshore areas or bays before joining the adult population residing in deeper waters (Brown and Carls 1998).

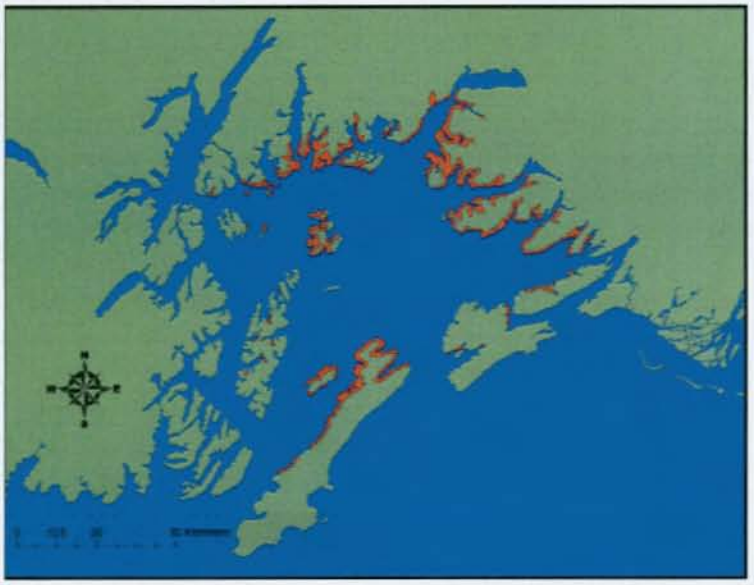


Fig.3 Pacific herring spawning beds located throughout PWS based upon 1973 - 2006 data from the Alaska Department of Fish and Game (Moffitt 2006, pers. comm.)

In PWS, adult Pacific herring rarely spawn before their third year and the average life span of a PWS herring is nine years. After spawning in the spring, adult Pacific herring disperse from the spawning aggregations to multiple schools in deeper waters, presumably close to the entrance of PWS (Brown and Carls 1998). In the fall, adult and two-year old fish return from summer feeding areas and over-winter in central and eastern PWS.

Newly hatched larvae carry a yolk sac that is typically depleted in the first week. The earliest larval stages begin feeding on the eggs of invertebrates and small zooplankton, such as copepods. While the larval Pacific herring grow and congregate nearshore through their first summer, they continue to live primarily on copepods but may also e at other crustaceans, barnacle larvae, mollusk larvae or young fishes (Brown and Carls 1998). As they move into deeper waters, copepods remain an important food for both juvenile and adult pacific herring, but adults also feed on larger crustaceans and small fish. During winter, as temperature and light decrease, food supply becomes limited and both young and adult year classes stop feeding functionally.

Survival of young herring through the winter depends on the amount of food that was available in the preceding summer and their ability to store sufficient lipid reserves to sustain them over the winter. For the older age classes, winter is less limiting on direct survival, but may affect their reproductive condition and spawning capacity in the spring (Carls et al. 2001).

II. Integrated Herring Restoration Plan – Restoration Options

1. Factors Limiting Recovery

The effectiveness of any restoration alternative depends on applying that alternative to bypass or overwhelm some limitation in the natural recovery of the PWS herring population. This leads to asking a fundamental question, what are the factors limiting herring recovery in Prince William Sound? Several potential factors have been identified including disease, predation, oceanographic changes, contaminants in the habitat, and competition. It may also be a combination of these factors that limits recovery. Adding to the complexity, differing life stages are likely affected in different ways or to different degrees by environmental factors. Rice and Carls (2007) provide a thorough review and synthesis of this topic. They conclude that the continued poor recruitment and lack of recovery of PWS herring probably is a combination of more than a single factor but exact explanations remain uncertain. These items are not listed in order of importance.

Disease

Disease prevalence must be monitored, by regular collection of specimens to test for the presence of pathogens. A historical limitation to the integration of population-level disease surveys into fisheries management has involved reactive, rather than proactive disease screening and decision-making process. Once an epizootic is underway, disease kinetics and spatial movement of the epizootic often result in a very difficult situation to manage on a real time basis. Therefore, in addition to monitoring for the prevalence and intensity of key pathogens in PWS herring, molecular and immunological tools must be developed that can that forecast the potential for disease on a population scale. Once these predictive tools are developed, they must be implemented concomitantly with infection, disease, and stock assessment surveys. Tool development should be an iterative process whereby the tools are tested and adjusted on an annual basis; additionally, due to unique characteristics of each of the primary herring diseases in PWS, select tools will be specific to each disease. As well, there must also be some provision to respond to epizootics as they occur: when die-offs are observed, rapid assessments must be done to discover the cause and extent of the outbreak. A preconceived disease action plan, containing multiple contingencies specific to different disease conditions, is essential to mitigating the population-level impacts of an epizootic.

Predation

Previous research has not eliminated predation as a limiting factor in PWS. Herring are of great importance in the PWS ecosystem; as roughly second- or third-order consumers, they transfer energy from zooplankton to a wide variety of consumers including humpback whales, harbor seals, birds, and other fish. Herring may also significantly influence or control the grazing pressure exerted on lower trophic levels (Cole & McGlade 1998). The relationships between herring and multiple predators is complex, but there it is plausible that abundant predator populations could significantly deplete the herring populations and or prevent recovery.

Oceanographic changes

Climatic changes can alter water temperatures thereby affecting the energetics of the fish. Climate changes can also alter the timing and location of productivity important to herring

feeding. Changes in circulation could alter larval dispersal and survival. Biological regime shifts associated with climate change can also alter the predators feeding on herring.

The exact conditions that favor herring survival remain unknown. Brown (2006) found that the Gulf of Alaska populations increased during the positive phase of the Pacific Decadal Oscillation (PDO), when the Aleutian low intensifies and warm water is found along the Alaskan coast, but other investigators concluded that herring do better during the negative phase of the PDO (Anderson and Piatt, 1999). Linking herring survival to a climatic index still does not indicate what aspects of that climatic index enhances herring survival.

Competition

With depressed population levels it may be possible that another species has filled some of the niches in the ecosystem that herring previously occupied. The competition for habitat or food at some life stage may limit the success of herring. Juvenile gadids, such as saffron cod or pollock, are often found in large numbers in the same habitats as juvenile herring. Although the Sound Ecosystem Assessment program found that there was no food competition between age 0 herring and pink salmon smolts (REF) there may be competition between these two species at different life stage or for different resources. At least one recent modeling project suggested that hatchery released salmon smolt are responsible for maintaining the depressed herring populations (Deriso et al. 2008). The roles of competition as a factor that prevents herring recovery remains speculative.

Contaminants in habitat

The waters and majority of the PWS shoreline are among the cleanest habitats in the world. Polynuclear aromatic hydrocarbon loads in the water are very low (Carls et al. 2002). Less than 0.2% of the shoreline has evidence of oil contamination, the current and historical human habitation sites and areas where *Exxon Valdez* oil remains (Boehm et al. 2004; Short et al. 2002 report). Only trace concentrations of persistent organic pollutants (e.g., pesticides and polychlorinated biphenols) are detectable in intertidal areas (Short et al. 2006 report).

While oil continues to linger on some beaches in PWS, lingering exposures of new herring cohorts is not suspected because there is little or no overlap of present day spawning sites with lingering oil. There is no known mechanism for continued oil exposures to this species. Direct oil effects were no longer detectable after 1990 in herring (Pearson, Elston et al. 1999; Carls, Marty et al. 2002) and strong recruitment of the 1988 year-class (in 1991) suggested that oil effects were restricted to the 1989 year class. No plausible oil-related mechanisms have been developed to explain a delayed response after intervening years of no response.

2. Core Data Collection

There is a necessary amount of basic information that is required to know where to focus any restoration activities, and to know whether or not any restoration option has been effective. Foremost, it imperative to have some idea of how many herring there are in PWS and where they occur. Although there is currently an annual stock assessment done

by ADF&G, the data requirements for a (typically conservative) management plan are substantially different from those of the restoration plan outlined here. Supplemental surveys that will improve spatial and temporal estimates of herring population size are required, for both adult and juvenile schools. These supplemental surveys will be most useful if they complement the fall and spring surveys done by ADF&G, but some additional surveys will be required.

It is also important to have some idea of how many new individuals are entering the population. ADF&G currently conducts aerial surveys for spawn extent in the spring. The fate of that spawn may be followed by a combination of focused surveys for larvae, and estimates of larval drift from hydrographic models (which are currently being developed by the AOOS project). That knowledge will then inform the abovementioned surveys, and further strengthen estimates of how many herring there are in PWS.
Finally, it is critical to address several questions posed by the prior section on factors that are currently limiting recovery:

Disease: Disease prevalence must be monitored, by regular collection of specimens to test for the presence of pathogens. As well, there must also be some provision to respond to epizootics as they occur: when die-offs are observed, rapid assessments must be done to discover the cause and extent of the outbreak.

Predation: It is required to have some idea of how many individuals are being removed from the population. Surveys to determine the abundance and distribution of key herring predators are necessary.

Oceanographic conditions: Environmental conditions set up the growth environment for herring: temperature plays a role in metabolic and therefore growth rates, and nutrient availability controls primary production, which ultimately determines how much zooplankton food are available each year. Moreover, the amount of transfer between PWS and the Gulf of Alaska (in terms of both water properties and plankton) can impact the ecosystem within the sound (Cooney et al. 2001). The environmental and food climate within PWS thus must be monitored with targeted surveys.

Competitors: As with predators, there is a requirement to have some idea of the abundance and distribution of important competitors to herring, in order to know if they have been displaced within the ecosystem of PWS. This may also be determined by surveys.

In summary, there are basic information needs about the state of both herring and the PWS ecosystem, that are required for the continual development of the IHRP so that restoration activities may be assessed and modified as necessary. Herring are an integral part of the PWS ecosystem, and an integrated ecosystem monitoring program will help draw the various programs within the IHRP together.

1. ADFG stock assessment program
2. Stock assessment program supplement

a. increased spatial and temporal scale of overwintering (fall & spring) surveys
b. evaluation of stock assessment techniques, especially spawn data input
c. evaluation of age at maturity (monitor gonad size & weight)
d. identification of stock structure (otolith chemistry, tags)
e. Juvenile surveys (summer, fall, spring)
f. establish distribution
g. use tags or otoliths to determine spatial contribution

3. Tracking survival and recruitment
   a. impacts of seabird, marine mammal and fish predators and disease
   b. evaluation of interspecific food competition of herring with pink salmon, sand lance and juvenile Pollock
   c. evaluate interrelationship among predation, prey availability, competition, and disease
   d. evaluate food limitation and key food/energy sources (outside or inside PWS) at juvenile and adult stages

3. Overview of Restoration Options

It may be possible to restore herring populations in Prince William Sound through the use of direct restoration or intervention methods such as the moving of fertilized eggs to habitats more favorable for survival or the release of juveniles reared in hatcheries. However, the efficacy of these or other direct restoration methods need to be proven and may remain technically infeasible or too costly. Furthermore, the use of direct restoration activities may cause unintended adverse environmental outcomes such as the increase in incidence of disease to herring or other fishes. Well-designed pilot projects can be used to test the efficacy and provide an experimental platform with which to better understand the factors limiting herring recovery, which must be accounted for in the implementation of full scale restoration activities.

The issue of restoration through intervention and particularly enhancement of marine fish populations is controversial. There is part of the fisheries science community, mainly from the ecological side, that is steadfastly opposed to the concept of marine finfish enhancement. There is another component who are comfortable with the concept. However, even the detractors of the concept suggest that the activity may be warranted when all other conventional management procedures fail. Even then there are reservations about the efficacy of the approach if density-dependent factors regulating recruitment occur after the release of cultured fish.

A decision to investigate the feasibility of a particular intervention alternative does not necessarily mean that the EVOS Trustee Council is committed to implementation of a large-scale intervention program. Instead, the intention is to examine the implications of the concept, as it applies to herring in Prince William Sound. Full scale intervention activities would require several years of preparation, mainly to develop and determine some technological issues, such as mass marking of fish. Mass marking and other technological activities are fundamental pre-requisites of intervention activity. Therefore, because the development of these technological issues will take time, it is important that some investigations begin immediately. It also is important to understand that these

investigations also could result in a definitive conclusion that the restoration activities are impractical or far too expensive.

The Integrated Herring Restoration Plan Steering Committee discussed and prioritized several restoration alternatives. The alternatives are presented in the order that they were rated by the group by possibility of success. Each alternative has advantages and disadvantages that should be considered when designing pilot and full scale programs. Because it is not clear what is the limiting factor to herring recovery it is not possible to predict the efficacy of any alternative so a plan to test the efficacy is essential to the development of that restoration approach.

Regardless of which intervention alternatives are developed, monitoring and research will play an important role in the restoration process. Monitoring will be required as part of any active restoration program to evaluate the efficacy of various active restoration methods, the status of recovery, and the potential occurrence of unintended adverse impacts. Research will be needed to support the particular activity and to identify if limiting factors elsewhere in the herring life cycle will prevent the restoration activity from being effective.

4. Restoration Options

a. Supplemental Production

Supplemental production is an enhancement activity designed to release cultured herring to supplement natural recruitment to assist recovery or restoration of the population to historical levels. Depending on the specific approach, supplementation can bypass early life stage mortality caused by larval drift, food availability, habitat competition, predation, and disease. For example, although juvenile herring could be released into nursery habitats after a few months, maintenance through the first winter would allow continued feeding and avoid winter starvation, a factor that may be limiting the population. The cost of any supplemental program depends on the length of time that the herring are maintained. All fish released must be marked to allow the efficacy of the program to be determined. Fundamental questions regarding the factors limiting recovery may be addressed with a well designed mark-recapture programs. There is also the potential for controlling the release site environment in a manner that can inform the efficacy of other restoration alternatives.

Supplemental production will be attempted only if the guiding principals are fulfilled (do no harm, base all activities on science, and be economically responsible) and the PWS herring biomass does not rebound naturally. To avoid harm, fundamental questions concerning the potential of introducing disease or exacerbating it in PWS herring will be addressed before any supplemental activities. This is the subject of ongoing research. Science-based tools, such as mass marking tools will be developed, authenticated, and peer reviewed before enhancement activities are considered. Mass marking is the subject of a pending workshop. A 'core' monitoring program to measure natural impacts on the PWS herring population must be fully operational before enhancement activity is considered. Furthermore, supplemental production will only be considered only if estimated probabilities of success are

reasonable. Costs will be estimated and discussed; no plan will advance if funding mechanisms are inadequate or cost-benefits are inappropriate.

To understand the implications of a supplemental program, one or more supplemental designs must be proposed for the purposes of cost analysis, regulatory implications, and consideration of potential positive and negative impacts on the herring population and the PWS ecosystem. In addition, a well designed supplemental program would also provide the information needed for developing a full scale in situ herring rearing program. These are the purposes of the supplemental proposal that follows.

The proposed supplemental program presumes juvenile herring will be released in spring, avoiding winter starvation conditions and that it will begin as a pilot program. Advantages of this alternative include that it directly adds fish to the ecosystem, technology exists for rearing hearing, large numbers of juveniles can be raised past one or more potential limiting factors, and the degree of manipulation should permit marking of all fish. Disadvantages include the higher costs associated with the length of time herring must be cared for and the potential for the release of diseased or inferior stock.

- **Action Steps**
  1. Pilot project
     a. Create a project plan
        i. Estimate total pilot project costs by phase
        ii. Create a collaboration plan with potential partners
        iii. Determine population enhancement objectives
     b. Design an operational plan including:
        i. Egg acquisition methods
        ii. staffing/observation schedules
        iii. release timelines
        iv. disease control protocols
        v. caging/netting/tank structure
        vi. feeding protocols (if necessary)
        vii. Permitting (EIS requirements)
        viii. lessons learned from salmon enhancement
        ix. equipment required (Ships, nets, divers, etc.)
        x. program for evaluating outcomes
     c. Develop disease surveillance program in and around the vicinity of the supplementation facility.
     d. Develop safe and effective biosecurity procedures including:
        i. Disease prevention procedures in the supplementation facility.
        ii. Methods to prevent the spread of pathogens from the rearing facility to wild fishes.
        iii. Standard Operating Procedures (SOP's) to implement in the event of disease outbreaks in the rearing facility / locality.
     e. Develop procedures to prevent exacerbation of disease resulting from comingling of released fish with wild cohorts.

2. Based on results of pilot project, if it is decided to proceed
    a. Create a project plan
        i. Estimate total project costs by phase
        ii. Create a collaboration plan with potential partners
        iii. Evaluate population enhancement objectives
    b. Design an operational plan including:
        i. Egg acquisition methods
        ii. staffing/observation schedules
        iii. release timelines
        iv. disease control protocols
        v. caging/netting/tank structure
        vi. feeding protocols (if necessary)
        vii. Permitting (EIS requirements)
        viii. lessons learned from salmon enhancement
        ix. equipment required (Ships, nets, divers, etc.)
        x. program for evaluating outcomes

- **Science Necessary**

1. Year 1 Steps
    a. Supplementation hypotheses, objectives, & strategies (intensive vs. extensive)
        i. Cost/Benefit Scale Study
    b. Evaluate the feasibility of marking and recapture technologies
        i. Mark/recapture detectability threshold & interpretation
        ii. Maintain the mark/recapture program
    c. Design a program for disease evaluation/control
        i. Evaluate the effect of stress on disease outbreaks
        ii. Maintain disease control program
    d. Identify potential egg acquisition, rearing, & release locations
    e. Evaluate the carrying capacity/natural food availability in each candidate bay
    f. Evaluate the grow out age/release condition
        i. bio-energetic model
    g. Evaluate the survival, condition, & distribution of post-release juveniles
        i. within nursery area
        ii. outside nursery area
    h. Evaluate the effect of juveniles released on natural populations
    i. Evaluate the optimal release cycles
    j. Basic understanding of disease kinetics and exacerbation factors including effects of rearing density, temperature, and nutritional status.
    k. Adaptive management strategies intended to mitigate disease.
    l. Expanded diagnostic tools for rapid diagnosis of pathogens and diseases
    m. Efficacious, long lasting, and safe vaccines that can be easily administered to reared herring.
    n. Develop required permitting.

- **Technologies Required**
  1. Mass marking and recapture techniques
     a. sub-group batch multiple marking
  2. Feeding methodologies
  3. Food production/composition
  4. Containment systems (nets, pens, etc.)
  5. Survey techniques

b. Predator Management

The goal of predator management is to reduce mortality by controlling the level of predation on herring. Herring are a common prey item of fish, birds, and mammals, and predation is therefore a likely factor limiting recovery of herring in PWS. Predator management can be accomplished by altering the behavior of a predator (known as "hazing"), or by outright removal of the predator.

Clearly, there are a number of herring predators whose abundance and behavior cannot be manipulated, on legal and moral grounds: two major mammal predators in PWS (humpback whales and Steller sea lions) are currently listed as endangered species. Moreover, the recovery of herring populations is partly because they are prey to avian predators still listed as not recovered from EVOS. However, there are a number of significant fish predators on herring, including groundfish (walleye pollock, cod and halibut) and salmon; behavioral modification of fish predators is not possible, but they may be removed by targeted fisheries. Walleye Pollock in particular has been identified as a potentially major predator (and competitor) of herring during the winter period, and a targeted fishery for that species is the most feasible restoration option.

- **Action Steps**
  1. Removing/hazing/barring predators

- **Science Necessary**
  1. Determine the predators that need to be included
     a. seabirds
     b. pollock
     c. marine mammals
     d. flatfish
  2. Complete overwintering density surveys at:
     a. entry to bay system (beginning of summer)
     b. leaving bay system (late summer)
     c. joining adult schools (fall)
     d. recruitment
  3. Determine energetics models for predators/prey
  4. Complete census of predator/prey fields
  5. Determine time varying age structure of herring (maybe predators also)
  6. Determine time varying distribution of predator/prey movement pathways

7. Surveys to determine success

- **Technologies Required**
  1. Active acoustic detection and alarm technologies
  2. Mass marking and recapture techniques
  3. Accurate census of juveniles

c. Altering carrying capacity by over-winter feeding

Food may be a limiting factor for at least part of the herring life cycle. During winter, as temperature and light decrease, food supply diminishes and could become limiting, especially for young year classes. Survival of young herring through the winter depends on the amount of food available in the preceding summer and the amount herring store as lipid reserves to sustain them over the winter (Blaxter and Holliday 1963; Hay, Brett et al. 1988; Paul, Paul et al.1998, Vollenweider 2007). For older age classes, winter is less limiting on direct survival, but may affect their reproductive condition and spawning capacity in the spring (Carls et al. 2001). Therefore the food environment experienced by herring prior to and during winter may influence year class strength and reproductive capacity. These observations indicate that multiple restoration measures might be taken.

It has been observed that herring will feed in the winter when food is available, and that winter feeding improves their condition (Rice, 2007). Overwintering starvation (or predation on nutritionally stressed individuals) is a potentially large source of mortality for herring, particularly for juveniles, so supplying supplemental food to young herring during the winter may lead to improved year-class strength. There is a wide variety of marine feeds that have been developed for aquaculture that could be used towards this end, some manufactured (pellet food and the like), some more natural than others (e.g. Artemia eggs and nauplii); each have some advantages and drawbacks in terms of price, simplicity, and nutritional value.

It may also be possible to increase productivity in an area of the Sound by adding additional nutrients: adding inorganic nutrients to increase fish production has been done successfully in lakes for many years (Hyatt et al., 2004). Fertilization has not been attempted in the coastal ocean, mainly due to problems of residence time (i.e. dilution by tidal flushing) and scale (the vast amount of nutrients required). Even in well constrained lakes, nutrient additions have usually been of a single, limiting nutrient, and unbalanced nutrient ratios have often lead to unintended consequences (blooms of algae types that are grazer resistant, for instance). Rather than adding allochthonous nutrients (i.e. nutrients that are brought in from an external source), it is also possible to enhance the movement of autochthonous (i.e. local) nutrients by moving deep water to the surface. Deep water is generally nutrient enriched (by the degradation of sinking organic matter); nutrient levels in the deep waters of the North Pacific are among the highest in the world ocean (Reid, 1961).

Nutrients are usually prevented from being mixed to the surface by temperature or salinity gradients. Such gradients are especially pronounced in in PWS, where the

large amount of fresh water input every spring and summer create a relatively fresh surface layer overlying deeper, nutrient rich water. However, it is possible to move deep water to the surface, which will increase nutrient concentrations and enhance production; the technology has been used for many years for shellfish aquaculture. A series of simple calculations suggest that artificial upwelling may enhance growth in fish stocks (Kirke, 2003), though those calculations were done for a low latitude reef ecosystem.

The surface waters of PWS are usually stratified in summer (Vaghan et al. 2001), which tends to reduce nutrient fluxes to the surface. Most primary production occurs in April and May (Eslinger et al., 2001) Mechanical "upwellers" could be used to enhance late-summer production: the technique has been recently demonstrated in the open ocean (Grabowski et al. 2008). Age-0 and -1 schools are generally found in inshore areas by late-July (Norcross et al., 2001), and locally enhanced production and increased food availability could then be expected to result in increased energetic reserves in young herring, which could be expected to cause a concomitant reduction in overwintering mortality.

There are numerous questions that need to be addressed prior to initiating an overwintering feeding or nutrient enrichment program. Within overwintering bays, it is important to have some understanding of the current winter carrying capacity. . Measurements of how much food is available to overwintering herring can be assessed by plankton surveys. It is also important to understand the bioenergetic requirements of herring during winter, in order to determine how much food is required. However, the bioenergetics of herring are fairly well known (Megrey et al., 2007). Finally, surveys to enumerate herring and their competitors are needed, in order to determine how much food would be required.

To assess the effectiveness of an overwintering feeding program, it would be important to monitor winter survival as well as the energetic condition of the fish. A comparative approach, where one bay is manipulated and one is not would permit testing whether or not food additions improved overwintering survival, and by how much. A potential test of the effectivenss of feeding supplementation could be based on fatty acid (FA) profiles. If the FA composition of manipulated bays were different than the profies of non-affected bays, then this would be reflected in the FA of herring that consume the food. Therefore FA testing, combined with other tests, could determine if manipulation led to increased feeding of herring, and if the effects of the manipulation were limited to local areas, or whether the possible movements of herring among different bays, obscured any local effects.

Similarly, to assess the effectiveness of a late summer nutrient enrichment, it would be important to also monitor the effectiveness of the upwelling system (with measurements of nutrients and productivity), as well as to follow survival and energetic condition of the fish. Again, a bay to bay comparison would be required to determine if nutrient additions were effective.

The technology requirements for a feeding program are fairly modest. There would need to be some development of the method used to deliver the food, and the nutritive composition. Aquaculture nutrition is a mature science, and there are many aquaculture feeds currently available that might be used for herring. Similarly, a late summer nutrient enrichment program could use existing upweller technology. Some upwellers are powered by waves, others by mechanical pumps, it is likely that an enclosed bay (which receives less wave action) would require the use of the latter. Both of these restoration options would need to be informed by synoptic, broad scale surveys of overwintering bays in PWS, high-speed cost-effective survey methodologies (optical and acoustic) are required to collect the data required at the appropriate scale, and at a reasonable cost.

- **Action Steps**
  1. Provide food
  2. Fertilize

- **Science Necessary**
  1. Determine what equipment is needed
  2. Determine the appropriate artificial/natural feed
  3. Determine required permitting
  4. Determine bays where juveniles are overwintering
  5. Evaluate overwintering Energetics
  6. Determine the natural survival level in each bay
  7. Determine the predation rates in each bay
  8. Compare herring results with competitor fish
  9. Evaluate efficacy of process
  10. Determine in-situ food availability
  11. Determine oceanographic conditions in each bay

- **Technologies Needed**
  1. Feeding methodologies
  2. Food production/composition

d. Disease Mitigation

Traditional disease management strategies involve an integration of infection prevalence and intensity monitoring with mitigation strategies including prevention with prophylactics, treatment with appropriate therapeutics, and adaptive disease management practices that are evaluated by continued disease monitoring. Although this proven process typically process works extremely well in hatchery situations, where fish are monitored and manipulated under semi-controlled conditions, the traditional disease management process is not appropriate in situations involving populations of wild marine fish, including Pacific herring in Prince William Sound. For example, administration of prophylactics and therapeutics to populations of wild marine fish are complicated by issues involving ecosystem scale and fish community dynamics, and are typically not considered appropriate for populations of wild fishes. These complications have historically prevented the advancement of disease

management in populations of wild fish; however, the field of disease ecology has recently emerged and is offering creative ways to mitigate and manage diseases in wild populations.

A disease ecology approach is similar to that employed by the World Health Organization (WHO) and Centers for Disease Control (CDC), and involves a three tiered process involving:

1. Establishment and continuation of infection prevalence and intensity monitoring and surveillances. This component is required to monitor changes that signal the emergence of future epizootics and to evaluate the efficacy of future disease management strategies.
2. Incorporation of empirical studies intended to determine the basic epidemiological relationships between environmental and biological factors influencing infection / disease prevalence.
3. Development of predictive tools, based on known epidemiological relationships, which will be useful in forecasting the potential for future disease epidemics.

Combined, this three-tiered approach will provide the basic epidemiological information necessary to develop and validate adaptive disease management strategies intended to mitigate the effects of future herring disease outbreaks in PWS; these adaptive management strategies can then be evaluated and adjusted through continued monitoring for infection prevalence and intensity. A very clear advantage of this approach over that employed by the WHO and CDC involves utilization of the natural host (Pacific herring), rather than mammalian surrogates for humans, in empirical manipulation studies.

- **Action Steps**
  1. Develop harvest management strategies to mitigate disease
     a. Culling the population before or during an epizootic
     b. Curtailing fishing
  2. Maintain population herd immunity

- **Science Necessary**
  1. Basic understanding of disease kinetics and exacerbation factors
  2. Predictive tools that forecast disease potential
     a. Genetic / molecular tools
  3. Bank of herring immune response genes
  4. Immunological tools
     a. In vitro tools
     b. Serological tools
  5. Epidemiological tools
     a. Processes involved in ickthophonus
  6. Evaluate success of the tools and harvest management strategies
  7. Annual monitoring
     a. Infection prevalence and intensity monitoring

b. Monitoring for susceptibility and disease potential
c. Evaluate epizootics
8. Determine cause through sampling
9. Develop vaccines and determine efficacy
10. Develop required permitting

Disease principles, relationships, and adaptive management strategies addressed in he Disease Mitigation option are also critical and intimately tied to the success of restoration Option: Supplemental Production. Disease is a natural phenomenon inherent to populations of both wild and hatchery fishes, with both groups of fish sharing similar causes, exacerbating factors, and principles of disease. For example, viral hemorrhagic septicemia causes large epizootics among populations of wild Pacific herring (Traxler and Kieser 1994, Meyers and Winton 1995, Meyers et al. 1999, Hedrick et al. 2003), and often causes epizootics in impounded herring used for the closed pound spawn-on-kelp (SOK) fishery that has occurred in Prince William Sound (Hershberger et al 1999). As a result of extremely large quantities of infective virus shed into the water during active epizootics (Kocan et al 1997, Hershberger et al 1999, and Hershberger et al *In Preparation*), some have questioned the impacts of the closed pound SOK fishery on initiating epizootics and deleterious population-level effects to wild, un-impounded herring.

e. Managing Competition (habitat (space) & food source)

There are several species of fish that occasionally compete with herring for food resources, and competition may thus be partly responsible for the lack of recovery of herring stocks. Recent work (Deriso et al. 2008) suggests that competition (and predation) from juvenile salmon released from hatcheries in PWS may be limiting the recovery of herring. However, the importance of salmon hatcheries in the local economy precludes limiting their output.

Juvenile walleye pollock (Theragra chalcogramma) is also a significant competitor to herring in PWS (Sturdevant et al., 2001). Juvenile pollock inhabit the same nursery bays as juvenile herring, and it has been observed that the energetic content of pollock tends to increase over the winter, while that of herring declines (Paul et al. 1998; Kline 2008). This suggests that herring may be out-competed by pollock during the winter, which would add to overwintering mortality (pollock is also a predator of herring, and predator control is dealt with in another section). If pollock is a significant competitor of herring, removal of that competition has the potential to reduce overwintering mortality.

The removal of pollock may be accomplished by a selective fishery specifically targeting that species. In practice it may not be possible to specifically target juvenile pollock, because it often co-occurs with herring. A selective fishery for adult pollock could be accomplished more easily, and would result in a concomitant reduction in the number of juvenile pollock the following year (as well as removing a major predator of herring in PWS).

In order for this option to be successful, some basic knowledge of the biology of pollock in PWS would be required, including estimates of stock size, age structure and distributions. As well, there would not need to be any specific fishing gear technologies developed for this option, pre-existing gear and methods could be employed.

- **Action Steps**
  1. Determine required permitting
  2. Remove competitors

- **Science Necessary**
  1. Distribution and abundance of competitors
  2. Distribution and abundance of overwintering juveniles
  3. Evaluate overwintering energetics
  4. Estimate the natural survival in each bay
  5. Estimate the predation rates in each bay
  6. Determine in-situ food availability
  7. Determine oceanographic conditions in each bay

- **Technologies Needed**
  1. Selective fishing gear

f. Improved Management Strategies

The recovery goal outlined in this plan requires a biomass above that currently used to open the fisheries. Therefore, changes to harvest strategies may be needed to allow full rebuilding of the stock. Such changes may include protecting spawning areas from staging and anchoring boats to reduce disturbance to the eggs, changing the fishery threshold, and restricting practices that tend to induce disease. Advantages of the approach include low costs to implement and potentially improved sustainability of the fishery. The disadvantages include not being able to implement until the fishery is reopened and no direct measure of how the changes affect the population.

- **Action Steps**
  1. Restrict or eliminate fishery gear types that tend to induce disease
  2. Increase or revisit fishery threshold
  3. Improve accuracy of stock assessment/ASA to minimize risk of over-fishing
  4. Create protected area for spawning

- **Science Necessary**
  1. Develop predictive tools to forecast future abundance
  2. Maintain existing stock assessment
  3. Strengthen stock assessment monitoring to evaluate effectiveness including egg deposition and GSI (gonad somatic index) & LSI (liver somatic index)
  4. Understand the role of spatial integrity in stock management
  5. Identify characteristics of productive spawning beds
  6. Model reproductive energetics and efficiency

7. Determine larval drift
8. Establish/verify predator prey relationships
9. Establish disease relationships
10. Determine if immunity can be introduced in-situ
11. Determine carrying capacity

- **Technologies Needed**
  1. Otolith chemistry for stock identification

g. Relocation of Stranded Eggs

Egg relocation involves moving eggs stranded on the shore back into the water to improve their viability or moving them to another location believed to be more favorable for survival. This approach attempts to reduce mortality at the egg and through the larval drift stages of life. Advantages of the approach are that the manipulation of eggs may allow them to be marked, and the cost is relatively low since handling is minimized. Disadvantages include potential harm to existing eggs during the collection process, the low likelihood of being able to manipulate enough eggs to detect an effect in the population, and it bypasses very few potential bottlenecks in herring recovery so it has a lower likelihood of success.

- **Action Steps**
  1. Return windrow eggs to the water
  2. Relocation of naturally spawned eggs, on natural or artificial substrate, to more favorable nursery bays

- **Science Necessary**
  1. Create operational plan for moving/gathering eggs
  2. Create a monitoring plan for moved eggs to determine success
  3. Survey to determine windrow egg quantity (variable in space and inter-annually)
  4. Determine the mortality rate of moving eggs
  5. Determine permitting requirements
  6. Determine hatching success on artificial and natural substrates
  7. Determine effects (if any) of stress on eggs
  8. Determine spatially diverse egg destinations using a larval drift analysis (probability map)
  9. Determine larval carrying capacity/natural food availability
  10. Determine the affect on natural populations
  11. Identify ideal nursery habitats
  12. Determine the larval disease prevalence/exposure

- **Technologies Needed**
  1. Technology for marking & recapture for evaluation
  2. Circulation model for larval drift analysis

h. No action – Allow Natural Recovery

If direct restoration activities are found to be impractical, too costly, or too risky, then monitoring and research may be the only viable means of understanding the natural recovery of the herring populations, or the mechanisms that prevent natural recovery. For example, monitoring and research might lead to a better understanding of the role of disease, predictability of disease outbreaks, and disease management practices that reduce disease impacts. Monitoring of herring populations and critical life-history attributes might also allow for the development of better predictive models of herring stocks, more protective fisheries management practices, and longer-term sustainability of the stock. Furthermore, monitoring and research might reveal unknown sources of human-induced impacts on herring that, if identified, could be ameliorated and removed as an impediment to natural recovery. The tools and understanding developed by monitoring and research would be expected to provide fisheries managers with better predictions of herring populations allowing for more adaptive management practices that will be needed even if active intervention is implemented. The greatest advantage is that no ecological manipulation is required. The disadvantage is that it does nothing to restore herring populations.

5. Recommendations

A number of restoration options may be dismissed for logistical, financial, and permitting reasons; the IHRP working group recommends that the restoration options that are most likely to be successful are:

- Supplemental production
- Carrying capacity supplementation
- Predator management (specifically the selective removal of Pollock)
- Competitor management (specifically the selective removal of Pollock)

An intensive field program (addressed in "core data collection") is also required, and should be initiated as soon as possible to provide the baseline data that will be needed by all restoration activities.

A precautionary approach is recommended for all the restoration options. Before any supplemental production activities begin, it is recommended that two workshops be held in FY2009, to investigate the feasibility of applying current marking technologies and to review the state-of-the-art in culturing technologies. White papers resulting from those workshops will then be used to plan pilot supplemental production activities in FY2010. All other restoration options should begin in FY2009 with small pilot studies to demonstrate feasibility and assess scalability.

Herring has an annual life cycle, so changes in the herring population will take several years to assess. It is thus important that the Trustee council recognize that a multiyear commitment to herring research is required, particularly support for the monitoring that will provide the critical data necessary to update and modify the plan as necessary. A long-term commitment is not incompatible with an annual funding cycle, for the various restoration options, and the IHRP has been designed to be flexible and to allow changes

to be made to the plan based on the status of the herring population on a year-to-year basis.

III. Integrated Herring Restoration Program – Programmatic Issues

1. Introduction
   This section of the Integrated Herring Restoration Program (IHRP) addresses the administrative and programmatic issues relating to maintaining the program. It discusses how the Herring Steering Committee will communicate with the Trustee Council, Restoration office, researchers and project leaders, agency personnel, and the public.

2. Integrated Herring Restoration Program Steering Committee
   The Herring Steering Committee ("Committee") consists of scientists, agency representatives, commercial fishermen, and members of the public. The Committee has been tasked with the creation and implementation of the IHRP and is responsible for making recommendations to the Executive Director on project proposals, progress reports, and final deliverables. The Committee currently consists of 10 members and meets on a bi-annual basis. Two temporary sub-committees have been formed for topic-specific experts to address issues and perform specific tasks, including writing the IHRP and evaluating current marking technologies that may be applicable to PWS herring. Temporary sub-committees will be formed as needed to address topics and members will be selected from both the Committee at large and from national experts on specific topics. The main tasks of the Committee will be to:

   - write and update the IHRP;
   - make recommendations to the Executive Director on project proposals, progress reports, and final deliverables;
   - identify the need for sub-committees to address specific topics; and
   - ensure open communication and data sharing between funded projects.
   - ensures communication with impacted communities and input from impacted communities is incorporated into the IHRP.

   a. *Organization*
      The Committee will provide guidance to the Executive Director and will work closely with the EVOSTC Restoration office and agency project managers to meet its identified goals.

   b. *Decision Making*
      The Committee functions on a majority vote basis and makes recommendations as a group. Any dissention in the group on a topic is provided along with the majority recommendation to ensure that all information is available to the Executive Director and the Trustee Council prior to making any decisions. The Committee will have two standing meetings scheduled each year.

c. *Internal Review and Reporting*
This section addresses the internal review and reporting structure of the Committee, the reporting required of each PI to the Committee, and how the committee will report to the Executive Director and Trustee Council.
Internal reporting – The Committee will communicate between meetings through email, teleconferences, and a web-based forum. Two standing meetings will be scheduled during each fiscal year and other meetings will be scheduled as needed to address specific topics.

Project Proposals – Upon receipt of project proposals, the Committee will to review and make recommendations on each proposal. Confidentiality and non-disclosure agreements will be signed prior to distributing the full proposals to the Committee members. They will also receive any anonymous peer reviews received for each proposal. Proposals that are received from a Committee member's agency, institution, or co-worker will not be shared with that Committee member and they must recuse themselves from any discussion or recommendation on that specific proposal(s).

After reviewing and discussing each proposal, the Committee will make recommendations to the Executive Director for each proposal based on its scientific merit, ability to answer questions identified by the Committee in the request for proposal, and how well the project will integrate with existing efforts. A majority vote will determine if a project is recommended for funding.

Project Progress Reports – Project progress toward identified objectives will be reviewed by the Committee at its bi-annual meetings. Each principal investigator (PI) will be responsible for providing a detailed report on the project's progress to both the Committee and to the assigned agency project manager 30 days prior to the identified Committee meeting date. PIs may attend the meeting either in person or via telephone to aid in the discussion of the project's progress. The Committee will make recommendations, if necessary, to the PI, Executive Director, and agency project manager for suggested changes in scope, schedule, or level of integration. The Committee will inform the Executive Director of any projects that are not meeting their identified goals or are not working as part of the integrated team.

Principal Investigator Reporting – Each PI will be expected to provide an in-depth review of their project's progress 30 days prior to each of the two Committee meetings. The review will be provided to their assigned agency project manager who will forward it to the EVOSTC Restoration Specialist for distribution to the Committee. The report will detail each of the project's objectives and what work has been accomplished to date on each, an update of the project's schedule, and a summary of how local communities have participated in or been made aware of their progress.

Reporting to the Executive Director – The Steering Committee will provide a written summary of each meeting to the Executive Director within 14 days of the end of the meeting. The summary will provide details of the discussion, recommendations of the committee based on the items reviewed, and a timeline for items that need action prior to the next meeting.
Project Final Reports/Deliverables – The Committee will review all final reports and deliverables for each project to ensure that the information gained is incorporated into the IHRP. The Committee will provide feedback to the EVOSTC office staff that will be added to independent peer reviews and addressed into each final report/deliverable.

d. Recommended Herring Coordinator

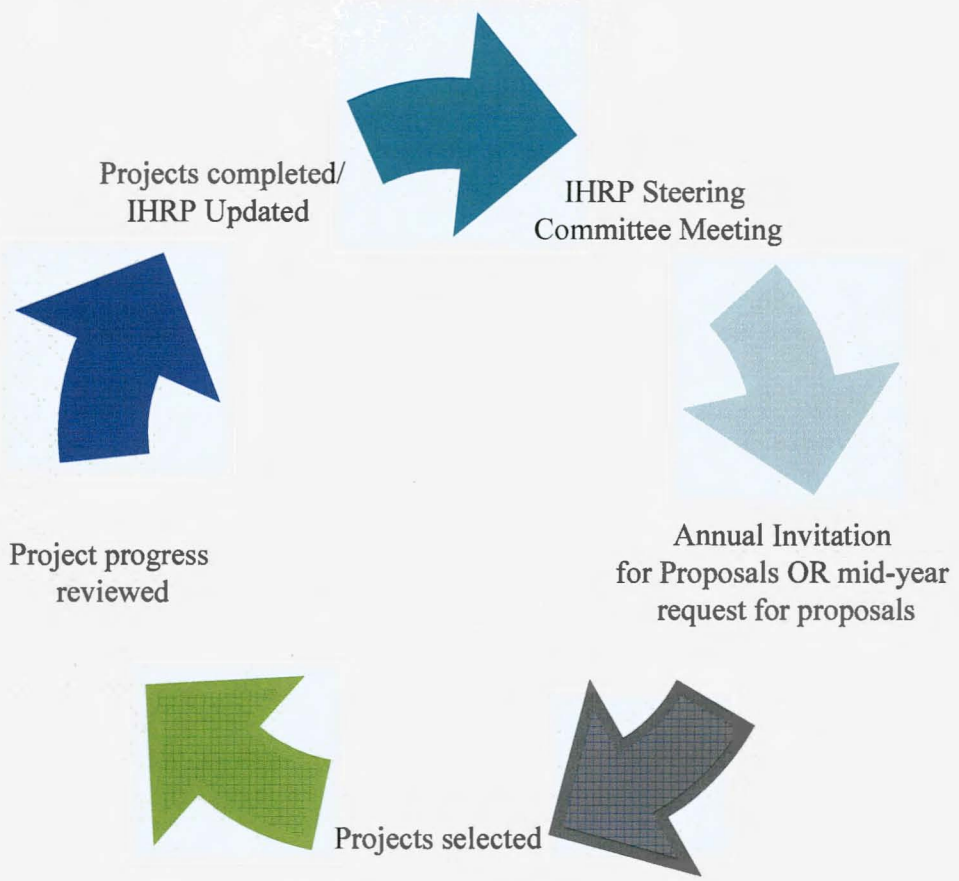
A full-time herring coordinator position has been recommended by the group to assist with logistics, internal and external communication, and to coordinate the efforts of the Steering Committee. The recommendation is for the herring coordinator to be housed at the EVOSTC restoration office in Anchorage, Alaska and to report directly to the Executive Director. The proposed tasks of this full-time position would include:

- coordination of all project logistics including vessel time, laboratory time (if appropriate), data transfer, and information sharing between the PI's;
- communication of the PI's and Steering Committee's progress to the Executive Director and the Trustee Council;
- scheduling the bi-annual workshops and any necessary meetings throughout the fiscal year;
- updating the Integrated Herring Restoration Program document under the guidance of the Steering Committee; and
- updating the herring information webpage on the EVOSTC website.

e. Adaptive Management Cycle

The restoration program for PWS herring can be managed adaptively where the problem evaluation, policy decisions, research, monitoring and outcomes are all related in a way that leads to logical decision making and provides order and context for the various program activities.

Flexibility will be key in determining the course of decisions for each fiscal year and the chart below illustrates the management cycle. At any point in the process, the Committee can make the decision to start over at the beginning of the cycle if necessary. An example of how the program can be adapted to meet particular goals would be if a project's progress is reviewed and it is determined that additional scope is needed or if a question has been raised in the research that requires a separate study. The Committee can then elect to meet again and begin the request for proposals cycle at any point in the year.



3. Administrative Procedures

   a. *Semi-Annual Meetings*

   In order for the Committee to make recommendations in a timely manner, two meetings per fiscal year will be scheduled as standing meetings and will include all members of the Committee. The meetings will last approximately three-four days and will be held in Anchorage or Cordova, Alaska. Sub-committee and full Committee meetings may be called throughout the year as needed and will be publicly advertised. All meetings will be open to the general public. The bi-annual workshops will serve to discuss proposals, project progress reports, and final reports and deliverables. The group will also discuss updates to the IHRP document and determine if any corrective action is needed.

   b. *Logistics coordination*

   Prior to the potential appointment of a herring coordinator, the funded PIs will be expected to prepare a detailed schedule of any necessary vessel or laboratory time, required samples, and community involvement activities as part of their original proposal. At the first workshop of the fiscal year, this information will be shared with the group to assist in the sharing of necessary resources to minimize overall cost. As part of any project's progress report or final report, it must detail the coordination that has taken place with other funded projects.

c. *Funding cycle*

While the Committee recommends the continued use of the annual invitation for proposal cycle, there is recognition that projects may be identified throughout the fiscal year as required to maintain the momentum of the IHRP. When these projects are identified by the Committee, an invitation for proposals related to that specific project will be generated and reviewed by the Executive Director, Trustee Council, legal counsel, and agency liaisons prior to being made public. Recommendations for funding will be provided by the Committee to the Trustee Council based on the proposals received for funding consideration.

d. *Data Sharing Program*

Open sharing of information, particularly collected scientific datasets and their associated metadata, between projects is a vital component of the IHRP. Timely availability of collected datasets allows for helpful crosschecks, comparisons, and improved accuracy of research results for each project. It can also generate new ideas for needed research that are not currently anticipated.

The Trustee Council's Data Policy (revised March 17, 2008 and available at http://www.evostc.state.ak.us/Policies/data.cfm) remains in effect for all projects participating in the IHRP. Like all EVOSTC projects, IHRP projects are required to provide copies of final datasets for public distribution at the time the final report is completed, as outlined in the Data Policy.

In addition to the requirements of the Data Policy, principal investigators participating in the IHRP are required to make collected and processed datasets available to other IHRP projects within 60 days of collection. Consistent with the Data Policy, such datasets will not be made publically available until the final report is completed.

Beginning in the FY09 funding cycle, and in future fiscal years, proposals for IHRP projects must include a detailed schedule showing projected data collection and processing timeframes for each proposed year of the project. The 60-day dataset availability requirement will be based upon the date of collection. For projects that began in previous fiscal years and are continuing into FY09, the principal investigator must provide a detailed schedule of projected data collection and processing timeframes to the EVOSTC Data Manager by November 30, 2008.

It is the responsibility of each PI to meet their data sharing obligations to other investigators, as outlined in this section, by making datasets available in a timely manner. PIs should inform the Data Manager as soon as possible if the 60-day requirement cannot be met so that an alternate delivery date can be arranged. The EVOSTC Data Manager will inform the EVOSTC Executive Director of projects consistently failing to provide datasets in a timely manner and future funding for such projects may be denied.

Datasets are shared using the web-based ProjectView application provided by the Trustee Council office. ProjectView provides a secure method for sharing datasets and metadata between IHRP projects without making them available to the general public. Investigators may upload datasets (and associated metadata) to ProjectView directly and share them with other IHRP projects, or provide them to the EVOSTC Data Manager by email, CD, or other agreeable method for uploading and sharing.

To reduce the probability of errors and preserve scientific integrity, it is recommended that only processed datasets be shared. Unprocessed (raw) datasets may also be shared, at the discretion of the PI responsible for collecting the data, if requested by investigators from other projects. Any unprocessed datasets that are shared should be clearly marked as such in their description, and to distinguish them from other datasets, which are assumed to have been processed unless otherwise noted.

e. *Use of Technology for Communication*
Constructive communications between the parties involved is critical to the success of this Program. Participants are encouraged to use the discussion forum located at http://www.evostc.state.ak.us/forum to discuss projects or ideas and comment on important documents. The forum software preserves the comments made for future reference and makes them available to all participants immediately. Forums are available for members of the Committee. Threaded discussions, document attachment, and email subscription capabilities are available to all participants.

f. *Intellectual Capital*
The open discussion of project ideas and proposals is of some concern to the Committee. In order to ensure that these discussions are as open as possible, each member of the Steering Committee will sign a non-disclosure and confidentiality statement at the beginning of the fiscal year.

g. *Communication Plan*
Recognizing the importance of this work to spill-affected communities and the public at large, the Committee will provide for meaningful public involvement and regular updates on the development and implementation of an Integrated Herring Restoration Program in PWS. This includes, but is not limited to:

- Providing routine advance notification of meetings and ensuring meetings are open to the public, accessible in person or by teleconference with scheduled time for participation (as needed).
- Providing periodic updates to citizens (especially to spill-affected local communities, native villages and corporations), PAC, TC, liaisons and Committee.
- Hosting community forums to report on progress and solicit input.

- Briefing TC members regularly. Arrange to brief elected officials with TC members and steering group members at key milestones.

h. Role of the EVOS Trustee Council Restoration Office
The EVOSTC restoration office will lead this effort and will be the primary point of contact for the PIs, Committee, and agency project managers. Since the Committee is not a Federal Advisory Committee Act group, they will make recommendations to the Executive Director. Prior to potentially acquiring a herring coordinator, the Restoration Specialist will serve as the central point of contact and will be responsible for the coordination of the Committee. The Restoration Specialist will work closely with the Executive Director, Environmental Program Specialist, Data Manager, and agency liaisons to ensure that the IHRP continues to serve the goals of the Trustee Council and to communicate its progress regularly.

i. Role of Agency Project Managers
The agency project managers will be responsible for keeping the Committee updated on the progress of projects funded as part of the IHRP. The project managers currently use a quarterly update process, which is publicly available, to communicate scope and schedule progress. The agency project managers will also be required to alert the Committee if a project is not meeting its identified goals and objectives.

4. Community Involvement
Meaningful community involvement is defined as a substantive role for individuals, communities, and community-based organizations in the design and conduct of research, monitoring, general restoration activities, in the analysis and application of the results, and in information-sharing in ways that ensure the information is both timely and easily understood.

The Trustee Council has determined that the IHRP will be community-based and will provide this meaningful participation by the local communities that continue to be injured from the loss of herring in the Sound. Community involvement can take many forms and can range from utilizing local vessel charters and guides to utilizing local citizens in the collection and analysis of project data.

Each proposal received as part of the IHRP will be reviewed for its level of community involvement prior to funding, during the course of the project, and in communicating its final deliverables. Assistance will be available to PI's and the Steering Committee through the Communication and Outreach Coordinator at the EVOSTC restoration office.

5. Opportunities for Partnering
There are many state and federal agencies and non-governmental organizations currently funding research and restoration projects in Prince William Sound. Opportunities for partnering are numerous and would be mutually beneficial both financially and in the

exchange of information. The following organizations are currently funding herring research and would be good candidates for partnering:

- Oil Spill Research Institute (OSRI)
- North Pacific Research Board (NPRB)
- Prince William Sound Science Center (PWSSC)
- Prince William Sound Regional Citizens Advisory Council (PWSRCAC)
- Alaska Ocean Observing System (AOOS)
- University of Alaska, Fairbanks (UAF)
- University of Alaska, Southeast (UASE)
- Alaska SeaLife Center (ASLC)

Each group will be contacted by the Executive Director to determine if a partnership will be beneficial and to determine the form of any potential partnerships. A memorandum of agreement will be signed between the Trustee Council and any interested groups that will detail the level of information and cost sharing. The Steering Committee may invite partners to any of its public meetings to discuss projects or upcoming opportunities.

IV. Integrated Herring Restoration Plan

1. Year 1
   a. Administrative needs:
      i. Herring Coordinator position
      ii. Two Herring Steering Committee meetings
      iii. Ad-hoc sub-committee meetings as needed

   b. Recommended projects:
      i. Host a "marking/tagging technologies workshop and produce a white paper.
      ii. Host a "strategies and technologies for supplemental production" workshop and produce a white paper.
      iii. Select 4 – 5 new projects, one of which is community based that would fill important identified data gaps.
      iv. Augment ongoing ADF&G survey work. The current surveys are not comprehensive and key information could be missed.
      v. Investigate geospatial and habitat features of bays for potential restoration activities. (Bays with historic herring spawning and larval rearing, oceanographic and geographic features that support retention, etc)
      vi. Validate larval drift models through cooperative investigations. (AOOS)
      vii. Complete disease, predation, oceanographic, competitor, and larval herring surveys.
      viii. Investigate dedicated fishery for pollock to reduce competition.
      ix. Begin investigation of carrying capacity enhancement. (Experimental foods/fertilization.)

x. Identify and begin a community-based project. (E.g. Pilot scale juvenile feeding experiment.)
xi. Begin an acoustic survey of distribution of Pollock to compare herring and pollock.
xii. Investigate regulatory permits that would be required for supplemental production.
xiii. Begin core monitoring program
    1. Stock assessment program supplement
        a. increased spatial and temporal scale of overwintering (fall & spring) surveys
        b. evaluation of stock assessment techniques, especially spawn data input
        c. evaluation of age at maturity (monitor gonad size & weight)
        d. identification of stock structure (otolith chemistry, tags)
        e. Juvenile surveys (summer, fall, spring)
        f. establish distribution
        g. use tags or otoliths to determine spatial contribution
    2. Tracking survival and recruitment
        a. impacts of seabird, marine mammal and fish predators and disease
        b. evaluation of interspecific food competition of herring with pink salmon, sand lance and juvenile Pollock
        c. evaluate interrelationship among predation, prey availability, competition, and disease
        d. evaluate food limitation and key food/energy sources (outside or inside PWS) at juvenile and adult stages
xiv. Develop an epizootic response plan.

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