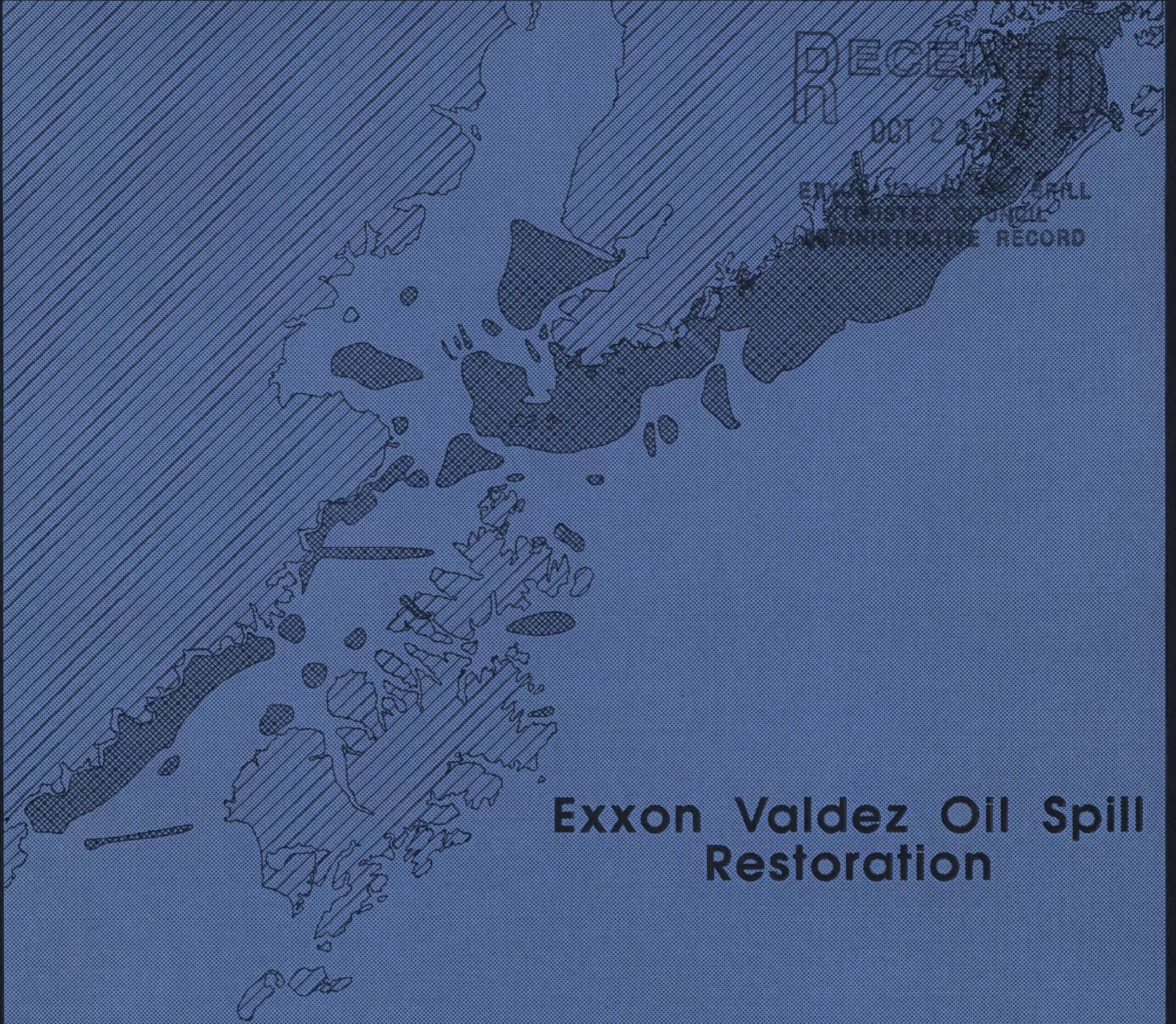


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Exxon Valdez Oil Spill Restoration

1993 Draft Work Plan

Prepared by:
Exxon Valdez Oil Spill Trustees
645 "G" Street
Anchorage, Alaska
99501
(907) 278-8012

October 1992

Dear Reviewer:

In the fall of 1991, the United States of America and the State of Alaska settled their claims against the Exxon Corporation and Exxon Shipping Company for natural resource and service damages from the *Exxon Valdez* oil spill. Monies provided by the settlement will be used to restore, enhance, replace, rehabilitate or acquire equivalent resources and services in Prince William Sound and the Gulf of Alaska. The undersigned three State and three Federal Trustee Council Representatives, in consultation with the public, are responsible for determining how restoration funds are to be spent in accordance with the Memorandum of Agreement and Consent Degree dated August 28, 1991.

The Federal and the State Trustees are developing a Restoration Plan for the injured resources and services. In April 1992, the *Exxon Valdez* Oil Spill Trustees prepared Volume I: Restoration Framework which provides background information and proposed guidelines for future planning efforts. The Trustees in April 1992, also prepared Volume II: 1992 Draft Work Plan which proposed activities that were important to undertake in 1992 prior to the development of a Restoration Plan.

A Draft Restoration Plan and associated Draft Environmental Impact Statement (EIS) are presently being developed and have not been completed. Therefore, the Trustees are preparing a 1993 Draft Work Plan which proposes activities to be undertaken in 1993 prior to the completion of the Final Restoration Plan and Environmental Impact Statement.

The 1993 Draft Work Plan is intended to elicit comments and suggestions from you and continue the public "scoping" process for environmental analysis under the National Environmental Policy Act (NEPA). NEPA Compliance will be completed on each 1993 proposal, and the 1993 and 1992 activities will be addressed in the Restoration Plan and EIS.

We invite your comments on the 1993 Draft Work Plan. The issues identified on the tear sheets in the 1993 Draft Work Plan are intended to facilitate but not limit your comments and suggestions. Written comments, in order to be considered during the development of the final 1993 Work Plan, must be received by November 20, 1992, at the following address:

Exxon Valdez Oil Spill Trustee Council
645 G Street
Anchorage, Alaska 99501

Questions concerning this document or its distribution should be directed to the Oil Spill Public Information Center, 645 G Street, Anchorage, Alaska 99501, or you may call (907) 278-8008.

We appreciate your interest and look forward to your participation in this important process.

Sincerely,

Charles E. Cole Date 9.21.92 Mike Barton Date 9/21/92

CHARLES E. COLE
Attorney General
State of Alaska

MICHAEL A. BARTON
Regional Forester
Alaska Region - USDA Forest Service

Carl L. Rosier Date 9/21/92 Curtis V. McVee Date 9-21-92

CARL L. ROSIER
Commissioner
Alaska Department of Fish and Game

CURTIS V. MCVEE
Special Assistant to the Secretary
U.S. Department of the Interior

John A. Sandor Date 9/21/92 Steven Pennoyer Date 9-21-92

JOHN A. SANDOR
Commissioner
Alaska Department of Environment
Conservation

STEVEN PENNOYER
Director, Alaska Region
National Marine Fisheries Service

**COMMENT SHEET
EXXON VALDEZ RESTORATION
DRAFT 1993 WORK PLAN**

You are invited to share your ideas and comments on the Draft 1993 Work Plan.

Public comments on this document will assist the Trustee Council as decisions are made on which of the proposed projects will be conducted in 1993. As you develop your comments on the 1993 draft work plan, please also address the following questions:

- The Restoration Plan will not be completed prior to the 1993 field season. The Restoration Plan is a primary means for the public to help the Trustee Council prioritize expenditures of restoration funds. In light of that, should the Trustee Council: (1) limit restoration actions only to those projects that are time critical or would otherwise be a lost opportunity; (2) also include some limited restoration projects that are not time-critical; or (3) implement a large-scale restoration program prior to the completion of the Restoration Plan?
- Do you believe there are other projects that directly address injured resources or services that are not contained in this document? If so, please identify the project(s)?
- Do you believe the proposed projects contained in this document are appropriate in terms of their scope and level of funding? Please explain what, if anything, you would change and the basis for such change.
- How would you prioritize the proposed projects and your additional recommended projects (if any)?

You may use this tear sheet to present your views or attach additional sheets.

Please address your comments to:

Draft 1993 Work Plan Comments
Exxon Valdez Trustee Council
645 "G" Street
Anchorage, Alaska 99501

Comments must be postmarked by November 20, 1992

COMMENTS

You are invited to share your ideas and comments with the Trustees.

Please use this tear sheet to present your views on the 1993 Draft Work Plan.

You may send additional comments by letter regarding the 1993 Draft Work Plan.

If needed, use the space on the back or attach additional sheets. Please fold, staple, and add a postage stamp. Thank you for your interest and participation.

Additional Comments:

------(fold here)-----Return Address:

Place
Stamp
Here

Exxon Valdez Oil Spill Trustee Council
645 G Street
Anchorage, AK 99501

Attn: 1993 Draft Work Plan

Table of Contents

INTRODUCTION	10
PROPOSED 1993 PROJECT BUDGET SUMMARY	16
ADMINISTRATION AND PROJECT SUPPORT	21
Administration-General	
Project Support	
1993 Administrative and Restoration Team Support Budgets	
PROJECT DESCRIPTIONS AND BUDGETS	25
(Some projects have been combined and others deleted resulting in discontinuous project numbers)	
Project Number: 93002 Sockeye Overescapement	30
Project Number: 93003 Pink Salmon Egg to Pre-emergent Fry Survival in Prince William Sound.	34
Project Number: 93004 Documentation, Enumeration, and Preservation of Genetically Discrete Wild Populations of Pink Salmon Impacted by EVOS in Prince William Sound.	38
Project Number: 93005 Cultural Resources Information, Education and Interpretation	44
Project Number: 93006 Site-Specific Archeological Restoration (Interagency)	48
Project Number: 93007 Archaeological Site Stewardship Program	52
Project Number: 93008 Archaeological Site Patrol and Monitoring	56
Project Number: 93009 Public Information, Education and Interpretation	60
Project Number: 93010 Reduce Disturbance Near Murre Colonies Showing Indications of Injury from the <i>Exxon Valdez</i> Oil Spill	64
Project Number: 93011 Develop Harvest Guidelines to Aid Restoration of River Otters and Harlequin Ducks	68
Project Number: 93012 Genetic Stock Identification of Kenai River Sockeye Salmon	72
Project Number: 93014 Quality Assurance for Coded-Wire Tag Application in Fish Restoration Projects	76
Project Number: 93015 Kenai River Sockeye Salmon Restoration	80
Project Number: 93016 Chenega Chinook and Coho Salmon Release Program.	86
Project Number: 93017 Subsistence Restoration Project	90

Table of Contents

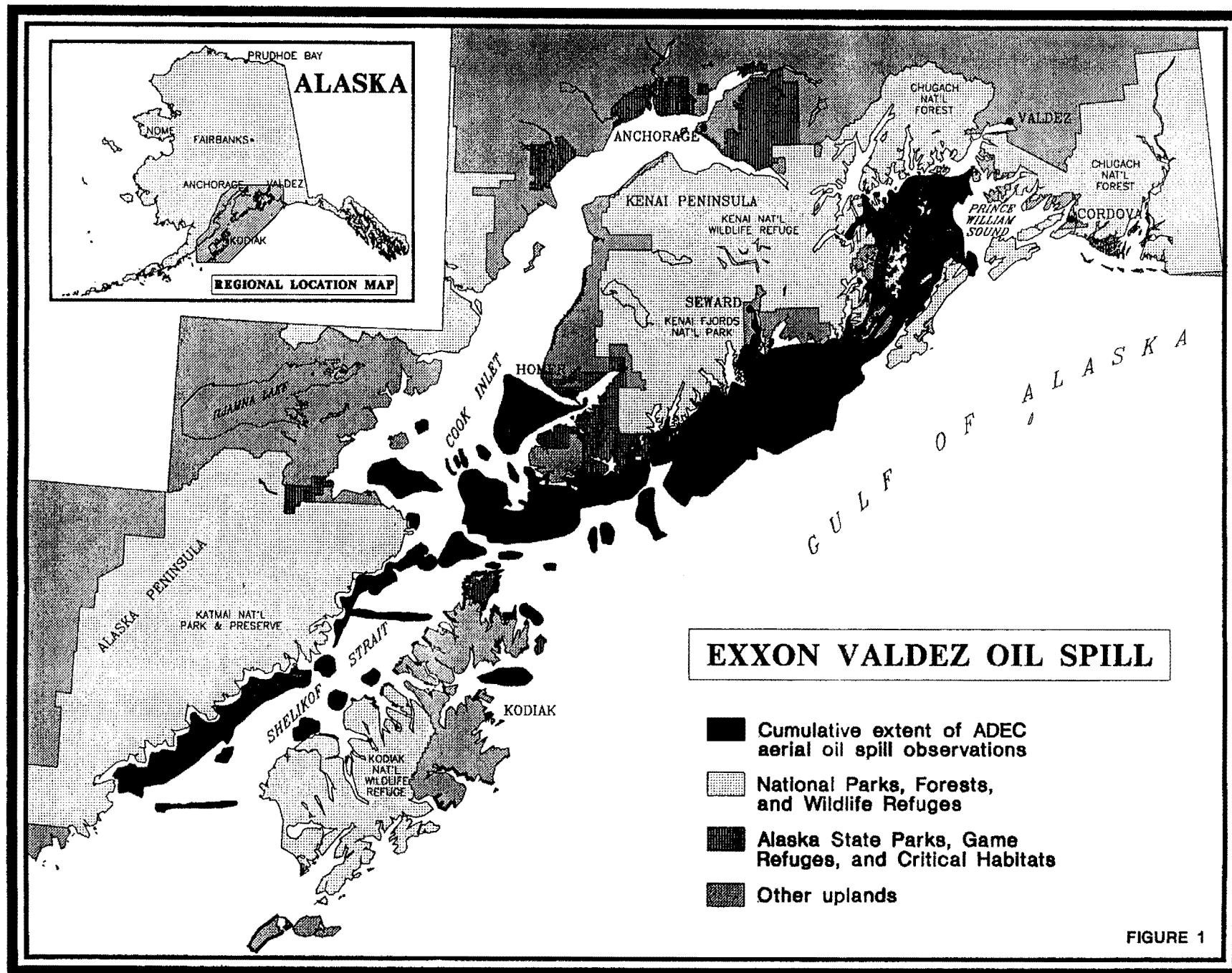
Project Number: 93018 Enhanced Management for Wild stocks in Prince William Sound, Special Emphasis on Cutthroat Trout and Dolly Varden.	94
Project Number: 93019 Chugach Region Village Mariculture Project	98
Project Number: 93020 Bivalve Shellfish Hatchery and Research Center	102
Project Number: 93022 Evaluating the Feasibility of Enhancing Productivity of Murres by using Decoys, Dummy Eggs, and Recordings of Murre Calls to Simulate Normal Densities at Breeding Colonies Affected by the <i>Exxon Valdez</i> Oil Spill, and Monitoring the Recovery of Murres in the Barren Islands	106
Project Number: 93024 Restoration of the Coghill Lake Sockeye Salmon Stock	110
Project Number: 93025 Montague Island Chum Salmon Restoration	114
Project Number: 93026 Fort Richardson Hatchery Water Pipeline	118
Project Number: 93028 Restoration and Mitigation of Wetland Habitats for Injured Prince William Sound Fish and Wildlife species	122
Project Number: 93029 Prince William Sound Second Growth Management	126
Project Number: 93030 Red Lake Restoration	130
Project Number: 93031 Red Lake Mitigation for Red Salmon Fishery	134
Project Number: 93032 Pink and Cold Creek Pink Salmon Restoration	138
Project Number: 93033 Harlequin Duck Restoration Monitoring Study in Prince William Sound, Kenai, and Afognak Oil Spill Areas	142
Project Number: 93034 Pigeon Guillemot Colony Survey	146
Project Number: 93035 Potential Impacts of Oiled Mussel Beds on Higher Organisms: Contamination of Black Oystercatchers Breeding on Persistently Oiled Sites in Prince William Sound	150
Project Number: 93036 Recovery Monitoring and Restoration of Intertidal Oiled Mussel Beds in Prince William Sound and the Gulf of Alaska Impacted by the <i>Exxon Valdez</i> Oil Spill.	154
Project Number: 93038 Shoreline Assessment	158
Project Number: 93039 Herring Bay Experimental and Monitoring Studies	162
Project Number: 93041 Comprehensive Restoration Monitoring Program Phase 2: Monitoring Plan Development	166

Table of Contents

Project Number: 93042 Recovery Monitoring of Prince William Sound Killer Whales Injured by the Exxon Valdez Oil Spill Using Photo Identification Techniques	172
Project Number: 93043 Sea Otter Population Demographics and Habitat Use in Areas Affected by the <i>Exxon Valdez</i> Oil Spill	176
Project Number: 93045 Surveys to Monitor Marine Bird and Sea Otter Populations in Prince William Sound during Summer and Winter	180
Project Number: 93046 Habitat Use, Behavior, and Monitoring of Harbor Seals in Prince William Sound, Alaska	184
Project Number: 93047 Subtidal Monitoring: Recovery of Sediments, Hydrocarbon- degrading Microorganisms, Eelgrass Communities, and Fish in the Shallow Subtidal Environment.	188
Project Number: 93050 Update: Restoration Feasibility Study #5 (<i>Identification and Recordation of Information Sources Relevant to Land and Resources Affected by the Exxon Valdez Oil Spill</i>)	192
Project Number: 93051 Habitat Protection Information for Anadromous Streams and Marbled Murrelets	194
Project Number: 93052 Identification and Protection of Important Bald Eagle Habitats	198
Project Number: 93053 Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the <i>Exxon Valdez</i> Oil Spill	202
Project Number: 93057 Damage Assessment GIS	206
Project Number: 93059 Habitat Identification Workshop	208
Project Number: 93060 Accelerated Data Acquisition	210
Project Number: 93061 New Data Acquisition	214
Project Number: 93062 Restoration GIS	216
Project Number: 93063 Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Fish	220
Project Number: 93064 Habitat Protection Fund	224

Table of Contents

APPENDIX A:	227
SUMMARY OF INJURY	
APPENDIX B:	247
EVALUATION OF THE PROPOSED PROJECTS BY THE CHIEF SCIENTIST	



Introduction

The March 24, 1989 grounding of the T/V *Exxon Valdez* in Alaska's Prince William Sound caused the largest oil spill in U.S. history. Approximately 11 million gallons of North Slope crude oil moved through the southwestern portion of the Prince William Sound and along the coast of the western Gulf of Alaska (see map, Fig. 1). The spill injured fish, birds, mammals, and a variety of other forms of marine life, habitats, and resources, and the services these resources provide.

On September 25, 1991, the State of Alaska, the United States and Exxon Corporation agreed to settlement terms of \$900 million for civil damage claims arising from the *Exxon Valdez* oil spill. On October 8, 1991, the U.S. District Court approved this settlement. The funds will be received by a joint trust fund over a ten year period and will be administered by the State and Federal Trustees. The spending guidelines for the civil settlement monies are set forth in the Memorandum of Agreement and Consent Decree that was filed in the United States District Court for the District of Alaska, United States vs. State of Alaska, A91-081 CIV ("Memorandum of Agreement"), and approved and entered by United States District Judge H. Russel Holland on August 28, 1991. Through this agreement the United States and the State of Alaska resolved their claims against each other and agreed to act as co-trustees in the collection and joint use of all natural resource damage recoveries resulting from the *Exxon Valdez* oil spill.

The Memorandum of Agreement provides that the governments shall jointly use such monies for purposes of "restoring, replacing, enhancing, rehabilitating, or acquiring the equivalent of natural resources injured as a result of the Oil Spill and the reduced or lost services provided by such resources" Under the Memorandum of Agreement the state and federal trustee agencies are to administer the restoration and injury assessment activities and to include public involvement as an integral part of the restoration process. The *Exxon Valdez* Trustee Council (representing the Trustees) is composed of six members, three Federal and three State of Alaska, representing the following trustee agencies - the United States Departments of Agriculture and Interior, the National Oceanic and Atmospheric Administration, the Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, and the Alaska Department of Law. The Restoration Team which is directed by the Trustee Council and is composed of representatives of the Trustee agencies, oversees the administration of restoration activities and makes recommendations to the Trustee Council. A Public Advisory Group has now been established, a charter written, draft operating procedures produced and all seventeen members have been selected by the Trustee Council. There are members representing twelve interest groups and five members chosen from the public-at-large. There are also two *ex officio* members representing the State of Alaska Legislature. This group will advise the Trustee Council on planning, evaluating, and implementing restoration activities and the remaining injury assessments; developing a restoration plan; and allocating restoration funds.

A comprehensive Restoration Plan is being developed that will describe the preferred options to be used to restore the natural resources and services injured by the oil spill. A draft plan will be released to the public and the Public Advisory Group for comment. After analysis of all responses, a final Restoration Plan will be adopted that will outline the work to be performed. Prior to completion of the Restoration Plan, certain projects will need to be implemented that address injured resources and services and are time critical or present a lost opportunity if not conducted in 1993. The Trustee Council prefers to defer funding many restoration projects pending completion of the Restoration Plan in 1993, to maximize public input on restoration

priorities. The Restoration Team has recommended to the Trustee Council that some projects which would be included in any set of preferred restoration options should be implemented as part of this work plan to expedite restoration of the spill-affected area. The 1993 Draft Work Plan is comprised of projects of these types and some continuing assessment studies.

On September 21, 1992, the *Exxon Valdez* Trustee Council directed that the 1993 Draft Work Plan, contained herein, be distributed for public review and comment. This document contains descriptions and budgets of projects that are proposed to be conducted during the last nine months of the 1993 federal fiscal year which ends September 30, 1993. **The Trustee Council has not indicated which of these projects they believe should be conducted in 1993, but are relying on public comment and scientific peer review to assist their decisions. There is a thirty-day public review period from October 20 to November 20, 1992. All correspondence that concerns these projects and is postmarked by November 20 will be copied and distributed to the Trustee Council. Your opinion is important and will be considered when the Trustee Council meets on December 11, 1992 to decide which projects are to be conducted in 1993.**

Public comment on this document will assist the Trustee Council as decisions are made on which of the proposed projects will be conducted in 1993. As you develop your comments on the draft 1993 work plan, please also address the following questions:

- The Restoration Plan will not be completed prior to the 1993 field season. The Restoration Plan is a primary means for the public to help the Trustee Council prioritize expenditures of restoration funds. In light of that, should the Trustee Council: (1) limit restoration actions only to those projects that are time critical or would otherwise be a lost opportunity; (2) also include some limited restoration projects that are not time-critical; or (3) implement a large-scale restoration program prior to the completion of the Restoration Plan?
- Do you believe there are other projects that directly address injured resources or services that are not contained in this document? If so, please identify the project(s)?
- Do you believe the proposed projects contained in this document are appropriate in terms of their scope and level of funding? Please explain what, if anything, you would change and the basis for such change.
- How would you prioritize the proposed projects and your additional recommended projects (if any)?

This year suggestions from the public were requested to assist in developing ideas for projects to be conducted in 1993. Some 450 ideas were received by the *Exxon Valdez* Trustee Council. The project ideas were synthesized by and evaluated by the Restoration Team working in conjunction with the Trustee Council chief scientist and peer reviewers. Some ideas were developed into project descriptions (which appear in this volume). Some were rejected as inappropriate uses of the settlement funds, and some were deferred until a Restoration Plan has been developed. After the project descriptions were prepared, the Restoration Team with the assistance of the chief scientist and peer reviewers screened the proposals for technical merit and made recommendations to the Trustee Council on which projects should be included in the 1993 Draft Work Plan. Though legal review of some ideas was requested and received, some concerns

Introduction

remain with a few projects or components of projects. Joint state and federal legal review is proceeding concurrently with public review and may result in further changes to the Work Plan.

Inclusion in this draft plan is not an indication that any of these projects will ultimately be approved. It does indicate that the Trustee Council is very interested in public comment concerning these proposed projects. As noted above, there are legal constraints on the use of settlement funds including a limitation on the expenditure of funds to the restoration and enhancement of injured resources and services. Although there are sufficient funds available to restore resources and services injured by the spill, there are not sufficient funds available to conduct all of the studies and projects which have been suggested and to acquire all of the habitat already proposed, and thus there must be a prioritization of restoration activities to be conducted in 1993. The Trustee Council has the responsibility to restore resources and services injured by the *Exxon Valdez* oil spill. As stated above, under the terms of the Memorandum of Agreement, restoration is a combination of activities. The Trustee Council recognizes the need to carefully weigh the mix of available restoration options to ensure development of the best restoration program for Alaska. Public comment will assist the Trustee Council in development of that program.

The proposed 1993 program includes damage assessment and restoration projects to be carried out in the last nine months of the 1993 federal fiscal year. Damage assessment projects are those necessary to complete or support the orderly completion of Natural Resources Damage Assessment (NRDA) studies that began after the *Exxon Valdez* oil spill. Restoration projects form two major groups. The first will provide timely information necessary to support subsequent decisions about restoration options for injured resources. The second restores the resources or the service provided by these resources. Categories of restoration projects described in the 1993 Draft Work Plan are recovery monitoring, implementation planning, manipulation/enhancement, habitat protection planning and acquisition, management actions, and technical support.

This volume contains: (1) a description of administrative and project support functions and budgets; (2) descriptions and budgets for field projects; (3) a description of the management structure (including the Restoration Team) which administers these projects; (4) a summary of the known oil spill-related injuries (Appendix A); and (5) evaluations of the proposed projects by the Chief Scientist (Appendix B).

The 1993 Draft Work Plan is the fifth of a series of plans prepared by the State and Federal Trustees for the *Exxon Valdez* oil spill. Previous plans include:

- State/Federal Natural Resources Damage Assessment Plan for the *Exxon Valdez* Oil Spill, August 1989
- The 1990 State/Federal Natural Resource Damage Assessment and Restoration Plan for the *Exxon Valdez* Oil Spill
- The 1991 State/Federal Natural Resource Damage Assessment and Restoration Plan for the *Exxon Valdez* Oil Spill
- The *Exxon Valdez* Oil Spill Restoration 1992 Draft Work Plan

Each of these previous plans contains descriptions of the projects that were conducted in each of those years.

Tables which outline the fate of each idea submitted and the detailed project budgets are available for public viewing at:

Oil Spill Public Information Center
645 G Street
Anchorage, Alaska 99501
(907) 278-8008
800-478-7745 (Alaska)
800-283-7745 (outside Alaska)

Copies have also been placed at the following libraries and teleconference sites:

Introduction

LIBRARIES

A. Holmes Johnson Memorial
Library
319 Lower Mill Bay Road
Kodiak, AK 99615
(907) 486-8686

Alaska Dept. of Fish & Game
Habitat Division Library
333 Raspberry Road
Anchorage, AK 99518-1599
(907) 267-2314

Alaska State Library
Government Publications Services
P.O. Box 110571
Juneau, AK 99811-0571
(907) 465-2910

Cordova Public Library
P.O. Box 1170
Cordova, AK 99574
(907) 424-6667

Minerals Management Service
Library
949 East 36th Ave., Room 603
Anchorage, AK 99508
(907) 271-6435

University of Alaska - Fairbanks
Elmer E. Rasmuson Library
310 Tanana Drive
Fairbanks, AK 99775
(907) 474-7481

U.S. Fish & Wildlife Service
1011 East Tudor Road
Anchorage, AK 99503
(907) 786-3358

Alaska Dept. of Environmental
Conservation Library
410 Willoughby Ave.
Juneau, AK 99801-1795
(907) 465-5006

Alaska Resources Library
U.S. Bureau of Land Management
222 West 7th Ave, #36
Anchorage, AK 99513-7589
(907) 271-5025

Auke Bay Fisheries Lab
Marine Fisheries Service Library
11305 Glacier Highway
Juneau, AK 99801-8626
(907) 789-6010

Kuskokwim Consortium Library
Pouch 1068
Bethel, AK 99559
(907) 543-4516

University of Alaska - Anchorage
Consortium Library
3211 Providence Drive
Anchorage, AK 99508
(907) 786-1800

U.S. District Court Library
222 West 7th Ave., Box 31
Anchorage, AK 99513-7586
(907) 271-5655

Valdez Consortium Library
P.O. Box 609
Valdez, AK 99686
(907) 835-4632

Z.J. Loussac Library
Alaska Collection
3600 Denali Street
Anchorage, AK 99503-6093
(907) 261-2975

TRUSTEE COUNCIL TELECONFERENCE SITES

Chenega Bay Volunteer Teleconference Center Box 60 Chenega Bay, AK 99574	Valdez Legislative Information Office Room 13, State Court and Office Bldg. 121 Hazelet Valdez, AK 99686 (907) 835-2111
Cordova Volunteer Teleconference Center Cordova City Hall Cordova, AK 99574 (907) 424-6200	City of Whittier P.O. Box 608 Whittier, AK 99683 (907) 472-2337
Fairbanks Legislative Information Office 119 Cushman Rd., Suite 101 Fairbanks, AK 99701-2879 (907) 452-4448	
Juneau Legislative Information Office Goldstein Bldg., Suite 314 130 Seward St. Juneau, AK 99801-2197 (907) 465-4648	
Homer Teleconference Center 126 W. Pioneer, #4 Homer, AK 99603 (907) 235-7878	
Kenai Peninsula Legislative Information Office 3482 Kalifornsky Beach Rd., Suite A Soldotna, AK 99669-9728 (907) 262-9364	
Kodiak Legislative Information Office 112 Mill Bay Rd., Kodiak Plaza Bldg. Kodiak, AK 99615-6431 (907) 486-8116	
Seward Volunteer Teleconference Center Seward Public Library Seward, AK 99664 (907) 224-3646	
Tatitlek - IRA Council Office General Delivery Tatitlek, AK 99677 (907) 325-2311	

PROPOSED 1993 PROJECT BUDGET SUMMARY

The budget summary table which follows lists only those budgets for *Exxon Valdez* restoration projects which are currently proposed for the last nine months of the federal fiscal year 1993. The funding period for projects is being changed from an oil year which cycled from March 1 to February 28 annually, to the federal fiscal year which runs from October 1 to September 30. Projects currently being conducted were approved earlier as part of the 1992 Work Plan and are funded through February 28, 1993. This volume does not address projects which were previously approved in the 1992 Work Plan. There is a portion of the 1993 fiscal year budget which, because it was already approved in the 1992 Work Plan, does not appear in the table of proposed projects which follows.

Projects in the table are grouped to show those which the Restoration Team is recommending that the Trustee Council include in the 1993 Work Plan. The projects included in the last grouping received less support from the Restoration Team but are still being considered by the Trustee Council and it is therefore important to review these potential costs as well. The Administrative Director's Office and Restoration Team Support projects are allocated between direct field support and process support. Pending public input on other new projects, the projects included in this table constitute the only projects currently under consideration for implementation in 1993.

PROPOSED 1993 PROJECT BUDGET SUMMARY
 EXXON VALDEZ OIL SPILL RESTORATION
 1993 Federal Fiscal Year 1-Oct-92 to 30-Sep-93

Project Number	Project Title	Agency	Proposed 1-Mar-93 30-Sep-93
	RESTORATION PROJECTS (Recommended by Restoration Team)		
93002	Sockeye Salmon Overescapement	ADF&G	\$714.6
93003	Salmon Egg to Pre-emergent Fry Survival	ADF&G/NOAA	\$686.0
93004	Genetics, Documentation, Enumeration, & Preservation of Pink Salmon	ADF&G	\$899.1
93005	Cultural Resource Information, Education and Interpretation	USFS/ADNR/DOI-NPS	\$399.4
93006	Site Specific Archaeological Restoration	DOI-NPS/ADNR/ DOI-FWS/USFS	\$259.1
93007	Archaeological Site Stewardship Program	ADNR/USFS/ DOI-FWS/DOI-NPS	\$194.6
93008	Archaeological Site Patrol and Monitoring	DOI-NPS/ADNR/ DOI-FWS/USFS	\$297.8
93009	Public Information, Education and Interpretation	USFS	\$316.7
93011	Develop Harvest Guidelines to Aid Restoration of River Otters & H. Ducks	ADF&G	\$11.2
93012	Genetic Stock Identification of Kenai River Sockeye Salmon	ADF&G	\$300.6
93015	Kenai River Sockeye Salmon Restoration	ADF&G	\$732.6
93016	Chenega Bay Chinook & Silver Salmon	ADF&G	\$25.9
93017	Subsistence Food Safety Survey & Testing	ADF&G/NOAA	\$360.6
93018	Enhanced Management for Cutthroat Trout/Dolly Varden in PWS	ADF&G/USFS	\$285.3
93022	Murre Decoy/Playback Facility/Colony Monitoring	DOI-FWS	\$281.0
93024	Restoration of Coghill Lake Sockeye Salmon Stock	ADF&G/USFS	\$191.9
93025	Montague Island Chum Salmon Restoration	USFS	\$81.5
93028	Restoration of Wetlands	USFS	\$82.1
93029	Prince William Sound Second Growth Management	USFS	\$62.0
93030	Red Lake Restoration	ADF&G	\$77.2
93031	Red Lake Mitigation	ADF&G	\$153.7
93032	Cold Creek Pink Salmon Restoration	ADF&G	\$36.1
93033	Harlequin Duck Restoration	ADF&G	\$717.9
93034	Pigeon Guillemot Recovery	DOI-FWS	\$165.8
93035	Black Oystercatchers/Oiled Mussel Beds	DOI-FWS	\$107.9

11-Sep-92

Amounts shown are in thousands of dollars.

1993

page 1 of 3

**FORM 1A
PROJECT
SUMMARY**

PROPOSED 1993 PROJECT BUDGET SUMMARY
 EXXON VALDEZ OIL SPILL RESTORATION
 1993 Federal Fiscal Year 1-Oct-92 to 30-Sep-93

Project Number	Project Title	Agency	Proposed 1-Mar-93 30-Sep-93
RESTORATION PROJECTS (Recommended by Restoration Team) (Continued)			
93036	Oiled Mussel Beds	NOAA/DOI-NPS	\$404.8
93038	Shoreline Assessment	ADEC/ADNR/USFS NOAA/DOI/ADF&G	\$520.7
93039	Herring Bay Experimental & Monitoring	ADF&G	\$507.5
93041	Comprehensive Monitoring	NOAA	\$237.9
93042	Killer Whale Recovery	NOAA	\$127.1
93043	Sea Otter Demographics & Habitat	DOI-FWS	\$291.9
93045	Marine Bird/Sea Otter Surveys	DOI-FWS	\$262.4
93046	Habitat Use, Behavior, & Monitoring of Harbor Seals in PWS	ADF&G	\$230.5
93047	Subtidal Monitoring	NOAA/ADEC/ADF&G	\$1,000.8
93051	Habitat Protection: Stream Habitat Assessment	USFS/ADF&G/ DOI-FWS	\$1,179.8
93053	Hydrocarbon Database	NOAA	\$105.5
93057	Damage Assessment GIS	ADNR	\$67.5
93059	Habitat Protection Workshop	USFS	\$42.3
93060	Accelerated Data Acquisition	USFS	\$43.9
93061	New Data Acquisition	USFS/ADNR	\$535.0
93062	Restoration GIS	ADNR	\$138.4
93063	Anadromous Stream Surveys	ADF&G	\$59.4
93064	Imminent Threat Habitat Protection*	ADNR/FED (To Be Determined)	\$20,000.0
93AD	Administrative Director's Office (Direct Project Support)	ADEC/ADNR/USFS/ DOI	\$576.4
93RT	Restoration Team Support (Direct Project Support)	ADEC/ADNR/USFS/ NOAA/DOI/ADF&G	\$2,042.8
RESTORATION PROJECTS SUBTOTAL			\$35,815.2

11-Sep-92

Amounts shown are in thousands of dollars.

1993

page 2 of 3

*Actual amount for interim habitat protection will be determined by the Trustee Council following imminent threat analysis.

**FORM 1A
PROJECT
SUMMARY**

PROPOSED 1993 PROJECT BUDGET SUMMARY
 EXXON VALDEZ OIL SPILL RESTORATION
 1993 Federal Fiscal Year 1-Oct-92 to 30-Sep-93

Project Number	Project Title	Agency	Approved 1-Oct-92 28-Feb-93	Proposed 1-Mar-93 30-Sep-93	Total FY 93
	ADMINISTRATION PROJECTS (Recommended by Restoration Team)				
93AD	Administrative Director's Office	ADEC/ADNR/USFS/ DOI		\$1,293.7	
93FC	Financial Committee	ADEC/ADNR/USFS/ NOAA/DOI/ADF&G		\$105.5	
93RT	Restoration Team Support	ADEC/ADNR/USFS/ NOAA/DOI/ADF&G		\$618.2	
	ADMINISTRATION PROJECTS SUBTOTAL			\$2,017.4	
	RESTORATION & ADMINISTRATION PROJECTS TOTAL (Recommended by Restoration Team)			\$37,832.6	
	RESTORATION PROJECTS (Not Recommended by Restoration Team)				
93010	Reduce Disturbance Near Murre Colonies	DOI-FWS		\$56.8	
93014	Coded Wire Tag Quality Assurance	ADF&G		\$94.8	
93019	Chugach Region Village Mariculture Project	ADF&G		\$589.1	
93020	Bivalve Shellfish Hatchery and Research Center	ADF&G		\$55.7	
93026	Fort Richardson Hatchery Water Pipeline	ADF&G		\$3,617.0	
93050	Update Information on Sources Relevant to EVOS Affected Resources	ADNR		\$10.2	
93052	Identification of Bald Eagle Habitat	DOI-FWS		\$188.0	
	RESTORATION PROJECTS TOTAL (Not Recommended by Restoration Team)			\$4,611.6	

11-Sep-92

Amounts shown are in thousands of dollars.

1993

page 3 of 3

**FORM 1A
 PROJECT
 SUMMARY**

ADMINISTRATION AND PROJECT SUPPORT

A. Administration-General

It is the intent of the Trustee Council to make use of existing agency administrative structures to keep administrative costs to a minimum. Each of the Trustee agencies already has administrative, personnel and financial management systems that will be used to the maximum extent possible for this purpose. Each project is assigned to a lead agency to provide oversight and the necessary financial structure. Administrative costs include the following:

1. Office of Administrative Director - The budget for the Administrative Director includes salaries, benefits, travel, office space, supplies, printing costs, contractual services, utilities, and other such items as may be necessary for efficient operation of the Trustee Council, Restoration Team, Restoration Planning Work Group, the Public Advisory Group and other working groups as needed.
2. Restoration Team - The budget for the Restoration Team includes personnel related costs, travel, contractual items, commodities, equipment and other miscellaneous items to support the respective Trustee agency personnel. Each Trustee agency has one representative per the approved Trustee Council and Restoration Team operating procedures.
3. Financial Committee - The membership of this Committee is comprised of three State and three federal representatives. The committee reports directly to the Trustee Council and is responsible for developing fiscal procedures, adherence to the procedures, and ensuring overall fiscal standards for accountability, and efficiency. The budget for this standing committee includes personnel related costs, travel, contractual items, commodities, equipment and other miscellaneous items to support the respective Trustee agency personnel.
4. Public Advisory Group - The Public Advisory Group consists of 17 members, plus two ad-hoc members from the State Legislature, representing 12 principal interest groups and five members from the public-at-large. The administrative support for the Group shall be provided by the Administrative Director's Office. The role of this group is to provide advice to the Trustee Council and Restoration Team on such items as the annual work plans, budgets and the Restoration Plan. The budget includes travel, per diem and administrative support expenses.

Specifically with regard to this document, the Public Advisory Group will receive the 1993 Draft Work Plan for review prior to their first meeting in late October. The Public Advisory Group will advise the Trustee Council with respect to decisions relating to the planning, evaluation, and allocation of available funds, the conduct of injury assessments and restoration activities.

Administration and Project Support

5. Work Groups

- A. Public Participation - Five of the six Trustee agencies are represented on this Work Group. Personnel related costs and travel are the only costs. This Group's tasks include: (1) review the public information/public participation elements of the draft Restoration Plan; (2) define the goals, objectives and strategies of public participation; (3) facilitate and review public information materials; and (4) define new public information products which need to be created to improve the communication with the public. These tasks are expected to be completed by March 1, 1993.
- B. Management* - This group assists the Administrative Director in the operation of the *Exxon Valdez* Restoration Office and will: (1) develop the annual budget; (2) assist in building and support staff operation; (3) assist in budget oversight; (4) assist in the preparation of quarterly and annual reports; and (5) develop policy and procedures for the Restoration Office. Costs include personnel related costs, travel and per diem. This Group is funded through September 1993 on an as-needed basis.

*This Work Group was formerly called the Process Work Group

B. Project Support

1. Chief Scientist & Peer Reviewers - The Trustee Council and the project principal investigators need access to the best possible scientific knowledge and understanding concerning injured resources and services. This information has been provided continuously by the chief scientist and expert peer reviewers since early in the injury assessment process started in 1989. It is essential that this expertise be retained on an upon-request basis to provide the unbiased scientific review and continuity essential to perform the best possible scientific work. The budget proposed is for personnel related costs and travel and per diem through September 30, 1992.

2. Work Groups

- A. 1994 Work Plan - The objective of this work group is to develop a 1994 Work Plan through a process of public solicitation of proposals, analysis and evaluation. Personnel related costs, travel, per diem and printing are the costs involved. A draft work plan is scheduled to be completed in the spring of 1993 and a final before October 1993.
- B. Cultural Resources - The two objectives for this Group are to: (1) review and screen 1994 study/proposals to ensure Archeological Protection Act Section 106 compliance; and (2) provide the 1994 Work Plan Work Group with interagency cultural resource proposals. Budget figures cover personnel-related costs. This is a small work group that will be used sparingly throughout 1993.

- C. Graphic Information System (GIS) - The two main objectives of this Group are to: (1) review and approve requests for GIS data sets and mapping products; and (2) provide oversight on GIS products and projects. Budget costs include personnel, travel and per diem. The group is used sparingly and will function at least through September 1993 to provide support to the proposed 1993 GIS activities.
- D. Environmental Compliance - The objectives for this Group are to: (1) review proposed 1993 and 1994 project proposals and study plans to ensure compliance with the National Environmental Policy Act, the Alaska Coastal Zone Management Act and other applicable laws and regulations; (2) draft the record of decision for the Restoration Plan; and (3) oversee the National Environmental Policy Act analysis of the draft and final Restoration Plan. The members represent four Trustee Agencies with a budget reflecting a contract with Walcoff & Associates to prepare a draft and final Environmental Impact Statement. Costs include agency-related personnel, travel, per diem and printing costs. The Work Group will have a reduced role after the Final Environmental Impact Statement consisting of providing project-related National Environmental Policy Act compliance support.
- E. Restoration Planning - The three main objectives of this full-time Work Group are to: (1) develop a draft Restoration Plan by March 1993; (2) synthesize and review public comments on the draft Restoration Plan; and (3) prepare a final Restoration Plan by October 1993. All Trustee agencies are involved with this group with costs reflecting printing costs, contracts, agency personnel costs, equipment, travel and per diem and commodities. This Group will disband upon completion of a final Restoration Plan.
- F. Habitat Protection - This Work Group has many objectives related to restoration through habitat protection such as the development of an imminent threat analysis process, characterization of essential habitats linked to injured resources and services, and compilation of existing data sources and identification of needed data. All Trustee agencies are involved. Budgets reflect personnel, travel and per diem costs. This standing committee will be crucial to the development of a comprehensive habitat protection plan as an integral part of the Restoration Plan and will be funded as needed through September 1993.

Administration and Project Support

1993 Administrative and Restoration Team Support Budgets

ITEM	ADEC	ADF&G	ADNR	USDI	USDA	NOAA	TOTAL
ADMIN DIR.	333.1	0.0	0.0	0.0	823.2	0.0	1,156.3
FINANCE	17.2	13.3	19.7	12.9	23.9	17.7	104.7
REST. TEAM	156.5	89.9	91.8	47.7	83.7	109.5	579.1
PAG	0.0	0.0	0.0	155.9	0.0	0.0	155.9
PUBLIC PART.	0.0	0.0	0.0	5.3	0.0	0.0	5.3
MANAGEMENT	26.0	0.0	0.0	0.0	0.0	7.8	33.8
SUBTOTALS	532.8	103.2	111.5	221.8	930.8	135.0	2,035.1
CS/PEER R.	0.0	0.0	576.4	0.0	0.0	0.0	576.4
1994 WP	83.3	78.0	66.5	56.7	95.4	40.8	420.5
CULT. RES	0.0	0.0	4.8	3.2	3.0	0.0	11.0
GIS	0.0	13.5	3.1	2.8	4.2	6.5	30.1
ENV. COMPL.	0.0	23.2	0.0	23.7	254.8	14.5	316.2
RPWG	244.4	98.9	70.0	38.5	136.9	81.3	670.0
HAB. PROT.	88.1	48.7	186.3	29.8	208.4	33.8	595.1
SUBTOTALS	415.8	262.3	907.1	154.7	702.7	176.9	2,619.5
TOTALS	948.6	365.5	1,018.6	376.5	1,633.5	311.9	4,654.6

PROJECT DESCRIPTIONS AND BUDGETS

INTRODUCTION

There are 50 projects currently under consideration in the 1993 Draft Work Plan. Though more were originally developed as brief project proposals, several have been combined by the Restoration Team and others were removed from the draft work plan by the Trustee Council. Unlike previous years, projects have simply received a numerical designation that has no relationship to category or type of project. To facilitate finding an individual project, projects are listed in numerical order rather than being grouped by related projects. Sockeye projects, for example, are numbered 93002, 93012, 93015, 93024, 93030, and 93931. Please refer to the Table of Contents for more information.

Projects were developed from ideas submitted both by the public and by agencies. Similar ideas were typically combined and then either developed into brief project descriptions, identified as inappropriate for settlement funding or deferred until development of the Restoration Plan. Tables have been prepared which enable interested parties to track the evolution of ideas. They are available at the locations listed in the introduction to this book.

Each project description is followed by a brief budget. More detailed budgets are also available for examination at the same locations as the idea tables.

The project descriptions that follow are being sent out by the Trustee Council for public review and comment. These comments will be used by the Trustee Council at their December 11, 1992 meeting when decisions will be made on funding individual projects. A joint federal and state legal review will concurrently be conducted to ensure that these projects are allowable within the terms of the settlement Memorandum of Agreement and Consent Decree (United States v. State of Alaska, Civil Action No. A91-081 CV), and all other applicable state and federal laws and regulations.

During the examination and discussion of projects by the Restoration Team, a set of these projects emerged which clearly had broad Restoration Team support as defined by the Team's operating procedures (available upon request). This set was presented to the Trustee Council on September 21, 1992 as the Restoration Team's recommended suite of projects to be conducted in 1993. Without taking action on the recommended list, the Trustee Council then added project 93042, Recovery Monitoring of Prince William Sound Killer Whales to this list of preferred projects. Other projects received less support, but all projects except those deleted by the Trustee Council are contained within this draft Plan for public comment. **Projects appearing in the preferred list will not automatically be included in the 1993 Work Plan nor will those not appearing in this list be automatically excluded. YOUR OPINION is very important. The Trustee Council has not and will not make final decisions on projects until they have reviewed public and legal comments.** The first list that follows displays the Restoration Team's preferred projects to be included in the 1993 work plan. The second list displays projects that received less Restoration Team support. Projects that do not appear in either of the following lists were combined with other projects or deleted from consideration by the Trustee Council.

Project Descriptions and Budgets

Restoration Team List of Preferred Projects

<u>Project Number</u>	<u>Project Title</u>
93002	Sockeye Overescapement
93003	Pink Salmon Eggs to Pre-Emergent Fry Survival in Prince William Sound
93004	Documentation, Enumeration, and Preservation of Genetically Discrete Wild Populations of Pink Salmon Impacted by EVOS in Prince William Sound
93005	Cultural Resources Information, Education and Interpretation
93006	Site-Specific Archaeological Restoration
93007	Archaeological Site Stewardship Program
93008	Archaeological Site Patrol and Monitoring
93009	Public Information, Education and Interpretation
93011	Develop Harvest Guidelines to Aid Restoration of River Otters and Harlequin Ducks
93012	Genetic Stock Identification of Kenai River Sockeye Salmon
93015	Kenai River Sockeye Salmon Restoration
93016	Chenega Chinook and Coho Salmon Release Program
93017	Subsistence Restoration Project
93018	Enhanced Management for Wild Stocks in Prince William Sound, Special Emphasis on Cutthroat Trout and Dolly Varden
93022	Evaluating the Feasibility of Enhancing Productivity of Murres by Using Decoys, Dummy Eggs, and Recordings of Murre Calls to Simulate Normal Densities at Breeding Colonies Affected by the EVOS, and Monitoring the Recovery of Murres in the Barren Islands
93024	Restoration of the Coghill Lake Sockeye Salmon Stock

Project Descriptions and Budgets

93025	Montague Island Chum Salmon Restoration
93028	Restoration and Mitigation of Wetland Habitats for Injured Prince William Sound Fish and Wildlife Species
93029	Prince William Sound Second Growth Management
93030	Red Lake Restoration
93031	Red Lake Mitigation for Red Salmon Fishery
93032	Pink and Cold Creek Pink Salmon Restoration
93033	Harlequin Duck Restoration Monitoring Study in Prince William Sound and Afognak Oil Spill Areas
93034	Pigeon Guillemot Colony Survey
93035	Potential Impacts of Oiled Mussel Beds on Higher Organisms: Contamination of Black Oystercatchers Breeding on Persistently Oiled Sites in Prince William Sound
93036	Recovery Monitoring and Restoration of Intertidal Oiled Mussel Beds in Prince William Sound and the Gulf of Alaska Impacted by the EVOS
93038	Shoreline Assessment
93039	Herring Bay Experimental and Monitoring Studies
93041	Comprehensive Restoration Monitoring Program Phase 2: Monitoring Plan Development
93042	Recovery Monitoring of Prince William Sound Killer Whales Injured by the EVOS Using Photo Identification Techniques
93043	Sea Otter Population, Demographics and Habitat Use in Areas Affected by the EVOS
93045	Surveys to Monitor Marine Bird and Sea Otter Populations in Prince William Sound During Summer and Winter

Project Descriptions and Budgets

93046	Habitat Use, Behavior and Monitoring of Harbor Seals in Prince William Sound
93047	Subtidal Monitoring: Recovery of Sediments, Hydrocarbon - Degrading Microorganisms, Eelgrass Communities, and Fish in the Shallow Subtidal Environment
93051	Habitat Protection Information for Anadromous Streams and Marbled Murrelets
93053	Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated With the Exxon Valdez Oil Spill
93057	Damage Assessment GIS
93059	Habitat Identification Workshop
93060	Accelerated Data Acquisition
93061	New Data Acquisition
93062	Restoration GIS
93063	Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Fish
93064	Imminent Threat Habitat Protection

List of Projects Receiving Less Restoration Team Support

<u>Project Number</u>	<u>Project Title</u>
93010	Reduce Disturbance Near Murre Colonies Showing Indications of Injury from the EVOS
93014	Quality assurance for Coded Wire Tag Application in Fish Restoration Projects
93019	Chugach Region Village Mariculture Project
93020	Bivalve Shellfish Hatchery and Research Center
93026	Fort Richardson Hatchery Water Pipeline
93050	Update: Restoration Feasibility Study #5 (Identification and Recordation of Information Services Relevant to Land and Resources Affected by the EVOS)
93052	Identification and Protection of Important Bald Eagle Habitats

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93002

Project Title: Sockeye Overescapement

Project Category: Damage Assessment

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: U.S. Fish and Wildlife Service

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

A. Background on the Resource/Service

The sockeye salmon resources of Kodiak Island lakes affected by overescapement comprise approximately 20% of the Kodiak Island long-term commercial sockeye salmon harvest. The Kenai River sockeye salmon lakes affected by the *Exxon Valdez* oil spill (EVOS) are the major income producers for commercial fishermen in Cook Inlet. Sockeye salmon spawn in lakes associated with river systems. Adult salmon serve an important role in the ecosystem, providing food for marine mammals, terrestrial mammals, and birds. Additionally, carcass decomposition serves to charge freshwater lake systems with important nutrients. Juvenile salmon, which rear in lakes for one or two years, serve as a food source for a variety of fish and mammals. Sockeye salmon are also an important subsistence, sport, and commercial species. The ex-vessel value of the commercial catch of sockeye from these lake systems has averaged about \$42 million per year since 1979, with the 1988 catch worth \$115 million. Sockeye salmon returns to the Kenai River system support some of the largest recreational fisheries in the State.

B. Summary of Injury

Commercial fishing for sockeye salmon in 1989, was curtailed in upper Cook Inlet, the outer Chignik districts, and the Kodiak areas due to presence of oil in the fishing areas from the EVOS. As a result, the number of sockeye salmon entering four important sockeye-producing systems (Kenai/Skilak, Chignik/Black, Red, and Frazer Lakes) and two less important lake systems (Akalura and Afognak or Litnik lakes) greatly exceeded levels that are thought to be most productive.

Overly large spawning escapements may result in poor returns by producing more rearing juvenile sockeye than can be supported by the nursery lake's productivity (Kyle et al. 1988). In general, when rearing fish abundance greatly exceeds the lake's carrying capacity, prey (zooplankton) are altered by changes in species and size composition (Mills and Schiavone 1982, Koenings and Burkett 1987, Kyle et al. 1988) and concomitant effects on all trophic levels can occur (Carpenter et al. 1985). Because of such changes, juvenile sockeye growth is reduced, mortality increases, larger percentages holdover for another year of rearing; and the poor quality of smolts increases

marine mortality. Where escapements are two to three times normal levels, the resulting high juvenile densities crop the prey resources to the extent that more than one year is required to return to normal productivity. Rearing juveniles from subsequent brood years suffer from both the poor quality of forage and from the increased competition for food by holdover juveniles (Townsend 1989; Koenings and Kyle 1991). This is the brood year interaction underlying cyclic variation in the year class strength of anadromous fish. Smolt production from the Kenai River in 1991 was extremely low as was production of smolt from Red Lake. In the spring of 1992, the Kenai River smolt estimates dropped by another order of magnitude, suggesting severe declines in sockeye salmon returns in future years. Counts of smolt migration in Red River (on Kodiak Island) were relatively higher in 1992, but still insufficient to provide an average return for this system. The effects of overescapement can cause continued adversity because of multiple-year impacts on the zooplankton community or other critical juvenile life-history habitat components. Consequently, damage assessment studies require continuation until the juvenile sockeye salmon habitat is restored or naturally recovers.

C. Location

The studies will be conducted on the Kenai Peninsula include the Tustumena and Kenai River lake systems. In addition, studies will continue on Kodiak Island to assess the damage to the Red Lake system with Upper Station Lake acting as a control.

WHAT

The goal of these studies is to determine the impacts of the overescapement of 1989 that was associated with fishery closures due to the EVOS. The studies have specifically focused on Red Lake and the major rearing lakes of the Kenai River system. Study activities include the enumeration of smolt production and sampling of smolt population characteristics, and monitoring of subsequent adult returns from these systems as well as measuring the changes in the rearing habitat of the effected lakes and nearby unaffected lake systems. A secondary benefit of these studies may be to provide insight as to what, if anything, can facilitate rapid recovery of these systems.

The specific objectives of these studies are as follows:

- A. Estimate the number, age, and size of sockeye salmon juveniles rearing in selected freshwater systems.
- B. Estimate the number, age, and size of sockeye salmon smolts migrating from selected freshwater systems.

Project Descriptions

- C. Determine effects of large escapements resulting from fishery closures caused by the EVOS on the rearing capacity of selected nursery lakes through:
 - 1. Analysis of age and growth of juveniles and smolts
 - 2. Examination of nutrient budgets and plankton populations.
- D. In addition, evaluation of diel vertical migration induced by sockeye salmon predation on subsequent growth and survival of juvenile sockeye will be made. Also, assessment of the role of egg-bearing copepods as an essential diet component of sockeye salmon juveniles in glacial lakes will be conducted.

WHY

Before any mitigation and restoration of sockeye salmon in the effected lakes can be undertaken, the extent and cause of damage needs to be established. The resource in question has major implications for the commercial fishing industry on Kodiak Island and in Cook Inlet, where sockeye salmon provide the major source of income. In addition, heavy use of the Kenai River by subsistence, personal use, and sport fishermen have much importance to the Alaskan economy.

To restore lost resources it is essential that a clear understanding of damages be assessed. In the case of overescapement, a lake may require many years to recover, as the extent of damage may persist. Thus, to prevent recurrence and compounding damage, and to expedite natural restoration of the system, an understanding of the mechanism is essential.

HOW

From early May to early July, two inclined plane traps will be operated daily in the outlet stream of Red Lake about one mile below the lake's outlet. The catch will be counted by species, and sockeye smolts will be sampled daily for age, length, weight, and condition factor. Each week, 500 sockeye smolts will be marked (biologically inert dye), and released about 0.5 mile above the traps to determine trap efficiency. A similar operation will occur at Upper Station Lake which is the study control. This project will also provide support for the assessment conducted by FRED Division (fall fry townetting) of pre-smolt sockeye rearing conditions (biomass and growth data) in Red and Upper Station Lakes.

On the Kenai River, expanded smolt enumeration is proposed for the lower river through increased marking and recovery effort. In addition, coded wire tagging of smolts is proposed on the Moose River and a smolt project is planned for the Russian River system.

Limnology studies will continue on Upper Station and Red lakes on Kodiak, the major lakes of the Kenai River (Skilak and Kenai lakes), and on Tustumena Lake which is the control for the Kenai system. In addition, an optical plankton counter will be used to assist in determining the effects of predator-induced diel vertical migration in Skilak Lake. These studies will be coupled with expanded tow netting on Skilak and Kenai Lake to obtain juvenile sockeye salmon specimens throughout their rearing cycle in freshwater. Water quality and physical measurements from all of the lakes will continue to be monitored. Disease screening of fish specimens is also planned.

ENVIRONMENTAL COMPLIANCE

None of the proposed projects are intrusive. They involve collection of data and do not affect fish and wildlife populations or their habitat.

WHEN

The studies are continuous and will most likely continue beyond the end of the upcoming fiscal year (September 30, 1993). The studies will terminate when the sockeye salmon populations or their habitat recover to pre-spill conditions. Progress reports and interim findings will be released annually in a progress report issued in late November. Major discoveries are issued through news releases or through scientific publication.

BUDGET (\$K)

	ADF&G
Personnel	\$ 440.1
Travel	7.8
Contractual	115.9
Commodities	51.2
Equipment	25.5
Capital Outlay	<u>0.0</u>
Sub-total	\$ 640.5
General	<u>74.1</u>
Administration	
Project Total	\$ 714.6

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93003

Project Title: Pink Salmon Egg to Pre-emergent Fry Survival in Prince William Sound.

Project Category: Damage Assessment/Restoration Monitoring

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Marine Fisheries Service (NOAA)

Project Term: March 1, 1992 to July 30, 1995

INTRODUCTION

Each year approximately one-half billion wild pink salmon fry emerge from the streams of Prince William Sound (PWS) and migrate seaward. Adult returns of wild pink salmon to PWS average from 10-15 million fish annually. These huge outmigrations of wild pink salmon and subsequent adult returns play a major role in the PWS ecosystem. Both juveniles and adults are important sources of food for many fish, birds, and mammals. Adults returning from the high seas also convey needed nutrients and minerals from the marine ecosystem to estuaries, freshwater streams, and terrestrial ecosystems. Wild pink salmon also play a major role in the economy of PWS because of their contribution to commercial, sport, and subsistence fisheries in the area.

Up to 75% of pink salmon spawning in PWS occurs in intertidal areas. In the spring of 1989, oil from the *Exxon Valdez* oil spill (EVOS) was deposited in layers of varying thickness in intertidal portions of many western PWS streams utilized by spawning salmon. Pink salmon eggs and fry rearing in these intertidal areas appear to have been adversely affected by the oil. Salmon egg mortalities were 70%, 65%, and 115% higher in oiled streams than in comparable and nearby unoiled streams in 1989, 1990, and 1991. Differences between oiled and unoiled streams in 1989 and 1990 were confined to intertidal spawning areas and may be attributed to direct lethal effects of oil. Large differences observed across all tide zones in 1991 may be the consequence of damage to germ cells of the adults which originated from the 1989 brood year when egg and larval exposures to intertidal oil were greatest. A consequence of this genetic damage may be persistent functional sterility and reduced returns per spawner for populations from oiled streams.

The proposed damage assessment and resource monitoring study will consist of field and laboratory studies conducted in western PWS and additional laboratory studies at the National Marine Fisheries Service (NMFS) Research facility at Little Port Walter in southeastern Alaska. The majority of project funds will be spent to support the portion of the project located in PWS and will contribute to the local economy of Cordova. Results of the project will direct future restoration efforts for pink salmon and may impact future harvest management strategies in PWS fisheries.

WHAT

The project will continue to monitor egg mortalities in the oiled and unoiled wild pink salmon streams previously studied, examine stream characteristics unrelated to oiling which may partially or completely explain observed mortality differences, and provide laboratory verification that field results observed for eggs in 1989, 1990 are consistent with lethal effects of oil contamination of intertidal pink salmon spawning habitat. The laboratory verification experiment will also test the hypothesis that oil contamination during incubation can result in functional sterilization of exposed animals at sexual maturity and may explain the persistence of higher egg mortalities observed in all tide zones of oiled streams in 1991.

The specific objectives of the project are as follows:

- A. Estimate the density, by tide zone, of eggs and pre-emergent fry in 31 streams using numbers of live and dead eggs and fry.
- B. Estimate egg mortality and overwinter survival of pink salmon eggs in the oiled and unoiled streams among the 31 sampled.
- C. Determine whether the increased pink salmon egg mortalities observed in oiled streams in 1989, 1990, and 1991 can be attributed to the physical characteristics of the study streams.
- D. Determine survival, genetic damage, hydrocarbon uptake, mixed function oxidase activity, and sublethal teratogenic effects from long term exposures to oil in each of two exposure groups:
 1. Green eggs to eyeing, and
 2. Green eggs to swim-up.
- E. Determine survival, genetic damage, hydrocarbon uptake, and mixed function oxidase activity from long term exposures of juvenile pink salmon fed oil-contaminated food.
- F. Determine growth characteristics from each exposure group from juvenile stage to maturity.
- G. Assess whether differences exist among exposure groups with respect to fecundity, fertilization rate, genetic damage, and sublethal teratogenic effects in the second generation progeny through swim-up.
- H. Compare lab study with field observations:
 1. Determine if the elevated egg mortalities in 1989 and 1990 were potentially caused by oiling in the environment.
 2. Determine if the elevated egg mortalities in oiled streams in 1991 were potentially caused by genetic damage to 1989 eggs.

WHY

Information from this study will provide resource managers insight to the magnitude and persistence of damages sustained by wild pink salmon due to EVOS. Efforts to restore damaged pink salmon populations depend upon the ability to identify sources of reduced survival and to monitor their persistence. Information on the potential of oil exposures causing genetic damage is needed so spawning escapement goals can be reevaluated and adjusted if necessary. Verification

Project Descriptions

of the genetic hypothesis would also provide the first evidence that reproductive capacity of fish exposed to chronic or acute sources of oil pollution would be compromised.

HOW

A. Field Studies

A systematic sampling program stratified by stream and tide zone will be used to collect egg and fry density and survival data from 11 oiled and 14 unoled sites sampled previously in *NRDA Fish/Shellfish Study 2, Injury to Salmon Eggs and Fry in PWS*. Sampling will consist of egg-digs conducted in late September and early October, and fry-digs conducted in mid-March. Egg and pre-emergent fry data will be summarized by date, stream, level of hydrocarbon impact, stream zone, and number of live and dead eggs and fry. Density estimates will be used to assess adult spawning success. Relative numbers of live and dead eggs and fry will be used to test for continued reductions in survival in oiled streams.

B. Laboratory Study 1

Intra-stream crosses will be made using within stream pools of randomly combined gametes from six oiled and six unoled streams from southwestern PWS. Eggs from the crosses will be incubated through hatching in a controlled laboratory environment. Egg mortalities will be compared for all crosses. Crossing results will be compared to results from field studies to determine the effect of stream characteristics on egg mortality differences previously observed between oiled and unoled sites.

C. Laboratory Study 2

This study consists of three experiments. The first will examine the effects of six levels of intertidal gravel oil contamination and two durations of exposure on responses to various life history stages of cultured eggs and fry. Responses measured in the first generation will include survival to eyeing, survival to emergence, hydrocarbon uptake, survival to maturity, growth to maturity, and fecundity. Responses measured in the second generation will include fertilization rate and number of defective progeny. Samples for use in genetic analyses will be collected from first generation eyed eggs, emergent fry, juveniles, and mature adults. Genetic analyses will include flow cytometry methods and examination of metaphase germ cells. Second generation eyed eggs and emergent fry will be similarly sampled. The second experiment will determine if cultured fish fed oiled food for 6 weeks experience genetic damage and reduced gamete viability. Treatments will consist of 6 concentrations of oil in the feed (1 control and 5 different oil levels). Biological responses to be measured between emergence and the first 6 weeks of feeding will include growth, survival, hydrocarbon concentration, chromosome damage, and MFO incidence. Subsequent response measurements will include growth to maturity, fecundity, fertilization rate and number of defective progeny. Flow cytometry samples and samples for examination of metaphase cells will be taken after the first 6 weeks and will mirror those taken in the first experiment. The third experiment will determine if there is evidence of differential gamete survival to emergence between ten randomly paired families of cultured fish for five different treatment regimes. The treatments will be a combination of oiling concentrations from study 1

(Ci) and duration of exposure as follows:

1. Control,
2. C₂ through eyeing,
3. C₂ through emergence,
4. C₄ through eyeing, and
5. C₄ through emergence.

The fertilized gametes from ten randomly selected pairs of pink salmon (family) will be divided into aliquots, each aliquot will be randomly assigned one of the five treatments (3 aliquots per treatment). Ten family groups will be created and assigned in this manner. Individual aliquots will be incubated in pipe incubators and all fish culture practices will be randomized between families. Families will be incubated until emergence when they will be inspected, counted, and terminated.

ENVIRONMENTAL COMPLIANCE

Egg and pre-emergent fry sampling will require an ADF&G Title 16 permit and an ADF&G biological collections permit. Transport of wild gametes to the PWSAC hatchery will require an ADF&G Fish Transport Permit for each stock and a Permit Alteration may be required to rear and incubate the wild eggs at the AFK Hatchery.

WHEN: August 1993 - Interim Report 1 including: instream egg density and survival results, intrastream crossing results, first generation doses response results for eggs and fry.

August 1994 - Interim Report 2 including: update of Interim Report 1, First generation doses response results through year 1.

Final Report - July 1995

BUDGET (\$K)

	ADF&G	NOAA	TOTAL
Personnel	\$ 192.7	\$ 117.9	\$ 310.6
Travel	11.4	10.0	21.4
Contractual	83.0	116.0	199.0
Commodities	21.5	54.0	75.5
Equipment	0.0	19.0	19.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 308.6	\$ 316.9	\$ 625.5
General Administration	<u>34.7</u>	<u>25.8</u>	<u>60.5</u>
Project Total	\$ 343.3	\$ 342.7	\$ 686.0

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93004

Project Title: Documentation, Enumeration, and Preservation of Genetically Discrete Wild Populations of Pink Salmon Impacted by EVOS in Prince William Sound.

Project Category: Restoration Monitoring and Management Action

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: U.S. Forest Service

Project Term: March 1, 1993 to June 30, 1995

INTRODUCTION

Historically, approximately five-hundred-million wild pink salmon fry emerged from streams throughout Prince William Sound (PWS) each year to migrate seaward. Adult returns of wild pink salmon averaged from 10 to 15 million fish annually. These returning wild-stock adults play an important role in the total Prince William Sound ecosystem; they convey essential nutrients and minerals from the marine ecosystem to estuaries, freshwater streams, and terrestrial ecosystems. Both juveniles and adults are important sources of food for many fish, birds, and mammals. Wild pink salmon also play a major role in the economy of PWS because of their contribution to commercial, sport, and subsistence fisheries in the area.

Wild-stock pink salmon suffered both direct lethal and sublethal injuries as a result of the Exxon Valdez oil spill (EVOS). Pink salmon embryos and alevins suffered increased mortality, diminished growth, and a high incidence of somatic cellular and genetic abnormalities as a result of spawning ground contamination and rearing in oiled areas. Wild stocks most impacted by the *Exxon Valdez* oil spill (EVOS) are also subject to excessive exploitation in mixed stock fisheries of western PWS which are targeting on large hatchery returns. Also, in 1989 the commercial harvest of pink salmon had to be shifted away from the hatchery and wild stocks in the oiled areas to target only the wild stocks in eastern Prince William Sound. This resulted in overharvest and depletion of these stocks evidenced by general run failures of stocks in the northern and eastern portions of Prince William Sound in 1991.

Furthermore, coded-wire tag recovery results from NRDA F/S Study 3 indicate that damaged wild salmon streams located on hatchery stock migratory corridors in western PWS experience a high incidence of genetic interchange as a result of straying from the burgeoning hatchery populations. Ample evidence in the literature suggests that hatchery fish are ill

adapted to wild conditions and that genetic interchange between hatchery and wild stocks may lead to reduced fitness of wild stocks. The combined effects of oil damage, excessive harvest, and genetic burden on wild fish may result in an overall reduction in population size, genetic diversity, and fitness of PWS salmon populations.

The proposed damage assessment and resource monitoring study will consist of field studies conducted from Cordova and laboratory studies in Anchorage. The majority of the funds support PWS field studies and will contribute to the local economy of Cordova. The project may result in altered harvest management strategies in PWS fisheries and will contribute to the natural recovery process for PWS pink salmon populations.

WHAT

Depending upon results from 1992, this project will monitor the recovery of damaged wild streams through timely and accurate estimates of wild pink spawning escapements, quantify the extent of hatchery stock staying into wild salmon streams, and examine the genetic structure of representative salmon populations from throughout PWS, measuring both within and between population diversity. Genetic sample sites will include those which tagging results indicate are highly susceptible to hatchery straying (see Restoration Science project R60) in order to better clarify putative EVOS impacts on hatchery/wild-stock interactions.

Fisheries managers will use escapement data inseason to enact harvest management strategies which insure that sufficient fish escape fisheries to spawn in streams damaged by EVOS. Data on straying rates will be used in conjunction with genetic data to develop alternate hatchery production strategies and develop criteria for wild-stock sanctuary areas where straying is minimal or does not occur. An understanding of the population genetics of affected pink salmon populations will also be used to guide restoration management decisions including those regulating commercial harvest. Genetic monitoring and risk assessment are also required to evaluate any supplemental restoration programs in a manner similar The Northwest Power Planning Council currently uses such a monitoring and evaluation program for their supplemental restoration program.

The specific objectives of the project are as follows:

1. Estimate straying rates of hatchery and wild stocks of pink salmon through systematic sampling of spawner carcasses in approximately 50 streams in PWS.
2. Monitor the recovery and status of pink salmon stocks through total weir enumeration of intertidal and upstream spawning escapements in eight streams which are representative of streams injured by the oil spill.
3. Define the genetic structure of pink salmon stocks in the EVOS-affected area in order to better direct harvest management decisions made for restoration purposes on a stock-specific rather than species-specific basis.
4. Provide information needed for genetic risk assessment and genetic monitoring of supplementation programs (e.g., as a result of Study R105) to guide stock-specific restoration and enhancement.

Project Descriptions

WHY

The most cost effective method for restoring injured wild pink salmon populations to their pre-spill condition is through modification of the human uses which affect their natural recovery. Commercial harvest is the major factor controlling wild pink salmon spawning escapement and reproductive success. The ability to impose stock-specific management on the commercial fishery and reduce fishery exploitation of oil impacted wild stocks is vital to their restoration. One of the most important pieces of information for stock-specific management of fisheries is timely and accurate escapement data which this project will supply.

The importance of pink salmon in the PWS ecosystem is predicated upon their abundance and their diverse spatial and temporal distribution. Genetic interchange between hatchery and wild fish may lead to reductions in the overall fitness and population size of wild stocks and will most certainly alter historic spatial and temporal abundance of wild pink salmon in the PWS ecosystem. The status of wild salmonid populations was a concern prior to the oil spill and the documented damage to these populations further increases the concern and the need to understand the underlying population structure and amount of gene exchange among populations. Reproductively isolated populations are by definition self-recruiting--the adults generally do not stray to repopulate depleted areas. Therefore, basing management decisions on known population structure is critical to facilitate successful restoration of reproductively isolated units.

Hatchery supplementation of wild pink salmon stocks cannot be contemplated without knowledge of the underlying population structure (see State of Alaska Genetic Policy). To do so would put the unique adaptive advantages of the wild stocks at risk. The same population genetic data will provide a baseline for possible mixed-stock fishery analysis (e.g., see Restoration Science Project R59) and possible genetic marking. Genetic marks are now used to manage the harvest of Fraser River pink salmon, for example, and such techniques may ameliorate the hatchery/wild-stock management problems exacerbated by the EVOS.

HOW

Adult salmon will be counted through weirs at eight streams where outmigrating fry were enumerated and coded-wire tagged, and where adults were counted in previous years. Weir crews will perform daily ground surveys of intertidal and upstream portions of the weired streams and at ten additional streams. At weekly intervals they will also apply Peterson disk tags to fish as they enter weired streams. During daily foot surveys crews will enumerate live and dead pink salmon, record Peterson disk tag recoveries from dead fish, and record the number of carcasses with missing adipose fin denoting the possible presence of a coded-wire tag. Heads from adipose clipped carcasses will be removed and sent to a centralized laboratory for tag extraction and decoding. Paired aerial and weir data will be used to calibrate aerial estimation procedures and estimate observer bias. Weir data, daily counts of live and dead fish, and results of Peterson disk tagging studies will be used to estimate average stream life for streams in the PWS aerial survey program. Improved stock specific estimates of spawning escapements combined with commercial catch contribution data will allow fisheries managers to accurately assess the impacts of the harvest management strategies on impacted stocks.

Pink salmon populations sampled during the escapement enumeration project represent a small percentage of the over 900 anadromous spawning populations in Prince William Sound. To better document the full extent of hatchery straying this project will expand tag recovery efforts in approximately 50 important spawning streams throughout PWS. Tag recoveries will be accomplished through multiple ground surveys during periods of peak salmon returns. Tag recovery sampling will be identical to the sampling at weired systems.

Tissue samples for baseline genetic data will be taken from 100 fish from two hatcheries and from spawned-out fish in 18 of the 50 streams sampled for straying. Both early and late stocks and intertidal and upstream-spawning stocks will be included among the 18 sampled. Heart, liver, and muscle tissue and aqueous humor will be removed from each individual sampled, frozen immediately on liquid nitrogen, and returned to Anchorage for storage at -80° C. Results of genetics samples will be used to define the genetic structure of pink salmon populations in PWS and identify reproductively isolated populations. Results of coded-wire tag recovery data will be analyzed and used in concert with genetic data to identify areas with no evidence of straying which could be designated as genetic sanctuaries which could be protected by future management actions and hatchery release strategies. Those oiled areas with documented high levels of straying should be monitored to examine the long term effects of straying and the resultant wild/hatchery salmon hybridization on the overall fitness of wild populations.

Genetic data will be collected using the techniques of allozyme protein electrophoresis on all samples and restriction fragment length polymorphism (RFLP) analysis of mitochondrial DNA (mtDNA) on a subset of samples. These procedures are well-established and currently being conducted in the genetics laboratory of ADF&G. As appropriate, data will be merged into the state and federal interagency coast-wide databases.

ENVIRONMENTAL COMPLIANCE

ADF&G has Title 16 permits for all of the proposed intertidal weirs. Corps of Engineers' permits are not required since none of the weirs are on navigable waters. All sampling on weired and unweired systems is covered by ADF&G biological collection permits. None of the proposed camps or structures are permanent nor will they permanently alter the study sites in any way. All weirs, camp structures, and equipment will be removed from study sites upon completion of the project.

Project Descriptions

WHEN

December 1993	-	Interim Report 1 including: Summary of weir counts, live and dead counts, stream life estimates, aerial surveyor bias estimates by stream, and hatchery straying rates by hatchery and stream for 1993.
December 1994	-	Interim Report 2 including: Summary of 1994 escapement and straying data and comparison of 1993 and 1994 results. Escapement and straying data analyses will be in the same format as 1993 report and including a comparison of 1993 and 1994 results.
June 1995	-	Final Report

BUDGET (\$K)

	ADF&G
Personnel	\$ 550.1
Travel	8.0
Contractual	168.5
Commodities	57.0
Equipment	33.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 816.6
General Administration	<u>82.5</u>
Project Total	\$ 899.1

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Project Descriptions

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93005

Project Title: Cultural Resources Information, Education and Interpretation

Project Category: Management Action

Project Type: Archaeology

Lead Agency: United States Department of Agriculture, Forest Service

Cooperating Agencies: U.S. Department of Interior, National Park Service; Alaska Department of Natural Resources

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

The *Exxon Valdez* oil spill affected cultural resources in the oil spill affected area. These resources are ethnographically within the Alutiiq, or Pacific Eskimo, area. Known sites in the region contain information from as long as 8,000 years ago to the early 20th century A.D. These sites are the non-renewable source of data which are the basis of knowledge about past peoples and their relationship to the marine and terrestrial animals, plants, and other natural resources of the area.

One of the most significant injuries to cultural resources as a result of the *Exxon Valdez* oil spill was vandalism and looting resulting from increased visibility and knowledge of site locations. Mitigation of this injury involves education of the public about the valuable cultural heritage information preserved in these archaeological sites, and the losses which result from the unscientific digging and looting of sites.

The proposed mitigation measures will occur for the most part in oil spill affected communities. Increased circulation of existing brochures and posters is proposed for Anchorage, communities in Prince William Sound, on the Kenai Peninsula, and on Kodiak Island. These same communities will be included in Alaska Archaeology Week activities, the expansion of which would be coordinated in Anchorage. Several projects will be developed locally and made available to communities both within the oil spill area and throughout the state. These include the proposed portable cultural resources exhibits, public service announcements, educational videos, curriculum developed to state educational standards, and educational pamphlets to be distributed through museums, visitor centers, tour operators, and other public outlets. Local groups will be organized and promoted in oil spill affected communities to involve interested amateurs in archaeology under professional guidance. Curriculum development will occur primarily in the communities of southcentral Alaska, and secondarily state-wide through the Department of Education and individual school districts.

WHAT

The overall goal and purpose of these projects is to educate the public to the value and finite nature of cultural resources, thereby effecting value and behavioral changes so that future site looting and vandalism is minimized or ended. In the process, damage that has occurred to archaeological sites as a result of the oil spill will be ameliorated. This will be accomplished through the following:

- A. Development and distribution of brochures, public service announcements, and videos concerning the heritage value of cultural resources in the oil spill area.
- B. Development, construction, and circulation of 6 portable exhibits on the cultural resources of the oil spill area.
- C. Design, production and implementation of curriculum for elementary through high school and teacher training is proposed. This effort will be coordinated with local, State and Federal agencies, private institutions, and other interested parties.
- D. Expansion of Alaska Archeology Week and associated activities.
- E. Organization and promotion of local amateur groups interested in cultural resources.
- F. Interpretation of cultural resources at sites on National Forest and State Parks.

WHY

Although some vandalism and looting of archaeological sites had occurred prior to the oil spill, the increased number of people in the area during clean-up activities and the increased knowledge of site locations led to a higher rate of vandalism of known sites. Because it is impossible to reverse this increase of knowledge about cultural resources, an educational response is necessary concerning the significance and proper treatment of archaeological sites. These educational projects will develop a stewardship ethic reflecting an appreciation for cultural resources, and will enable individuals to be directly involved in furthering the understanding of the prehistory of Southern Alaska.

HOW

Several agencies will cooperate in achieving the desired education results.

- A. A Department of Interior National Park Service (NPS) archaeologist will arrange for production and distribution of additional copies of existing ARPA publications and posters, and will design and supervise the production and circulation of the six traveling cultural resource exhibits. This archaeologist will arrange an expansion of the Alaska Archaeology Week program to include oil spill affected communities and will prepare, with the assistance of a Visual Information Specialist, three public service announcements concerning cultural resources.

Project Descriptions

- B.** Three archaeologists working for the Alaska Department of National Resources (ADNR) will develop new cultural resource pamphlets to distribute to the public, as well as a script for a 15-20 minute video about the value of archaeological sites. The actual video will be produced under contract. Most importantly, the archaeologist will organize and promote, in oil spill affected communities, groups interested in local archaeology. In connection with these groups, the archaeologists will develop activities which involve amateurs in archaeological work under the guidance of professionals.
- C.** The Kodiak and Kenai Peninsula State Parks offices will develop and present programs for school-age children on the importance of protecting cultural resources, and will contract to develop visitor exhibits.
- D.** Under USDA Forest Service contract a curriculum will be developed by an individual or agency who will be responsible for design, production and dissemination, working cooperatively with Forest Service, NPS, ADNR, Native organizations and other interested parties. Summer institutes will be the venue for teacher training and materials development, to be followed by field testing of materials in classrooms. Subsequent summer institutes will emphasize rewriting of the curriculum, with finalization envisioned by the fifth institute. Teachers who have been trained and have field-tested material will become trainers of other teachers within districts and at institutes.

ENVIRONMENTAL COMPLIANCE

Development of curriculum, publications, and videos is categorically excluded from documentation in an environmental impact statement or environmental analysis.

WHEN

A. Curriculum Development Time Line

01/01/93 - 04/01/93 -	Develop contract/ Award contract.
04/01/93 - 09/30/93 -	Contact agencies and institutions/ Identify and collect instructional materials.
10/01/93 - 02/27/94 -	Plan with cooperative agencies the core Elementary Curriculum Outline/ Prepare advertisements/ Initiate contact for contracted persons.
07/01/94 - 08/31/94 -	Conduct the summer institute and prepare for field testing.
09/01/94 - 12/31/94 -	Coordinate the field testing and oversee the administering of testing of classroom participants.

B. Pamphlets

07/01/93	-	Drafts of four pamphlets complete
08/01/93	-	Final pamphlets complete
09/15/93	-	Pamphlets printed

C. Video

06/01/93 - Draft
 07/01/93 - Final

D. Local Workshops

05/01/93 - Activity schedule set
 06/01/93 - 08/31/93 - Local group activities
 09/30/93 - Report on activities

BUDGET (\$K)

	USFS	USNPS	ADNR	TOTAL
Personnel	\$ 73.7	\$45.6	\$ 99.1	\$ 218.4
Travel	6.5	0.0	11.0	17.5
Contractual	0.0	66.0	30.0	96.5
Commodities	3.2	23.0	1.3	27.5
Equipment	0.0	0.0	0.0	0.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 83.4	\$ 134.6	\$ 141.9	\$ 359.9
General Administration	<u>11.0</u>	<u>11.5</u>	<u>17.0</u>	<u>39.5</u>
Project Total	\$ 94.4	\$ 146.1	\$ 158.9	\$ 399.4

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93006

Project Title: Site-Specific Archeological Restoration (Interagency)

Project Category: Restoration Management Actions

Project Type: Archeology

Lead Agency: National Park Service

Cooperating Agencies: Alaska Department of Natural Resources; Department of Interior, Fish and Wildlife Service; Department of Agriculture, U.S. Forest Service

Project Term: Five years for restoration action component; 10 years for monitoring component January 1, 1993 to December 30, 2002

INTRODUCTION

A two-phase archeological restoration assessment of all existing and accessible oil spill response documentation has revealed that there is solid evidence for substantive injury to 24 known archeological sites that can be directly linked to the *Exxon Valdez* oil spill event. The sources of injury include oiling, oil spill beach cleanup actions, and vandalism. Of these three identified sources, cleanup activities and vandalism appear to have resulted in the most clear-cut cases of injury to archeological sites (e.g. loss or destruction of diagnostic artifacts, illegal excavation, disturbance of human remains). The effects of oiling are more problematical, but the available evidence indicates that oil penetration impairs the ability of radiocarbon samples to yield accurate dates and may alter archaeologically-relevant soil chemistry.

In June 1992 the Trustees convened a multi-agency panel of experts in the archeology of the oil spill region chaired by Martin McAllister, the nation's foremost expert in archeological restoration. This panel gave thorough review to all available oil spill injury data and arrived at the following conclusions:

1. Nineteen known archeological sites had been injured by cleanup activities or vandalism related to the oil spill event.
2. A total of 10 known sites had been affected by moderate to heavy oiling (5 of which are also among the 19 sites injured by cleanup and vandalism).
3. Based on the total known sites and projected archeological sites in the oil spill pathway supplied by the Exxon Company contractors and a special Trustee-sponsored GIS/statistical study by the State University of New York, it is estimated that:
 - a. A total of 112 archeological sites suffered substantive injury from oil spill cleanup or vandalism tied to the oil spill event.

- b. A total of 59 archeological sites were subjected to moderate to heavy oiling during the oil spill event (at least half of these sites also number among the 112 sites affected by other sources of injury).

Note: These numbers represent the most conservative, statistically-derived estimate of injury endorsed by the "McAllister Panel." The next-lowest estimates put forward by Dr. Al Dekin's injury study are 338 and 155, respectively; statistically valid estimates, but based on what appear to be less valid assumptions about the nature and distribution of injury.

The purpose of this project is to conduct site-specific restorative actions at injured archeological sites on federal or state lands within the oil spill pathway. Guidance for the proposed work is drawn from Section 14 of the Archeological Resources Protection Act (ARPA). None of the planned work duplicates previous studies; it is based on a careful review of the results of earlier injury investigations.

WHAT

The goal of this project is to ameliorate injury to archeological sites that were impacted by oiling, oil spill cleanup, or vandalism as a direct result of the *Exxon Valdez* oil spill event. The measures include the following:

1. Full damage examination and analysis of the injured sites.
2. Recovery analysis and curation (and where appropriate, repatriation) of any remaining archeological resources that were exposed or disturbed by oil spill related injury.
3. Data recovery to compensate for the loss of important archeological information at injured sites and/or the stabilization and physical repair of disturbed areas within injured sites.

WHY

Archeological sites constitute a category of finite, non-renewable resources managed by the state and federal governments for the public benefit. These resources represent a major part of the cultural heritage of the United States and injury to resources of this type results not only in the loss of important scientific data about the human past but in an irrevocable diminution of our nation's historic patrimony. The restorative measures proposed herein are designed to either repair physical injury or reduce the loss of important archeological information caused by injury. Physical repair includes such actions as restoring trampled protective vegetation at a site or filling in a looter's hole. Data recovery is used to recover what bits of information can be salvaged from the area of an illegal excavation--in a sense, restoring to the public what information has been potentially lost by means of scientific investigations. If restorative measures are not taken; current signs of vandalism may provoke further vandalism, disturbed archeological soils will most likely result in accelerated erosion of archeological fabric, and altered artifact patterns and contaminated radiocarbon samples will probably play subtle havoc with future archeological

Project Descriptions

interpretations in the region--one of Alaska's richest but least known archeological zones. In recognition of the archeological importance of the area, the National Park Service has already committed a majority of its funds under a five-year National Archeological Survey project to conduct a sample survey and evaluation of coastal sites in Kenai Fjords and Katmai. Other participating agencies lack a similar funding source, but they are committed to do what they can to increase survey coverage of the area.

HOW

The first step in this project will be to conduct site-specific restoration assessments at sites with documented injury, but where there is insufficient detail upon which to determine appropriate treatment (19 sites). The second step will be to carry out the indicated restorative action--either physical repair and/or data recovery. In many cases, the anticipated restoration treatments will be limited in scope and difficulty and the necessary restorative actions will be taken immediately upon completion of the assessment. A few may require carefully-planned return visits. This portion of the work will be carried out in a two-year split (1993 and 1994) to permit sufficient time for planning larger and more complex restorative measures and to take advantage of corrective feedback from the first year of the project.

A concurrent restoration assessment, coordinated with the first, will address long-term injury resulting from oiling. Ten known sites that have been exposed to moderate to heavy oiling will be monitored for a period of 10 years to determine the effect of oil on radiocarbon samples, archeological soil chemistry, and protective site vegetation. Research assessments of this type are specifically authorized by Section 14(c) of ARPA when the nature and level of injury to archeological sites remains uncertain or problematic. The results will alert future researchers to any skewing effect the oil may have on archeological soil or radiocarbon specimens and make land managers aware of any residual threats to archeological sites (e.g., alterations or reductions in protective vegetative cover). The 10 sites selected for monitoring include 5 from the list of 19 sites with evidence of injury attributable to cleanup or vandalism and 5 additional sites that have been oiled, but presently have no documentation of other injury. These 5 sites bring the total number of known injured sites to 24, the number mentioned at the beginning of this proposal.

After completion of the assessment and treatment of previously-known injured sites in 1994 the work could be expanded in 1995 to discover additional injured sites, assess the nature and extent of the injury, and carry out appropriate treatment. The favored approach will be a "find and restore strategy." A problem-oriented research design will be developed to guide this inventory. The search will employ a stratified-random survey methodology to target the effort toward the most likely zones to contain injured archeological sites in need of treatment. Continuation of the oiling assessment and the start of this work will depend on an interim review of the results from the first two years of the project and the express approval from the Trustee Council to proceed.

The results of all project work will be published in both technical and popular formats. As they become available, pertinent findings will be fed into the stewardship, site protection monitoring, and public education projects. The research and restorative actions will follow the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation. The Division of Polar Research, National Science Foundation, is recommended as the most appropriate source and coordinator for peer review of the project.

ENVIRONMENTAL COMPLIANCE

The proposed project is a categorical exclusion from the National Environmental Policy Act but subject to the provisions of the Historic Preservation Act, the Archeological Resources Protection Act, and the Native American Graves and Repatriation Act. The project will be carried out in conformance with the consultative processes and standards demanded by these legislative mandates.

WHEN

January 1 to June 1, 1993	Consultation under the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act; preparation of work plans and research designs.
June 1, 1993	Start of field work for restoration assessment and oil monitoring projects.
December 30, 1994	Completion of restoration assessment for known injured sites.
June 1, 1995	Start of fieldwork for discovery, assessment, and treatment of additional archeological sites.
December 30, 1997	Completion of restoration assessments and treatment actions for additional injured sites.
December 30, 2002	Completion of oil monitoring project.

BUDGET (\$K)

	USNPS	USFWS	USFS	ADNR	TOTAL
Personnel	\$ 9.1	\$ 14.9	\$ 10.6	\$ 48.6	\$ 83.2
Travel	7.7	10.4	7.2	8.5	33.8
Contractual	84.9	3.0	5.3	14.5	107.7
Commodities	1.1	1.2	1.0	3.9	7.2
Equipment	1.2	1.8	1.2	2.9	7.1
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 104.0	\$ 31.3	\$ 25.3	\$ 78.4	\$ 239.0
General Administration	<u>7.3</u>	<u>2.6</u>	<u>2.0</u>	<u>8.2</u>	<u>20.1</u>
Project Total	\$ 111.3	\$ 33.9	\$ 27.3	\$ 86.6	\$ 259.1

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93007

Project Title: Archaeological Site Stewardship Program

Project Category: Management Action

Project Type: Archaeology

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: U.S. Forest Service, Department of the Interior; National Park Service;
Department of the Interior, Fish and Wildlife Service

Project Term: January 1, 1993 to January 15, 1994

INTRODUCTION

A. Background and Summary of Injury

The late prehistoric residents of the Prince William Sound, Kenai Peninsula, Kodiak Island and Alaska Peninsula areas oriented their subsistence activities to marine resources, and large numbers of archaeological sites occur along the coast in the area affected by the *Exxon Valdez* oil spill. Due to tectonic activity in this region, some archaeological sites which were once on dry land now occur in the intertidal zone, and 24 or more sites were directly oiled or disturbed by cleanup activities following the spill. In addition to these direct effects on archaeological resources, the spill brought hundreds of people into the spill area for response and damage assessment thereby increasing public knowledge of the locations of archaeological sites. Looting and vandalism of sites in the spill area has increased. Vandalism of archaeological sites is often caused by individuals that are interested in artifacts but are unaware of the damage caused by removing artifacts or disturbing the site. Vandalism results in the irretrievable loss of information from damaged sites. Vandalized sites cannot be returned to their original condition, and the most effective counters to vandalism are public education and increased oversight of the sites.

Site stewardship is the recruitment, training, coordination and maintenance of a corps of local interested citizens to watch over nearby archaeological sites. Site stewardship programs in Arizona, Arkansas and Texas have successfully reduced the incidence of vandalism of archaeological sites. A stewardship program for the area affected by the *Exxon Valdez* oil spill was initiated in 1992, and this proposed project would continue that program.

B. Location

In 1993, stewardship programs will be instituted using residents of Kodiak, Homer and Chenega. In subsequent years, the program will expand to include other communities in the spill area.

WHAT

A. Goal

The goal of the Program is to reduce or eliminate vandalism at archaeological sites in the area affected by the *Exxon Valdez* oil spill.

B. Objectives

1. Recruit and train local residents to protect the archaeological resources in their areas.
2. Obtain agreements with private landowners and agencies with land management responsibilities to participate in the stewardship program.

WHY

A. Benefit to Injured Resources/Services

This proposed project will benefit archaeological sites by preventing their destruction through vandalism. Archaeological sites in the area affected by the *Exxon Valdez* oil spill that were not directly oiled are nevertheless subject to continuing injury related to the spill due to increased public knowledge of the sites. This project will benefit an injured resource by preventing further injury.

B. Relationship to Restoration Goals

This proposed project meets the Trustee Council goal of restoring the environment to its pre-spill condition through management action.

HOW

A. Methodology

The stewardship program is based on functioning programs in Arizona and Texas. The program will be managed by the Alaska Department of Natural Resources, Office of History and Archaeology (SOHA) with assistance from the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the National Park Service during the early phase of program development. The SOHA will have ultimate management responsibility for the stewardship program. The SOHA will employ a State Coordinator to coordinate and administer the network of site stewards and steward coordinators. The U.S. Fish and Wildlife Service, U.S. Forest Service and National Park Service will assist in the implementation of the program. These federal agencies will also cooperate with the SOHA in continued operation of the program.

Agencies with land management responsibilities in the spill area, including the U.S. Forest Service, National Park Service and U.S. Fish and Wildlife Service, and private landowners interested in participating in the stewardship program will enter into agreements with the SOHA. The program will employ volunteers to watch assigned sites and report any changes or

Project Descriptions

disturbances to the sites. A local coordinator, also a volunteer, will guide day to day efforts and recruit and train new stewards. Local coordinators will also make recommendations on future actions to land owners and the State Coordinator. The State Coordinator will provide overall direction for the program. Land owners and managers will identify sites for monitoring, help select and train stewards, and provide technical advice and assistance.

B. Coordination with Other Efforts

The stewardship program will continue the current stewardship project effort begun in 1992. This program will complement the archaeological site monitoring proposal submitted by the National Park Service. The stewards, with their intensive level of site observations, will be a valuable supplement to patrols by monitoring teams. The monitoring teams will, in turn, provide the professional and legal expertise to act on damage reports from stewards. The stewardship program will also complement the Public Education proposal submitted by the U.S. Forest Service. Stewards could assist in public education outreach programs by giving lectures and talking in classrooms in their local areas.

ENVIRONMENTAL COMPLIANCE

This proposed project is a non-intrusive study that appears to qualify for a categorical exclusion from the requirements of the National Environmental Policy Act.

WHEN

January - February 1993	Prepare/print 1993 training materials/handbooks
Winter 1993	Develop agreements with landowners and agencies
March 1993	Train stewards
Spring/Summer 1993	Stewards in place
Fall 1993	Compile reports from stewards
January 1994	Submit Status Report

In subsequent years, additional areas within the spill area will be included in the program. Training materials will be modified as needed.

BUDGET (\$K)

	ADN	USFWS	USNPS	USFS	TOTAL
Personnel	\$ 52.0	\$ 21.4	\$ 4.4	\$ 16.3	\$ 94.1
Travel	8.5	6.0	4.0	6.0	24.5
Contractual	33.5	5.0	2.5	5.0	46.0
Commodities	2.0	2.6	1.5	2.5	8.6
Equipment	4.0	2.2	0.0	0.0	6.2
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 100.0	\$ 37.2	\$ 12.4	\$ 29.8	\$ 179.4
General Administration	<u>8.5</u>	<u>3.2</u>	<u>0.7</u>	<u>2.4</u>	<u>14.8</u>
Project Total	\$ 108.5	\$ 40.4	\$ 13.1	\$ 32.2	\$ 194.2

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93008

Project Title: Archaeological Site Patrol and Monitoring

Project Category: Restoration Management Actions

Project Type: Archaeology/Cultural Resources

Lead Agency: National Park Service

Cooperating Agencies: Department of the Interior, U.S. Fish and Wildlife Service; Department of Agriculture, U.S. Forest Service; Alaska Department of Natural Resources

Project Term: May 5, 1993 to March 1, 1997

INTRODUCTION:

The *Exxon Valdez* oil spill and associated cleanups have resulted in an increased public knowledge of archaeological resources in the oil spill area. The greater visibility of site locations brought on by oil spill activities has resulted in higher incidence rates of looting and vandalism to these resources (An Evaluation of Archaeological Injury Documentation, Exxon Valdez Oil Spill, NPS, DNR).

The purpose of this project is to ameliorate the impact of these higher rates of archaeological looting and vandalism. This will be accomplished by utilizing agency archaeologists and resource protection personnel who will conduct public contact patrols and archaeological site monitoring along the coastlines in the *Exxon Valdez* oil spill area. The agency teams will work in their respective areas making contact with the public and informing them of the values of protecting archaeological sites and the federal and state statutes that require this protection. The teams will also monitor selected segments of the coastline for signs of looting or vandalism that may require additional management or law enforcement action.

WHAT

The goal of this project is to reduce or eliminate archaeological site looting and vandalism through the following measures:

1. Create greater public awareness of the value of archaeological resources and the laws protecting them.
2. Create an agency presence and demonstrate agency interest in archaeological resources to discourage and prevent future vandalism in the oil spill area.
3. Identify areas most vulnerable to looting and vandalism that will require further law enforcement action.

4. Track the geographical and temporal variation in the incidence of looting and vandalism in order to take the appropriate protective measures.
5. Increase the efficiency and effectiveness of archaeological resource protection among the involved agencies.

WHY

Before the oil spill, archaeological resources were, practically speaking, protected by their unknown locations. Unfortunately, it is impossible to reverse the expanded knowledge of these resources gained by the public as a direct result of the spill and cleanup activities. Therefore, it is necessary to offset this knowledge of the resource with a positive presence by the agencies and additional effort to spread the message that these resources are protected by state and federal laws.

HOW

The agency teams will consist minimally of an archaeologist and a resource protection specialist. The interdisciplinary team approach is essential to the success of this project. The teams will make active contact with the public that utilizes the target coastal zones and inform them of the values of protecting archaeological sites and the federal and state laws that require this protection. They will also monitor selected segments of the coastline for signs of looting or vandalism that may require further management or law enforcement action and refer the information to the appropriate agency for action. Site patrol and monitoring will give priority to known problem areas where looting has already occurred or where sites are known to be at risk as identified in the archaeological resource damage assessment study, recently completed.

Standard resource protection and archaeological data collection practices will be employed. Successful programs for cooperative multi-agency patrol and monitoring projects have been developed in the American Southwest, and the National Park Service (NPS) has an incipient program in place in Alaska. Detailed field notes, photographs or video tapes, and all patrol reports, including a log of all public contacts, will be kept by the field teams.

The bulk of the project funding for this component will be distributed among the participating agencies for field personnel salaries, for supplies, and for flight time, fuel, etc., to supplement existing site patrol and monitoring efforts, or establish them where necessary. Augmenting existing agency efforts is the most cost-effective approach. The three federal agencies and the state already have existing patrol capabilities in the oil spill zone. The purpose here is to expand those capabilities to cover the affected archaeological sites. In addition, the NPS has used ARPA law enforcement funds from Washington for the last two years to expand the patrolling capabilities of several seasonal rangers in Katmai National Park to cover archaeological resources.

The technical lead for this component will be the National Park Service which has expertise in this area, including a well-developed archaeological resource protection and training program. An archaeologist with a law enforcement commission will act as project coordinator and the regional law enforcement specialist will act as a technical advisor to the program. Both will serve as trainers for field personnel.

Project Descriptions

The overall management of the project will be done by the project coordinator in consultation with the project technical advisor and the agencies. The project coordinator will ensure that there is uniformity among the agencies in carrying out the project, will act as the liaison among agencies, and will recommend the most efficient use of project resources.

The project coordinator will act as the project information officer and maintain all project records, including a copy of all field notes, patrol reports, photographs, and other records or data collected by field personnel. The project coordinator will also consolidate and analyze this information to produce an annual report for the project, and make recommendations for future efforts. Data will be maintained in the files of the project coordinator and will be made available to all participating agencies.

Uniform training for field personnel is essential to the success of this project, and will be conducted by the project coordinator and the technical advisor with input from the agencies. A nationally recognized expert on archaeological resource protection will be brought from Duluth, Minnesota for the training session. All field personnel must attend the project training, to be held at the beginning of each field season, before they will be allowed to participate in the project. Training will consist of orientation to the project, archaeological resource protection training, resource familiarization, and public education and contact techniques.

To ensure uniformity and comparability of observations and data collection, the project coordinator and the technical advisor will periodically review individual agency operations, including field evaluations. Issues of safety and logistics will be handled by individual agencies.

A plan of operations must be filed by each participating agency for each year. An annual report will be required from each agency, including a status report on the targeted sites. The project coordinator will prepare an annual report for the entire project which compiles and analyzes the data collected by each agency for that year, and make recommendations for the following year's effort.

This project will be coordinated with the archaeological site stewardship program currently administered by the US Fish and Wildlife Service, and with any other archaeological restoration projects approved by the Trustees.

ENVIRONMENTAL COMPLIANCE

The proposed project is a categorical exclusion from the National Environmental Policy Act.

WHEN

The duration of the full project will be three to five years, depending on the level of documented site damage.

May 1, 1993	Agency Operating Plans for 1992 Field Season Due
June 1 to June 5, 1993	Field Personnel Training in Anchorage
June 8 to August 27, 1993	Field Work
November 16, 1993	Agency Annual Reports and Copies of Field Data Due
March 1, 1994	Project Annual Report Due and Distributed to Agencies and Trustees.

Similar schedules would be implemented for following years.

BUDGET (\$K)

	USNPS	USFWS	ADNR	USFS	TOTAL
Personnel	\$ 41.0	\$ 14.8	\$ 48.3	\$ 14.8	\$ 118.9
Travel	10.7	2.3	2.3	2.3	17.6
Contractual	29.9	29.2	29.2	29.2	117.5
Commodities	0.0	5.5	5.5	5.5	22.0
Equipment	0.0	0.0	0.0	0.0	0.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 87.1	\$ 51.8	\$ 85.3	\$ 51.8	\$ 276.0
General Administration	<u>6.1</u>	<u>2.2</u>	<u>9.3</u>	<u>2.2</u>	<u>19.8</u>
Project Total	\$ 93.2	\$ 54.0	\$ 94.6	\$ 54.0	\$ 297.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93009

Project Title: Public Information, Education and Interpretation

Project Category: Restoration Management Actions

Project Type: Education

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: Department of the Interior, National Park Service; Alaska Department of Fish and Game

Project Term: January 1, 1993 to September 30, 1997

INTRODUCTION

A. Background on the Resource/Service

This project will provide interpretive materials and experiences for communities, visitors, commercial and recreation users in the oil spill area about the *Exxon Valdez* oil spill and resultant research and restoration projects.

B. Summary of Injury

Numerous people in the PWS communities suffered adverse impacts from the spill. In a broader sense, many Americans felt injured by the effects of the spill on what they believed was one of the more pristine and beautiful areas of Alaska.

C. Location

The public information outreach will benefit all of Southcentral Alaska with an emphasis on the communities of Valdez, Whittier, Cordova, Seward, Homer, Kodiak, and the Municipality of Anchorage.

WHAT

A. Goal

1. To inform and educate the public on the effects and impacts of the *Exxon Valdez* oil spill, current research and restoration project activities.
2. To provide to the public an accurate/balanced view of existing conditions in PWS.
3. To interpret PWS and the Gulf of Alaska environment to the public to enhance their enjoyment and understanding of this area.
4. To enhance eco-tourism recreation opportunities and experiences through interpretation of the natural resources and environment.

B. Objectives

1. Development of a family of brochures on the oil spill impacted areas - the focus of the brochures will be on how the different subject areas were or were not affected by oil spill, and on educating recreationists and other users of the oil spill areas about minimum impact use to avoid further damage to injured resources. Subjects to be covered would include but not be limited to marine mammals, waterbirds, anadromous fish, plants, upland wildlife, intertidal life, cultural resources, history of PWS, upland birds, and recreational opportunities.
2. The development and production of a family of videos on the oil spill impacted areas. These will be short (5-10 minute) videos that can be used in visitor centers, in kiosks, taken to schools, public meetings or can be sent off as stand alone entities or as a combined package to whomever has a need for this type of information.

WHY

This project will provide to the public balanced and accurate information on the oil spill, injured and non-injured resources, and on restoration efforts. This project would tie into the restoration team's need to provide the public with information.

Project Descriptions

HOW

A public-affairs specialist (PAS) will be hired by the Forest Service in FY 1993 as overall coordinator for the approved projects. The PAS will report to the public affairs officer on the Chugach National Forest and be responsible for monitoring the progress of all projects and for their ultimate completion. Projects may be accomplished by agency (both state and federal) specialists or by contract. The project coordinator will also be responsible and accountable for all project budgets. Support services such as clerical help, purchasing, contracting and the execution of interagency agreements (if needed) will be provided by the Chugach National Forest Supervisor's Office. Close coordination with other agencies will be critical. The project coordinator will need to work closely with other appropriate cooperating state and federal agencies to ensure their active involvement. All of the projects will be accomplished through the efforts of a multi-agency team.

ENVIRONMENTAL COMPLIANCE

These projects are categorically excluded (FSH 1909.15, paragraph 26.1a, item #4).

WHEN

	Start	Complete
A. Brochures (10)	10/92	09/93
Writing Script	01/93	04/93
Design and Layout	04/93	07/92
Printing	07/93	09/93
B. Video (1)	01/93	09/94
Footage Gathering	01/93	07/93
Edit & Duplicating	07/93	09/93

BUDGET (\$K)

	USFS
Personnel	\$ 69.0
Travel	10.0
Contractual	205.0
Commodities	2.0
Equipment	6.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 292.0
General	<u>24.7</u>
Administration	
Project Total	\$ 316.7

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93010

Project Title: Reduce Disturbance Near Murre Colonies Showing Indications of Injury from the *Exxon Valdez* Oil Spill

Project Category: Management Action

Project Type: Birds

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

A. Background on the Resource/Service

Common and thick-billed murres were the species of higher vertebrates most frequently injured by the oil from the *Exxon Valdez* oil spill. These diving seabirds have continued to demonstrate abnormal breeding behavior and low reproductive output at several sites since the spill. Murres normally nest in dense aggregations, presumably an adaption which reduces the rate of predation of eggs and chicks. Social behavior within aggregations apparently is important in stimulating the onset of laying and there is a tendency for laying within aggregations to be relatively synchronous. Murres often respond to abrupt, loud noises by panic flights from nesting cliffs. They are especially prone to panic flights when they are not incubating an egg or brooding a chick. If a small percentage of the murres in an aggregation have laid and a panic flight occurs, eggs tend to be abandoned temporarily. In contrast, after a substantial proportion of birds have laid, incubating birds are more likely to remain with eggs even when non-breeders and pre-breeders fly. In most locations, eggs left unattended are taken by avian predators (e.g., gulls, ravens). If food is adequate and eggs are lost early in incubation, murres will relay about 14 days after eggs are lost. Nevertheless, a lower proportion of chicks fledge from second eggs than from first. The result of panic flights, especially when such flights occur during early incubation, is reduced productivity.

B. Summary of Injury

Over 100,000 murres were killed by the oil, and counts of birds at colonies within the trajectory of the oil indicated reduced populations after the spill. In the 3 years following the spill, remaining murres at colonies affected by the oil have initiated laying relatively late, if they laid at all, and reproductive output has remained lower than normal. Avian predators have been responsible for much of the egg loss. Murres in colonies where a high percentage of the individuals are failing to reproduce tend to be flighty at the slightest disturbance. As indicated above, panic flights, especially early in incubation, tend to reduce productivity for the colony. With reduced populations, it is important for remaining murres to produce recruits at a high

enough rate to cause recovery. Poor reproductive success following the spill has continued, and few young were produced during the breeding seasons of 1989-1991 to recruit to breeding populations in the future. If this continues, recovery to former population levels is unlikely.

C. Location

The project will attempt to reduce disturbance at the main murre colonies where evidence of injury has been recorded. These colonies are Ugaiushak Island and Puale Bay, located on the south side of the Alaska Peninsula near the downstream end of the spill trajectory; the Barren Islands, located near Homer between the Kenai Peninsula and Kodiak Island area; the Triplet Islands, located between Kodiak and Afognak Island; and the Chiswell Islands, located near Seward. This project will include education displays and efforts in Kodiak, Homer, Seward, and Chignik.

WHAT

A. Goal

The purpose of this project is to facilitate the recovery of murre colonies affected by the *Exxon Valdez* oil spill by reducing disturbance during the breeding season.

B. Objectives

1. Educate people who use areas near the murre colonies affected by the *Exxon Valdez* oil spill about the need to avoid disturbance to birds.
2. To enhance productivity of murres by reducing disturbance.

WHY

A. Benefit to Injured Resources/Services

Murre colonies within the trajectory of the spill were injured initially by loss of breeding birds. The lingering effect has been abnormal breeding behavior resulting in reduced reproductive success. This may be the result of a breeding population composed almost entirely of young inexperienced birds which may not have been present in 1989 when the oil-related mortality occurred. Reducing disturbance near breeding colonies during the breeding season should enhance productivity by diminishing the panic flights which leave eggs and chicks exposed to predators. Reducing disturbance bouts also may accelerate the return to an earlier nesting phenology by reducing the proportion of pairs that are forced to relay lost eggs. The timing of chick hatching is presumably timed to coincide with maximum food resources needed to successfully rear chicks. A return to more normal timing would therefore favor higher reproductive output and foster restoration of populations to former levels.

Project Descriptions

B. Relationship to Restoration Goals

There are few reasonable proactive approaches that will aid restoration of murre, but minimizing disturbance likely will result in increased hatching success of murre eggs. Further, if eggs laid early are not lost, the phenology of breeding events should return to a more normal schedule, one adaptive for maximum survival of young.

HOW

A. Methodology

The public education campaign would include development of a brochure, articles in community and industry newspapers and magazines (e.g., commercial fisherman), presentations to communities and industry groups, and automated slide shows at visitor contact centers at Homer, Kodiak, and Seward. Recommendations would be provided on how users may conduct activities in a less disturbing manner (e.g., ask halibut charter operators to gaff fish rather than shooting them to eliminate the loud noise). The targeted audience would include tour boat and fishing charter operators from Seward and Homer, and commercial fishermen from villages in the vicinity of colonies (e.g., Kodiak, Seldovia, Chignik, Seward). In addition, workshops for charter operators would be held, the Federal Aviation Agency would be contacted to try to get advisories out to pilots in these areas, and regular radio and television spots would be developed for use in selected communities. Although existing facilities, communication networks, and ongoing programs would aid accomplishment of the objective, one person would be hired specifically to perform the duties associated with this project.

B. Coordination with Other Efforts

This effort will compliment existing interpretive programs, and provide an opportunity to build understanding and appreciation for marine resources. An effort would be made to solicit aid from the National Park Service and Alaska Department of Fish and Game to disseminate information. Another restoration project, monitoring would provide a basis for judging the effectiveness of this project to minimize disturbance. Coordination with existing law enforcement programs will be a part of this project, but no new regulations are proposed initially. Not only murre but other colonial seabirds would benefit from reduced disturbance.

ENVIRONMENTAL COMPLIANCE

This is a non-intrusive project which appears to qualify for categorical exemption under NEPA.

WHEN

October 1992	Advertise for and hire a lead person
November to December 1992	Plan specific strategies for project and coordinate with cooperators
January to March 1993	Produce brochure, develop presentations, and schedule presentations
April to August 1993	Distribute information, make presentations
September 1993	Analyze program effectiveness, recommend modifications

BUDGET (\$K)

	USFWS
Personnel	\$ 35.0
Travel	9.0
Contractual	4.0
Commodities	2.0
Equipment	2.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 52.0
General Administration	<u>4.8</u>
Project Total	\$ 56.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93011

Project Title: Develop Harvest Guidelines to Aid Restoration of River Otters and Harlequin Ducks

Project Category: Management Actions

Project Type: Birds/Mammals

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

A. Background on Resource/Service

River otters (*Lutra canadensis*) and harlequin ducks (*Histrionicus histrionicus*) occur throughout the area impacted by the *Exxon Valdez* oil spill. Damage assessment studies of both species has documented injury and raised the possibility of long-term detrimental effects. Legal harvest of these species is continuing. This is a controllable source of mortality that should be applied as a restoration tool. However, that application cannot occur until harvest guidelines are developed and implemented that fully utilize injury assessment information. This project will develop those guidelines.

B. Summary of Injury

Otters forage in intertidal and subtidal zones that were heavily contaminated with oil. Analysis of bile and blood samples indicated hydrocarbons were accumulated and that toxic effects of oil are continuing. Oiled mussels eaten by otter are likely one source of continuing contamination. Home ranges of radio-collared animals were larger in oiled than non-oiled areas suggesting that oil contamination made it more difficult for them to find food. Body lengths, body weights and diet diversity were all lower in oiled areas, further substantiating indications of food problems. A population decline in the oiled area in 1991 was indicated by a high rate of latrine site abandonment (nearly 15%) as compared to non-oiled sites (less than 4%).

C. Location

More than 2,000 sea duck carcasses were recovered after the spill, including more than 200 harlequins. Harlequins use the intertidal and shallow subtidal zones most heavily affected by the spill. They feed on invertebrates, such as mussels, which showed continuing evidence of hydrocarbon contamination. Tissues from about 40% of harlequins sampled in the oiled area during 1989 and 1990 were contaminated with hydrocarbons, and about 33% of birds collected in the spill area were in poor body condition. In 1991, surveys indicated a harlequin population decline and near-total reproductive failure in oiled areas of PWS. Preliminary results of 1992 surveys suggested continuing reproductive failure.

WHAT

A. Goal

This project will recommend harvest guidelines to facilitate restoration of river otters and harlequin ducks in PWS.

B. Objectives for river otters are to:

1. Estimate number, composition and location of historical and current harvest.
2. Recommend seasons and bag limits that will facilitate restoration.

C. Objectives for harlequin ducks are to:

1. Recommend seasons and bag limits that will facilitate restoration.

WHY

Manipulation of seasons and bag limits to aid recovery of river otter and harlequin duck populations is likely the only restoration action possible over the next several years. Mortality from trapping and hunting could be reduced and recovery thereby accelerated. However, it must be clear that the benefit to injured species outweighs the loss of resource use opportunity for the public.

Other restoration actions, such as transplants or protection and enhancement of habitat will not be effective in the short-term because both species likely suffer continued exposure to petroleum hydrocarbons through ingestion of contaminated food. Moreover, it is possible that natural degradation of hydrocarbons in the environment over a long period of time is the only way to eliminate this food contamination.

Work proposed by this project will supplement normal management activities of ADF&G Division of Wildlife Conservation. It will allow formulation of harvest guidelines that consider restoration goals. Normal management activities for river otters and harlequins include at least four weeks of staff time devoted to collecting and analyzing harvest data, considering regulation changes, and implementing any season and bag limit changes that are approved. Those activities are supported by data entry services, travel funds, and facilities.

Project Descriptions

HOW

A. Methodology

1. River Otters.

The reliability of monitoring the use of latrine sites as an index to population trend will be evaluated. Literature will be searched and experts will be contacted to obtain opinions. If monitoring appears reasonable, it will be proposed as a continuation project.

Most harvest will be quantified by searching ADF&G furbearer sealing records. Additional harvest by local subsistence users that was not reported will be estimated using results of household surveys conducted by ADF&G Subsistence Division during 1992-93. Funding for those surveys is not requested as part of this proposal. All available information will be summarized by year beginning in 1985.

Harvest guidelines will be formulated by considering the restoration goal, population trend and harvest level. The goal is to restore the oil spill area to its pre-spill condition. Achieving it will require reversing an apparent downward population trend. The role of harvest mortality as a limiting factor will be estimated and guidelines formulated to insure that harvest facilitates recovery.

2. Harlequin Ducks.

Harvest and population data will be considered and harvest guidelines developed. The sport harvest data used will be very general in nature because specific information on harlequins in PWS has not been collected by management agencies. Existing subsistence harvest information is also non-specific. However, improved subsistence data is expected from household surveys that will be conducted by ADF&G Division of Subsistence during 1992-93. Population status information is expected from the harlequin duck restoration monitoring study (#93-033).

ENVIRONMENTAL COMPLIANCE:

No environmental assessment is required for this project.

WHEN

A. River Otter

November 1992	Make recommendation concerning emergency order changing 1992/93 trapping season.
March 1993	Evaluate reliability of latrine site monitoring as an index to population trends.
August - September 1993	Summarize harvest, make recommendation concerning an emergency order changing 1993/94 trapping season.

B. Sea Ducks

January 1993	Make recommendation on season and bag limits to Board of Game.

BUDGET (\$K)

	ADF&G
Personnel	\$ 6.6
Travel	0.5
Contractual	2.0
Commodities	1.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 10.1
General Administration	<u>1.1</u>
Project Total	\$ 11.2

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93012

Project Title: Genetic Stock Identification of Kenai River Sockeye Salmon

Project Category: Restoration Management Actions

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Project Term: January 3, 1992 to September 30, 1995

INTRODUCTION

A. Background on the Resource/Service

Fishing time in the Upper Cook Inlet area was affected in 1989 due to the presence of oil from the *Exxon Valdez* oil spill (EVOS). As a direct result, sockeye salmon (*Oncorhynchus nerka*) spawning in the Kenai River system exceeded optimal escapement goals by three times. This overescapement resulted in overproduction of sockeye salmon fry. The overabundance of sockeye salmon juveniles depleted invertebrate prey populations to the point that widespread juvenile mortality occurred during the winter-spring rearing period. Consequently, sockeye smolt outmigrations in the Kenai River have been severely reduced, and the number of adult sockeye salmon returning from the overescapement in the Kenai River system is expected to be well below minimum escapement levels. Starting in 1993, a large reduction, or closure of Kenai River sockeye salmon harvests may be necessary in an attempt to reach adequate escapements.

Sockeye salmon harvested from the mixed-stock fishery of Cook Inlet include fish from the Kenai, Kasilof, and Susitna Rivers. In order to effectively manage the harvest of EVOS-damaged stocks, Restoration Science Study R59 - Assessment of Genetic Stock Structure of Salmonids - was implemented. This study uses Genetic Stock Identification (GSI) techniques to identify Kenai River stocks in mixed stock Cook Inlet fisheries. Area managers will use this information to modify fishing areas and openings in order to facilitate the harvest of surplus Kasilof and Susitna River stocks while protecting the EVOS-damaged Kenai River stocks.

Restoration of Kenai River sockeye stocks will benefit subsistence, sport, and commercial fishermen in coastal communities throughout Cook Inlet, from Homer north through Anchorage to Tyonek. In 1992 nearly 10,000 families obtained subsistence permits to harvest salmon in UCI, most targeting Kenai River sockeye salmon. The most recent statistics indicate that nearly 100,000 sport anglers fished the Kenai River for salmon in 1990, spending \$38 million in 1986 dollars. Forty percent of those anglers were from out of state. Of the 1,323 permits licensed to commercial fish in UCI, 80% are fished by state residents with the remaining predominantly from Pacific Coast states. Average ex-vessel value (1987-1991) of the UCI commercial salmon harvest was \$ 67.8 million.

WHAT

Contingent upon the funding in 1992, the Alaska Department of Fish and Game (ADF&G) will continue to develop a comprehensive genetic database of sockeye salmon stocks in Cook Inlet. In 1992 ADF&G began collecting baseline genetic data from 28 subpopulations from the Kenai, Kasilof, and Susitna Rivers. Beginning in 1993, samples from the Cook Inlet commercial harvest will be analyzed to estimate the composition of the fisheries. This information will enable area managers to identify Kenai River fish occurring in the mixed-stock commercial fishery and thus harvest surplus stocks of sockeye salmon while providing protection to EVOS-damaged stocks destined for the Kenai River. The specific objectives are the following:

1. Refine and expand the allozyme database to include all significant spawning stocks contributing to mixed-stock harvests of sockeye salmon in Cook Inlet. Initiate the development of DNA marker detection in sockeye salmon to test for expanded resolving power.
2. Obtain genetic data each week from samplings of the various mixed-stock fisheries occurring in 1993 - 1995.
3. Use Genetic Stock Identification (GSI) algorithms to estimate the proportion of Kenai River stocks in mixed stock fisheries so that managers may modify area and time of harvest in order to protect these damaged stocks while targeting surplus Kasilof River and Susitna River stocks. Estimates will be provided within 48 hours post-fishery.

WHY

Attempts to use stock identification to manage harvests of Cook Inlet sockeye salmon in the past have relied on scale growth patterns. However, the accuracy of the scale technique alone has not been reliable, and it is insufficient to permit the in-season protection of the EVOS-damaged Kenai River stocks. GSI techniques rely on genetic variation to discriminate between populations of organisms. This method has recently been applied as an in-season fisheries management tool, and it has proven to be extremely effective for allocating and adjusting the harvest of fish stocks intercepted in mixed-stock fisheries such as those that occur in Cook Inlet. Once a data base has been established, GSI techniques should provide a mechanism for in-season management on a stock-specific basis. This will allow managers to control the harvest of Kenai River sockeye salmon and facilitate their recovery.

HOW

A comprehensive baseline genetic database will be developed for all sockeye salmon stocks contributing to Cook Inlet fisheries. Additional sockeye salmon will be collected from approximately 20 baseline subpopulations each year (1993-1995). Sites will be chosen to supplement those being collected during the 1992 field season. Mixed stock fishery samples will be collected from every drift net fishery occurring during the July fisheries (1993-1995). Muscle, liver, heart, and eye tissue will be taken from individual fish and examined by protein electrophoresis (allozyme analysis) for discriminating gene markers. Genotypic and allelic frequency estimates will be calculated from allozyme electrophoretic data for each baseline and mixed-stock sample at every gene locus examined and will be used to identify discrete spawning populations. Stock components of mixed fishery samples will be estimated using a conditional

Project Descriptions

maximum likelihood algorithm. Fishery composition estimates will be available within 48 hours following the fishery so that management decisions can be based on the actual composition of the fisheries.

ADF&G will also screen representative individuals for DNA-level markers. Total genomic DNA will be extracted and amplified through PCR (polymerase chain reaction) techniques utilizing various mitochondrial and nuclear primers. Restriction analyses as well as sequencing studies will be performed. Maximum likelihood simulation studies will be performed to test the additional resolution that could be provided by the DNA-level data. DNA data will be collected from the fishery samples as scientifically and logistically feasible.

ENVIRONMENTAL COMPLIANCE

Collecting permits will be obtained as required.

WHEN

June - Sept. 1992	Baseline & Mixture sample collections/coordination with project R53
July - Dec. 1992	Laboratory analyses of baseline and model mixtures
Jan. - April 1993	Laboratory analysis of baseline populations and annual report
July - Sept. 1993	Laboratory analyses of mixtures; numerical analyses of stock structure; modeling for 1993 mixture analyses
Oct. 1993 - Sept. 1994	Baseline analyses, in-season analyses, annual report
Oct. 1994 - Sept. 1995	Baseline analyses, in-season analyses, final monitoring of Prin

BUDGET (\$K)

ADF&G

Personnel	\$ 149.1
Travel	12.0
Contractual	30.0
Commodities	45.0
Equipment	40.0
Capital Outlay	<u>0.0</u>

Sub-total	\$ 276.1

General Administration	<u>24.5</u>

Project Total	\$ 300.6

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93014

Project Title: Quality Assurance for Coded-Wire Tag Application in Fish Restoration Projects

Project Category: Technical Support

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 1, 1993 to December 31, 1993

INTRODUCTION

This project will maintain high quality coded-wire tag (CWT) application and CWT data tracking for EVOS restoration projects. The target species are pink, chum, and sockeye salmon. The *Exxon Valdez* oil spill (EVOS) injured wild pink and chum salmon eggs and fry. Various amounts of oil were deposited in intertidal spawning habitats in Prince William Sound (PWS) where up to 75% of the spawning occurs. Salmon eggs deposited in 1989 and all subsequent years have been contaminated and direct egg mortality has been documented. The growth and survival of juvenile salmon during the early marine period was reduced by oil contamination in 1989. Recently suspected genetic damages resulting from oil contamination in spawning beds may further reduce the productivity and fitness of wild salmon populations for many years to come. Sockeye salmon rearing lakes on Kodiak Island and elsewhere were damaged when fisheries were closed allowing large numbers of spawners to escape into rearing lakes. The resulting large fry populations overgrazed the resident fry food resources in the lakes causing a reduction in lake carrying capacity. The benefits of this project will be realized in the communities of Kodiak, Anchorage, Whittier, Valdez, and Cordova which support important sport and commercial fishing industries in the region.

WHAT

The goal of this project is to establish and maintain high quality CWT application and data tracking procedures within EVOS restoration projects. The project will achieve the following objectives:

1. Interface CWT application database with CWT recovery databases being developed for restoration projects,
2. Implement appropriate quality control standards, tag application, and data tracking procedures for CWT application within EVOS restoration projects and provide technical assistance to staff involved with CWT application,
3. Review data from CWT application projects at the end of the season to insure that quality control standards, tag application, and data tracking procedures are maintained, and
4. Conduct a pilot project to develop a methodology to quantify CWT placement in pink salmon fry and incorporate into CWT application database.

WHY

Coded-wire tagging is currently used in several fishery "management action" and "resource manipulation and enhancement" projects. Management action projects utilize CWT data to (1) direct fishing effort away from damaged wild salmon, and (2) inventory and evaluate the effects of straying hatchery salmon on wild salmon populations. Manipulation and enhancement projects utilize CWT as a tool to evaluate project success. Failure to assure proper CWT application procedures and data tracking may seriously compromise the quality of CWT programs, confound interpretation of CWT data, and reduce the success of EVOS restoration projects. This project is designed to maintain high quality CWT application and data tracking procedures to insure that this stock separation tool provides the expected results.

Coded-wire tagging is a very effective tool for marking large numbers of juvenile fish if high quality tag application and data tracking procedures are maintained. All CWT programs are based on the assumption that tagged fish are representative of untagged fish. Poor tag application and fish handling procedures will result in a violation of this assumption by (1) reducing the growth and survival of tagged fish, or (2) reducing the fishes' ability to home accurately to its stream of origin. Standard methods must be used during the application process to minimize damage to tagged fish, insure good tag placement, properly estimate number of tagged fish, number of untagged fish, tag mortality, tag retention, and number of good fin clips. This project will benefit all restoration projects that involve coded-wire tagging (e.g., Red Lake Salmon Restoration, Restoration of Coghill Lake Sockeye, Inventory and Effects of Straying of Hatchery Pink Salmon on Wild Pink Salmon Populations in PWS, Montague Island Chum Salmon Restoration) by insuring maintenance of quality control standards and interfacing of CWT application and recovery databases. Technical assistance will be provided to private groups that will use CWT to evaluate restoration program success (e.g., Chenega Chinook and Coho Stocking).

Poor tag placement is the most likely cause of reduced growth, survival, and homing ability in tagged fish. There is documented damage to the olfactory nerve in chum salmon fry tagged with CWT. Good placement is particularly important to maintain when tagging pink salmon fry because of their small size. Each year approximately one million CWTs are applied to pink salmon at five private nonprofit hatcheries in PWS. Recovery of these marked fish in hatchery broodstock and common property and cost recovery harvests is essential for effective management of hatchery and wild salmon populations. Recovery of CWT fish is currently being used to evaluate the effect of straying hatchery salmon on damaged wild salmon populations in PWS. A program to quantify CWT placement in pink salmon is needed to insure that variations in placement between tag codes do not confound interpretation of straying data.

HOW

This project will establish and maintain high quality CWT application and data tracking procedures within all EVOS restoration projects. The project will initially focus on a review of existing CWT quality control and tag application procedures. Sample sizes and procedures currently used to estimate tag mortality, tag retention, and fin clip quality will be evaluated and adjusted if necessary. The existing CWT application database will be interfaced with developing CWT recovery databases. Standard quality control, tag application, and data tracking procedures will be implemented. Documents detailing these procedures will be distributed to government and

Project Descriptions

private groups responsible for CWT application in various EVOS restoration projects. Each CWT application site will be visited periodically to answer questions and insure that CWT quality standards are being followed. Each restoration project involving CWT will prepare a report describing the methods and results from each field season. CWT reports will be reviewed for consistency with quality standards and recommendations will be developed for further improvement of the program.

A pilot study will be conducted to collect data needed to design a program to quantify CWT placement in pink salmon fry. Samples of tagged fry ($n=200$) will be collected from randomly selected tag groups/codes of pink salmon. Fry tissues will be cleared with a sequential treatment of formaldehyde and potassium hydroxide solution. A computer image analysis system will be used to quantify tag placement within the head of each fish relative to a reference line drawn between the eyes. Histological analyses will be conducted to determine the degree of olfactory nerve damage in fish exhibiting poor tag placement. The data obtained from the study will be used to estimate sample sizes and costs associated with quantification of tag placement.

ENVIRONMENTAL COMPLIANCE

This project will not have a direct impact on any environmental parameters.

WHEN

This project will take place during FY93. Project activities will occur throughout much of the year.

Jan. - Feb.	Review and revise CWT quality control standards and interface CWT application database with CWT recovery databases
Feb. - June	Collect samples for tag placement study and assist restoration project staff involved with CWT application
June - July	Review data from CWT application projects
July - Sept.	Process samples from tag placement study and analyze data
Oct. - Nov.	Prepare annual report

BUDGET (\$K)

	ADF&G
Personnel	\$ 68.4
Travel	3.8
Contractual	10.3
Commodities	1.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 83.5
General Administration	<u>11.3</u>
Project Total	\$ 94.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93015

Project Title: Kenai River Sockeye Salmon Restoration

Project Category: Restoration Management Action

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 3, 1992 to September 30, 1996

INTRODUCTION

Sockeye salmon *Oncorhynchus nerka* which spawn in the Kenai River system were injured by the *Exxon Valdez* oil spill. Reduced fishing time in the Upper Cook Inlet area due to the oil spill caused sockeye spawning escapement levels in the Kenai River system to exceed the desired amount by three times. The biological impact of the oil spill on Kenai River sockeye salmon stocks is expected to be serious. Data collected by NRDA Fish/Shellfish Study 27, *Sockeye Salmon Overescapement*, showed greatly reduced survival estimates of juvenile sockeye salmon during the winter-spring rearing period. The large escapement appears to have produced more rearing juvenile sockeye salmon than could be supported by nursery lake productivity. In general, when rearing salmon abundance greatly exceeds lake carrying capacity, the species and size composition of prey resources are altered, which, in turn, affects all trophic levels. Because of such changes, juvenile sockeye growth is reduced and freshwater mortality is increased. Greater numbers of fry remain in the lake for another year of rearing. Competition for a limited food supply reduces condition of surviving fry. Marine mortality is increased because of poor condition of outmigrating smolts.

Limiting sockeye salmon fry production by closely regulating the number of spawning adults is the best way to restore the productivity of these rearing areas. However, the number of adult sockeye salmon returning from the 1989 overescapement may be so low that a reduction or closure of Kenai River sockeye may be necessary starting in 1993 in an attempt to reach adequate spawning escapements.

This project consists of increased monitoring and management of the sockeye salmon stocks in the Kenai River and Upper Cook Inlet (UCI) north of Anchor Point. The project will benefit subsistence, sport, and commercial fishermen in coastal communities throughout Cook Inlet, from Homer north through Anchorage to Tyonek. In 1992 nearly 10,000 families obtained subsistence permits to harvest salmon in UCI, most targeting Kenai River sockeye salmon. The most recent statistics indicate that nearly 100,000 sport anglers fished the Kenai River for salmon in 1990, spending \$38 million in 1986 dollars. Forty percent of those anglers were from out of state. Of the 1,323 permits licensed to commercial fish in UCI, 80% are fished by state residents with the remaining predominantly from Pacific Coast states. Average ex-vessel value (1987-1991) of the UCI commercial salmon harvest was \$ 67.8 million.

WHAT

A. Goal

The goal of this project is to restore Kenai River sockeye salmon stocks injured by the oil spill. This will be accomplished through improved stock assessment capabilities, more accurate regulation of spawning levels, and modification of human use. Restoration of Kenai River sockeye salmon stocks will be achieved when average fry, smolt, and adult production can be maintained at pre-spill levels. Prey resources of rearing lakes must also be restored to normal levels (This will be monitored under another restoration study, which will be based on information obtained from NRDA Fish/Shellfish Study 27).

B. Objectives

Specific objectives of this proposal are as follows:

1. Improve stock identification capabilities by combining parasite and genetic stock identification information with available scale growth data to provide statistically reliable estimates of Kenai River stocks in the mixed stock fishery of Upper Cook Inlet (UCI)
2. Increase the accuracy and precision of escapement monitoring by supplementing hydroacoustic equipment used in the Kenai River, and
3. Provide more accurate estimates of abundance of Kenai River sockeye salmon within UCI through hydroacoustic assessment techniques.

WHY

More intensive management is necessary to restore affected stocks to pre-spill levels and maintain them at those levels until the populations stabilize. This project will help restore those stocks by providing the information needed to properly manage human uses. Intensive fisheries management will temporarily reduce human pressure on these injured stocks to speed their recovery. As a means of minimizing impacts on the fisheries, existing fisheries may need to be restricted or redirected to alternative sites. For Cook Inlet this will relieve pressure on what are anticipated to be small runs to the Kenai River in the next several years without shutting down other UCI fisheries.

HOW

A. Stock Identification

Stock identification studies used to regulate human use of UCI sockeye salmon have, in past years, relied on scale growth patterns. The accuracy and precision of this technique has varied considerably from year to year. Kenai stocks typically dominate the total return and their scale patterns are generally distinct enough to provide some separation from other stocks. However,

Project Descriptions

when runs to other systems are more abundant (as may occur in 1993-1995) separation of Kenai stocks will be much more difficult. Improvements in stock identification procedures will be necessary to identify the contribution of Kenai River sockeye salmon to the total run accurately in this situation. Recent work by ADF&G, in cooperation with National Marine Fisheries Service staff, has shown that parasite occurrence can be used to improve estimates of stock contribution during the fishing season. The combination of scale patterns, parasites and genetic stock identification techniques (Restoration Science Study Number 59) will greatly increase the accuracy of UCI stock assessment estimates.

Sockeye salmon escapements into major drainages of Upper Cook Inlet were sampled for genetic, parasite, scale and otolith characteristics in 1992. During 1993, 20 additional baseline populations will be sampled and mixed-stock samples will be collected from the commercial drift gillnet fishery. Stock composition of mixed stock fishery samples will be estimated using scale pattern analysis, parasite data, genetic data, or a combination of all three. Stock resolution will be enhanced by using several kinds of biological marker data simultaneously. Typically a maximum-likelihood estimation procedure for a mixture problem with learning samples has been used to combine these data. The principal components of this project are sample collection, transportation to genetic laboratory facilities (for preparation by Restoration Study Number 59) and real time stock composition modeling necessary for inseason resource management decisions.

B. Escapement Monitoring

Bendix Corporation side-scan hydroacoustic equipment has been used since 1976 to count adult sockeye salmon entering the Kenai River to spawn. Lack of Bendix replacement parts and the inability to purchase new Bendix counters will compromise our future ability to provide escapement estimates. Accuracy of estimates would be greatly enhanced through use of newer, more technically advanced equipment. Evaluation of new equipment in 1992 will result in selection of the most appropriate replacement system. Funding for purchase of replacement equipment was authorized in 1992. ADF&G will conduct continuous operations with both the old Bendix equipment and the new equipment on both banks of the Kenai River during a three week period in 1993 to encompass the peak of the sockeye salmon run. This will provide a measure of quality assurance that will allow comparison of data previously collected using only the Bendix device to that collected using new equipment. Use of the Bendix is expected to be unnecessary in subsequent years.

C. Offshore Assessment Program

Sockeye salmon returning to UCI are captured with a drift gill net at a series of stations between Anchor River and Red River delta. Estimates of the total sockeye salmon return are made several times during the season by estimating expected total test fishery catch per unit of effort for the season and catchability of sockeye salmon in the test fishery calibrated by the commercial drift gillnet fishery. Analysis of historical data indicates that existing sampling effort and catch has not been proportional to abundance. Calibration by the commercial fleet is not guaranteed for future reduced run sizes. In 1992 hydroacoustic equipment and techniques were evaluated by a contractor experienced in marine salmon investigations to supplement the existing program. Anticipated results include: (1) operating parameters of the hydroacoustic system used, (2) real

time estimates of fish density, (3) fish distribution across the transects, and (4) definition of run timing models and total return estimates. In 1993 a hydroacoustic survey will be conducted to provide a real-time estimate of adult sockeye salmon in UCI. Placement and duration of transects needed for the 1993 survey will be based on 1992 results to provide an appropriate level of precision and accuracy for an abundance estimate of sockeye salmon. This is to include appropriate species composition estimates of fish targets. Purchase of offshore hydroacoustic equipment will be necessary in order to meet these goals.

ENVIRONMENTAL COMPLIANCE

A Corps of Engineers Section 10 or 404 permit, State of Alaska Title 16 permit, and a finding that this project is consistent with the Alaska Coastal Zone Management Plan may be required.

WHEN

Four additional years will be required to meet project objectives. Adult returns from the injured 1989 brood year will occur during 1993-1995, but information on the 1990, 1991, and 1992 brood years will also be needed to monitor recovery of the system. Adult returns from the 1992 brood year will not be observed until 1996.

Events and Milestones for 1992-1993

Aug. 1992	Begin to evaluate results of escapement monitoring, purchase new equipment and design escapement monitoring for 1993.
Jan. 1993	Begin to evaluate results from the offshore hydroacoustic investigation and design a survey for 1993.
April 1993	Results of baseline genetic sampling due to evaluate accuracy and precision of stock composition modeling and set sample design and sample size goals for 1993.
May 1993	Award contract for the offshore hydroacoustic survey in UCI to begin in July.
June 1993	Begin field work: fishery sampling and escapement monitoring begin in July, and escapement sampling for stock identification baselines through September.
Sept. 1993	Interim Report to include (1) performance of stock composition modeling with scale, genetic, and parasite data, (2) estimates of adult sockeye escapement in the Kenai River, and (3) offshore hydroacoustic estimates of sockeye salmon.

Project Descriptions

BUDGET (\$K)

	ADF&G
Personnel	\$ 271.0
Travel	15.5
Contractual	270.5
Commodities	36.0
Equipment	81.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 674.0
General	<u>58.6</u>
Administration	
Project Total	\$ 732.6

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93016

Project Title: Chenega Chinook and Coho Salmon Release Program.

Project Category: Manipulation and Enhancement

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Project Term: January 1, 1993 to December 31, 2003

INTRODUCTION

A. Background

Due to the oil spill, salmon stocks were impacted. Subsistence as well as sport and commercial fisheries were disrupted. Traditional usage of fish stocks and fishing grounds by the Chenega Village residents was lost. This project will help to restore lost subsistence fishing and establish alternate subsistence fishing opportunities.

B. Injury

As a result of the Exxon Valdez Oil Spill, subsistence harvest of salmon and other resources was disrupted.

C. Location

Fish production at W. Noerenberg (WHN) Hatchery at Esther Island in PWS. (This is the preferred site if production can be accomplished without major modifications). Fish will be released and harvested in the vicinity of Chenega Village in southwestern Prince William Sound, at Deadend Bay.

WHAT

A. Goal

To replace subsistence resources by permitted releases of chinook and coho salmon at designated sites near Chenega village from stocks of Prince William Sound Aquaculture Corporation (PWSAC) Wally Noerenberg Hatchery near Esther Island.

B. Objectives

Produce 50,000 chinook salmon smolts at the W. Noerenberg Hatchery for transport and release at site(s) near Chenega Village

Hold and feed the smolts in net pens at the release site for 2 weeks before they are released.

Harvest approximately 1500 adult chinook salmon when they return (Assume 3% survival rate; 4 years before all year classes are represented).

Produce 50,000 coho salmon smolts for transport, holding, feeding and release near Chenega Village.

Harvest approximately 2500 adult coho salmon annually (assume 5% survival rate; annual return beginning 1 year after first release).

WHY

A. Benefit to Injured Resource/Service

These projects will restore and improve subsistence salmon harvests that were lost because of the Exxon Valdez Oil Spill.

B. Relationship to Restoration Goals

Results from this project will help to restore lost subsistence fisheries. (Restoration Options: replace lost subsistence use (Management of Human uses) 18 (Resource Manipulation), 30 (Other) related to hydrocarbon contamination of subsistence foods.

HOW

A. Method

1. Smolts will be utilized from existing production lots and raised to smolt stage at the W.H.N. Hatchery.
2. Smolts will be transported by barge to the designated sites.
3. Smolts will be held and fed in net pens for 2 weeks before release to improve survival and imprinting.
4. Adults will be harvested when they return.
Chinook Salmon: broodstock - from hatchery stock.
Coho Salmon: broodstock - from donor stock near the release site.

All plans will be reviewed by the PWS Regional Planning Team (RPT) and by the Fish Transport Permit (FTP) process and will comply with the ADF&G Fish Genetics Policy.

B. Other Efforts

This project will provide an alternate source of food for subsistence use and reduce the need for reliance on wild stocks that were injured by the oil spill.

Project Descriptions

ENVIRONMENTAL COMPLIANCE

This project will be reviewed by the NEPA Process, the PWS RTP, and the ADF&G FTP review before it is implemented.

WHEN

Jan.	1993	Plans are reviewed by the NEPA process, PWSAC, and the PWSAC RPT.
June	1993	First chinook smolts transported, penned, fed, and released.
Oct.	1993	Coho salmon broodstock screening and selection.
June	1994	First "adult" (jack) returns of chinook salmon.
Oct.	1994	First coho salmon eggs are taken from the designated location.
June	1995	First coho salmon smolts are released.
Aug.	1996	First coho salmon adults return.
June	1996	First complete complement of all chinook salmon age classes return.

Each year, smolts will be released in June (or late May).

BUDGET (\$K)

ADF&G

Personnel	\$ 2.5
Travel	0.0
Contractual	21.5
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 24.0

General 1.9
Administration

Project Total \$ 25.9

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93017

Project Title: Subsistence Restoration Project

Project Category: Restoration Management Actions

Project Type: Subsistence

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Oceanic and Atmospheric Administration

Project Term: January 1, 1993 to September 30, 1995

INTRODUCTION

A. Background on the Resource/Service

Subsistence use of fish and wildlife constitute a vital natural resource service that was injured by the *Exxon Valdez* oil spill. Data collected by the Alaska Department of Fish and Game's Division of Subsistence has demonstrated this injury.

B. Summary of Injury

Annual per capita subsistence harvests declined dramatically (from 12 to 77 percent decline as compared with pre-spill averages) in ten of the communities in the path of the spill during the first year after the event. While some of these communities' harvests demonstrated a limited recovery in the second post-spill year, harvest levels in other affected communities showed no signs of recovery. Concern over the long-term health effects of using resources from the spill area, a loss of confidence on the part of subsistence hunters and fishermen in their own abilities to determine if their traditional foods are safe to eat, and a perceived reduction in available resources, all contribute to the reduced harvest levels.

C. Location

This subsistence restoration project will involve the following communities: Chenega Bay, Tatitlek, Cordova, Valdez, Nanwalek, Port Graham, Seldovia, Kenai, Seward, Larsen Bay, Karluk, Old Harbor, Akhiok, Port Lions, Ouzinkie, Kodiak City, Chignik Lake, Chignik, and Chignik Lagoon.

WHAT

A. Goal

The goal of the project is to restore the subsistence use of fish and wildlife damaged by the *Exxon Valdez* Oil Spill. Community meetings will be held in order to identify and map the specific areas and resources of continued concern to subsistence users. These meetings will provide a

comprehensive, final opportunity to identify these concerns. Data obtained in these meetings will provide prioritization and locations of sites to the Alaska Department of Environmental Conservation's 1993 spring shoreline survey, Restoration Project 93018, in order to focus treatment efforts if necessary. Samples of subsistence foods will be collected from harvest areas identified during the mapping.

C. Objectives

Community representatives will assist in site selection, as well as the collection of samples. The samples will be analyzed for the presence of hydrocarbon contamination. The results of the tests, along with findings from other damage assessment and restoration studies, will be interpreted by the Oil Spill Health Task Force, and reported to the communities in an informational newsletter and community visits. This information will assist the Trustee Council in making decisions concerning restoration, enhancement or replacement of lost subsistence resources and uses. In addition, some mitigation of lost subsistence use will be provided by making funds available to communities to support travel to harvest areas away from oiled sites or to areas where resources have not been depleted. As further mitigation, funds will be made available to support subsistence food sharing programs between communities. * *

WHY

The Oil Spill Health Task Force has had some success in conveying the message that most subsistence foods are safe to eat. However, concerns about long-term effects remain. Also, limited public access to the damage assessment studies has created the impression in most communities that the task force did not base its conclusions on a complete assessment of all data. This project provides the opportunity to put information from the damage assessment into context. This will help to empower the people in the impacted communities to make informed decisions and encourage those who are so inclined to return to using more subsistence resources. It would also restore the communities' abilities to pass on skills and knowledge associated with using subsistence foods.

Making information from subsistence users part of the restoration process will facilitate the recovery of subsistence use areas, the importance of which might otherwise be missed. There is a need in these communities to actively participate in restoration of the environment. This project would provide for this involvement.

The project answers the need to continue to monitor the risks to human health from the oil spill. This is consistent with the goal of restoring human services of the natural resources damaged in the oil spill. It also addresses the need to restore the natural resources and the services these resources previously provided to subsistence users.

Project Descriptions

HOW

By involving subsistence users in decisions affecting mitigation, and the monitoring, enhancement and replacement of the natural resources, we can accelerate the recovery of the resources subsistence users rely upon. This involvement, combined with effective communication of information concerning the safety of the resources should cause subsistence harvests to begin to approach pre-spill levels, and reduce anxiety about their use.

The Division of Subsistence will use the results of a joint study currently being conducted with the U.S. Minerals Management Service in 15 communities impacted by the *Exxon Valdez* oil spill to determine the communities where concern continues to exist, as well as the nature of that concern. Similar activities were suggested by the Bureau of Indian Affairs

** If this portion of the project is not within the scope of the settlement agreement and is eliminated, it would reduce the cost of the project by 53.5 thousand dollars. for inclusion in 93017. These were seen as duplicative with the MMS/ADF&G study and therefore not included in 93017. As a member group of the Oil Spill Health Task Force, the Division of Subsistence will continue to ensure coordination with that group.

The details of the subsistence research being undertaken by the Department of the Interior as part of the Chenega Bay settlement are not available due to the litigation sensitive nature of the work. Nevertheless, the Department of Fish and Game has been assured by Regina Sleater, an attorney of the U.S. Department of the Interior, that there is minimal overlap between the ADF&G study and the DOI study. In addition, the results of the Interior study will be available in December 1992 and 93017 will be able to build upon--rather than overlap with--the Interior project.

ENVIRONMENTAL COMPLIANCE

This project is categorically excluded under NEPA guidelines.

WHEN

January 1 - May 31, 1993	Community meetings to map areas and species of concern
June - July 1993	Coordinate with DEC shoreline assessment to verify oiling information
June 1993	Collect subsistence food samples for testing (two months for analysis)
August 1993	Informational newsletter issued
September 1993	Collect subsistence food samples for testing
November 1993	Informational newsletter issued
December 1993	Collect subsistence food samples for testing
February 1993	Informational newsletter issued
March 1994	Collect subsistence food samples for testing
May 1994	Informational newsletter issued
June - July 1994	Coordinate with DEC shoreline assessment to verify oiling information
June 1994	Develop plan for additional cleanup/mitigation of oil
September 1994	Develop plan for enhancement/replacement of resources
May 1995	Coordinate with DEC shoreline assessment to verify oiling information

Note: there will be ongoing communication with subject communities throughout the duration of the project, with visits to communities as needed.

BUDGET (\$K)

	ADF&G	NOAA	TOTAL
Personnel	\$ 78.5	\$ 65.2	\$ 143.7
Travel	30.0	0.0	30.0
Contractual	135.5	0.0	135.5
Commodities	0.8	17.3	35.4
Equipment	0.0	0.0	18.1
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 244.8	\$ 82.5	\$ 327.3
General Administration	<u>21.3</u>	<u>12.0</u>	<u>33.3</u>
Project Total	\$ 266.1	\$ 94.5	\$ 360.6

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93018

Project Title: Enhanced Management for Wild stocks in Prince William Sound, Special Emphasis on Cutthroat Trout and Dolly Varden.

Project Category: Restoration Management actions

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: U.S. Department of Agriculture, Forest Service

Project Term: January 1, 1993 to September 30, 1994

INTRODUCTION

The status of many of the wild fish stocks and their habitats in the aftermath of the *Exxon Valdez* oil spill, are unknown. Numerous efforts have been conducted or initiated to evaluate effects of the oil spill on specific stocks and information exists scattered throughout various agencies on various aspects of some of these stocks. Higher mortality and slower growth rates for Dolly Varden and cutthroat trout was documented in oiled areas compared to non-oiled areas. Recreational fishing for Dolly Varden and cutthroat trout was curtailed by emergency closures and changes in sport regulations following the oil spill, likely resulting in faster recovery times for the stocks that were closed to sport fishing. In other parts of Prince William Sound (PWS), however, there is insufficient information on which to base population management actions for these two species. In addition, information to prioritize population and habitat management actions for most of the wild fish stocks in PWS is lacking or at least unconsolidated. Without appropriate information on which to base management action, injury may occur to other stocks due to overfishing or overly conservative regulations may be made which would unnecessarily restrict recreational sport fishing opportunities. Likewise, a readily accessible informational database is needed to identify appropriate strategies for protecting, maintaining and enhancing populations and habitat of wild stocks of fish in PWS.

Project personnel will operate weirs in Cordova, Valdez and western PWS at Eshamy Creek to sample outmigrating cutthroat trout and Dolly Varden. Where possible enumerations of other salmon smolts will be made. Concurrently, the Forest Service will construct a database of information on the wild stocks of cutthroat trout, Dolly Varden, coho salmon, pink salmon, and all other freshwater and anadromous fish in PWS. The combination of these two efforts will benefit all users who participate in sport fisheries in PWS by providing the means to assist resource managers in making prudent decisions regarding the viability and long term sustainable yield of all fish species in PWS.

WHAT

A. Goal

The goal of this project is to collect the information needed for the responsible management of populations and habitats of all fish species in PWS with a special emphasis on Dolly Varden and cutthroat trout. Resultant management actions will be prioritized toward recovery of depressed stocks of all species while assuring that anglers can fish for Dolly Varden and cutthroat trout where stocks are healthy enough to withstand fishing pressure.

B. Objectives

The Alaska Department of Fish and Game (ADF&G) objectives are as follows:

1. Determine the abundance of anadromous Dolly Varden and cutthroat trout over 200 mm in length outmigrating from Eyak Lake, McKinley Lake, Robe Lake and Eshamy Lake for both 1993 and 1994.
2. Obtain length compositions of the 1993 and 1994 outmigrations of Dolly Varden and cutthroat trout over 200 mm in length from Eyak Lake, McKinley Lake, Robe Lake and Eshamy Lake such that the composition is within $\pm 5\%$ of the true value 95% of the time.
3. Estimate mean length and age for anadromous cutthroat trout that overwintered in Eyak Lake, McKinley Lake, and Eshamy Lake such that the estimate is within $\pm 10\text{mm}$ of their true value 90% of the time.

The U.S. Forest Service (USFS) objectives are as follows:

4. Compile existing information on all freshwater and sea-run fish stocks in PWS in a readily available computerized format that will be made available to all interested resource management agencies.

WHY

The goal of this project is to collect the information needed to develop management strategies which will provide for the responsible management of wild fish stocks and their habitats in PWS, with special emphasis on Dolly Varden and cutthroat trout. Restoration project R 106, which was funded in 1991, provided preliminary information about the distribution of Dolly Varden and cutthroat in PWS and the adjoining CRD. Numerous other studies on other fish species have been conducted since the oil spill and much information prior to the oil spill on fish stocks in PWS exists scattered among various agencies and researchers. Information on where populations exist, their significance (e.g., biological, commercial, recreational cultural), habitat limiting factors, susceptibility to disturbance and potential impacts to populations and habitats are needed to adequately prioritize management actions. The availability of all this information in a readily accessible computerized format will increase the effectiveness of the Forest Service and other resource managers in the maintenance of population diversity in PWS.

Project Descriptions

Cutthroat trout and Dolly Varden population information is currently lacking for many sites in PWS. Two of the overwintering populations which will be studied in 1993 and 1994 are those of Eyak and McKinley Lakes. Both of these lake systems currently support popular sport fisheries; however, abundance and length composition for these populations is not known. Therefore we don't know how much fishing pressure either population can sustain. Furthermore, logging activities are planned for the Eyak Lake drainage. Population data from this site prior to logging will be useful in assessing the impacts of logging on these populations. Robe Lake was selected for evaluation because of the habitat restoration opportunities that exist at this site. This drainage once supported active sport fisheries for salmon and Dolly Varden. However, the lake has physically deteriorated in the last 20 years, and we don't know what the lake currently supports for terms of fish. Because this site has the possibility of replacing lost fishing opportunity we feel that population research at this site is warranted. Eshamy Lake was a NRDA treatment site for Dolly Varden and cutthroat trout. We believe that monitoring at this site be continued in order to gauge the recovery of populations that were exposed to oil. Abundance and length parameters for the populations of the four sites will be studied for two consecutive years to obtain accurate estimates. These estimates, along with the information gained from NRDA F/S 5 and R 106 will be used to form a regulatory package for Dolly Varden and cutthroat trout fisheries in PWS that will be presented to the Alaska Board of Fisheries in 1996.

HOW

To estimate abundance of sea-run cutthroat trout and Dolly Varden, all emigrating fish over 200 mm in length, passing through weirs placed on the four streams and rivers, will be counted during the spring outmigrations for both species. To obtain length compositions for overwintering stock, all fish over 200 mm in length will be measured to the nearest 1 mm. To obtain estimates of mean length at age, three scales will be removed from all cutthroat trout emigrating through the weirs. Age will be determined by examination of the scales.

All existing information, including the results of the Dolly Varden and cutthroat trout field portion of this project, will be compiled by a contractor, hired and directed by Forest Service personnel. The contractor will work closely with individuals from the ADF&G, USFWS, NMFS and USFS researchers, and individuals who have information on wild fish stocks in PWS. A computer database will be developed using ORACLE software and will operate in a MS-DOS environment.

ENVIRONMENTAL COMPLIANCE

Title 16 permits will be obtained for each weir that is installed.

WHEN

January 1 - March 31, 1993	-	Operational plan will be written, materials purchased, crews will be hired and the Eyak River weir will be constructed.
January 1 - February 15, 1993	-	Contract for FS database will be written.
February 15 - April 15, 1993	-	Contract will be advertised
April 15 - June 30, 1993	-	Field Season
April 30, 1993	-	Contract will be awarded
May 1 - September 1, 1993	-	Database structure developed and start collecting information.
July 1 - September 1, 1993	-	Data entry, editing, and analysis. Cutthroat trout scales will be aged.
September 30, 1993	-	Preliminary Report
January 1 - March 31, 1994	-	Operational plan written, materials purchased and crews will be hired.
Sept. 1, 1993 - Sept. 1, 1994	-	Continued data compilation and computer database construction
April 15 - June 30, 1994	-	Second field Season
July 1 - September 1, 1994	-	Data entry, editing, and analysis. Cutthroat trout scales will be aged.
September 30, 1994	-	Database completed and installed on Forest Service computer.
September 1 - October 1, 1994	-	Final Report will be written.

BUDGET (\$K)

	ADF&G	USFS	TOTAL
Personnel	\$ 143.0	\$ 5.0	\$ 148.0
Travel	7.0	0.0	7.0
Contractual	35.5	50.0	85.5
Commodities	16.5	0.0	16.5
Equipment	0.0	0.0	0.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 202.0	\$ 55.0	\$ 257.0
General Administration	<u>24.0</u>	<u>4.3</u>	<u>28.3</u>
Project Total	\$ 226.0	\$ 59.3	\$ 285.3

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93019

Project Title: Chugach Region Village Mariculture Project

Project Category: Restoration Enhancement

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish & Game

Cooperating Agencies: Chugach Regional Resources Commission

Project Term: October 1, 1992 to September 30, 1996

INTRODUCTION

This project involves the culture of bivalve shellfish for use as a subsistence food and for economic development in Native villages of the Chugach Native Region. There are five Native villages in the region; Eyak, adjacent to Cordova; Tatitlek, in northern Prince William Sound; Chenega Bay, in southwest Prince William Sound; and Nanwalek and Port Graham, both of which are located on the southwestern tip of the Kenai Peninsula. All these villages will participate in this project. Shellfish have long comprised a significant subsistence food resource for these villages. This resource also has commercial potential for mariculture. A pilot commercial mariculture project underway near the Chenega Bay village in 1989 was aborted because of the oil spill.

The March 1989 *Exxon Valdez* oil spill adversely affected the waters and beaches utilized by the villagers. The oil spill affected the longstanding reliance of Chugach Native villages on the productivity of the marine habitat for their livelihood and traditional lifestyle.

Shellfish resources in the oil spill affected were affected in two ways. First, the sheltered habitats that were most hospitable to shellfish were also most protected against Prince William Sound's natural cleansing action. Oil spill residues tend to persist in contaminated shellfish habitats. The National Oceanic and Atmospheric Administration estimated that oil could remain in sheltered, low energy areas for twenty years or longer. Regardless of the action taken to remove the oil from shellfish beds, it will be a long time before these shellfish could be considered fit to eat. Second, the tendency of shellfish to accumulate, concentrate and store toxic contaminants such as polycyclic aromatic hydrocarbons (PAHS) compounds this habitat injury. An active approach to replace lost resources is needed.

The upshot is that the oil spill badly eroded community confidence in the healthfulness of this subsistence shellfish stock. It also arrested initial efforts to explore the commercial feasibility of shellfish mariculture. Thus, the oil spill has given special impetus and urgency to ongoing efforts to initiate Native-sponsored shellfish mariculture projects. Mariculture is a feasible and cost-effective means to conserve, repair and enhance the natural productivity of the renewable resource base.

WHAT

The broad long range goal of the village mariculture project is to strengthen the villages' economic well-being and self-sufficiency through the culture of shellfish stocks for subsistence and commercial harvest.

Three specific project sub goals are identified to implement the long range goal to strengthen Chenega Bay and Tatitlek's economies and economic self-sufficiency:

1. Develop self-supporting village-owned and managed commercial mariculture enterprises.
2. Create new local opportunities for employment and earned income.
3. Restore/enhance traditional subsistence as a supplement to cash income.

Eyak, Tatitlek and Chenega Bay have already begun the process of establishing mariculture operations. The first-year project objective for these villages will be to complete the development of an initial mariculture facilities installation, initiate maintenance activities, and expand the mariculture training program for the villagers.

First-year objectives for English Bay and Port Graham will be to identify potential sites for mariculture operations and initiate permitting procedures required for mariculture development.

Objectives for the ensuing years of the project will involve establishing mariculture operations for Port Graham and Nanwalek, continued training, expanding production and continued market development.

WHY

This project will provide the villages of the Chugach Native region with a means to develop the local bivalve resource in a manner that provides some level of protection against manmade disasters such as EVOS. The local marine environment offers one of the very few opportunities available to these villages for economic development. EVOS amply demonstrated how vulnerable marine resource development is to disasters such as the oil spill. As well as being an efficient way of utilizing the local marine environment, the mariculture techniques that will be utilized in this project will allow steps to be taken to protect the shellfish that are under culture from the effects of disasters such as EVOS. Such steps could include moving the shellfish to a safe area or sinking them in subtidal water.

The project is designed to provide a long term source of income and subsistence food. It will provide a means for the villagers to maintain their traditional lifestyle in the face of increased and sometimes conflicting use of the area of the Chugach region. The project has already gone through feasibility testing and is designed to will become self sufficient after the development stage which will take the next four years. Development will consist of purchase and installation of seed and equipment, training interested villagers in mariculture techniques, and setting up a management structure in each village to take over the project after the development stage.

HOW

The basic strategy for the village mariculture projects will be to concentrate initially on oyster

Project Descriptions

culture. The reasoning is that oyster seed is readily available for culturing, there is a good market for oysters grown in Alaska, and oysters have proven to be an acceptable substitute for local shellfish species (oysters are not indigenous to Alaska) for subsistence use. The objective will be to set up a mariculture operation in each village that will produce about 650,000 marketable oysters per year.

The feasibility of establishing mariculture projects in the Native villages of the Chugach Region has been tested extensively at both Tatitlek and Chenega Bay. As mentioned, both these villages have established mariculture feasibility operations with very encouraging results. In addition, data collected from the Port Graham/Nanwalek (English Bay) area and from potential sites in the vicinity of Eyak suggest the mariculture would be successful in these areas as well.

For those villages that already have permitted mariculture areas, the procedure will be to establish new oyster culture operations or increase existing operations to commercial production levels. A mariculture specialist will be retained to organize the operations in these villages, help put together village crews for training and initiate a training program that will run concurrently with the development of the mariculture operations. Mariculture development plans, required as part of the permitting process, will be followed in setting up and developing the culture sites.

For those villagers without permitted sites, initial efforts will concentrate on locating suitable sites and submitting permit applications. Criteria used for locating sites will include the presence of residual oil, the amount of tidal flow, level of protection from adverse weather, upland ownership and ease of access from the village. It may be that for some reason it is determined that mariculture is not practical or feasible for a particular village at this time. In this case the village will be dropped from the project.

In addition to oysters, there is good potential for the culture of clams and scallops as well as the availability of good markets for these products. Clams and scallops are also important for subsistence use. It is hoped that this project can investigate the potential for clam and scallop mariculture on the Chugach region. However, before that can be undertaken, a reliable source of clam and scallop seed needs to be established.

The bulk of the cost for this project will go to training village residents in mariculture and in establishing a management structure for each village. In order to have an effective program it will be necessary to maintain these aspects of the project. Some cost savings could be realized by reducing the amount of seed and culture equipment. However, this would result in village projects with inefficient levels of production. Obviously, reducing the scope of the project to include fewer villages would reduce the cost. It would be possible to reduce the overall cost of the project by up to 50% and still maintain some level of long term benefit.

ENVIRONMENTAL COMPLIANCE

To obtain a permit a mariculture site must meet the criteria set forth in the Corps of Engineers general permit for mariculture projects in Alaska (GP 91-7). They must also be in compliance with the local coastal zone management plan. An environmental impact analysis has not been necessary for permitted mariculture sites.

WHEN**For villages without permitted mariculture sites:**

March 1 - March 30, 1993	Identify suitable sites
March 1 - April 30, 1993	Apply for mariculture permits
March 1 - March 30, 1994	Obtain permits

For villages with permitted sites:

Jan. 1 - Dec. 31, 1993	Organize village crew, set up training schedule and initiate training
Jan. 1 - Jan. 31, 1993	Order culture equipment and seed
March 1 - June 30, 1993	Install culture equipment and seed
March 1 - March 30, 1993	Initiate ongoing maintenance schedule for mariculture operations
Ongoing -	Continue training and maintenance

Second Year:

January 3, 1994	Order new seed
March 1 - June 30, 1994	Install new seed
July 1994 - ongoing	Sort out market sized oysters from first year seed and place in intertidal hardening area
August 1994 - ongoing	Begin to market oysters
Ongoing -	Training and maintenance

The remaining years of the project will concentrate on increasing production efficiency in order to bring each village operation to the 650,000 marketable oyster per year level, and to increase marketing effort and improve transport.

BUDGET (\$K)

	ADF&G
Personnel	\$ 7.5
Travel	0.0
Contractual	556.8
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 564.3
General Administration	<u>24.8</u>
Project Total	\$ 589.1

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93020

Project Title: Bivalve Shellfish Hatchery and Research Center

Project Category: Restoration manipulation and/or enhancement

Project Type: Fish and shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

A. Background on the Resource/Service

Shellfish resources in the *Exxon Valdez* oil spill (EVOS) affected area were impacted in several ways. Most obviously, shellfish populations were damaged, destroyed and/or contaminated by the spill and/or subsequent cleaning activities.

B. Summary of Injury

Some bivalve shellfish populations were affected directly by the toxic effects of the spilled oil and subsequent cleaning. Still other populations were contaminated or were suspected to be contaminated to the degree that they were unfit for human consumption and/or were negatively affecting birds, mammals and other animals that fed upon those shellfish. Evidence indicates that natural cleansing is not proceeding well in some areas. The sheltered habitats most hospitable to shellfish were also those most protected from natural cleansing action. Oil spill residues continue to persist in these areas.

Native communities in the oil-impacted area were altered by the EVOS. Prior to the EVOS at least one mariculture feasibility study was under way (near Chenega Bay Village). This was terminated because of the spill. Replacement shellfish opportunities are reasonable expectations for impacted villages.

C. Location

The project involves two physical facilities. The proposed location for these facilities is in Seward, Alaska. A component of this study is to determine if that is the best location. Target locations for projects resulting from the operation of these facilities include Tatitlek, Chenega Bay, Eyak, Port Graham and Nanwalek.

WHAT

A. Goal

The goal of this project is to assess the feasibility of using aquatic farming technology to restore, replace or enhance bivalve shellfish populations in oil-affected areas and to mitigate the negative affects of the *Exxon Valdez* oil spill on native communities.

B. Objectives

The initial objectives of the project are to assess the feasibility of a shellfish production hatchery and a mariculture technical center to be used to restore, replace and/or enhance bivalve shellfish populations in oil-impacted areas. A report on the feasibility of the proposed facilities relative to potential uses will be generated from data collected during the year. Alternative configurations will be considered and analyzed. This initial study will also attempt to identify potential species and establish production goals for those species.

Native communities and organizations in the affected area would be involved from the outset in development of this project. Pending the results of the feasibility analysis, they would be the logical entity to operate the production shellfish hatchery.

If full funding for construction of the facilities is not realized from oil spill funds, additional funding sources will be required before they can be built. Though this would not affect the stated objectives, it would alter the project time frames and facility priorities

WHY

A. Benefit to Injured Resources/Services

Bivalve shellfish populations were severely impacted by the oil spill and by the cleanup efforts following. All of the affected populations were used to some degree by marine mammals, birds, fishes and in many cases for human subsistence. This project would provide the facilities and infrastructure to research techniques to restore, replace and/or enhance affected populations using shellfish hatchery and aquatic farm-based technology.

HOW

A. Methodology

Utilizing concepts already developed for the Seward shellfish hatchery and the ADF&G Mariculture Technical Center, a feasibility analysis of the project will be conducted. Engineering and biological expertise will be retained to conduct the analysis. If construction funds are later approved, direct restoration, replacement and/or enhancement of bivalve shellfish will be accomplished via an onshore production hatchery operated by the private sector using technology developed at a State-operated research center. The combination of the two facilities is necessary to accomplish the overall production objectives of this project because of the lack of technology for indigenous species.

Project Descriptions

Analysis of similar projects in other areas will be conducted. The information will be incorporated into the project design.

Evaluation and feasibility determinations of potential projects for restoration, replacement or enhancement of bivalve shellfish in more remote areas, but of import to marine mammals, birds and fish will also be accomplished.

B. Coordination with other efforts

During the process of needs assessment and feasibility analysis, necessary coordination of efforts needs will also be determined and analyzed. At this time ADF&G is aware of efforts by Alaska native groups to establish a shellfish hatchery and an aquatic farm industry in the oil-affected area. This project is supportive of and will be coordinated with those efforts to insure maximum efficiency and utility.

ENVIRONMENTAL COMPLIANCE

Project compliance with the National Environmental Policy Act (NEPA) will be assessed during the feasibility phase. Until project design and specifications are finalized, specific NEPA requirements cannot be determined. Aquatic farms are addressed under a Corps of Engineers' general permit (GP 91-7). If facilities are constructed, a determination of compliance with the Alaska Coastal Management Plan (ACMP) will be required. The required State and Federal permits will be identified and incorporated into the project planning process.

WHEN

The feasibility study will occur this budget year (1/1/93 - 9/30/93). The clam restoration/enhancement demonstration project will occur next budget year.

If the project is determined to be feasible and appropriate budgets realized, construction of the facilities will begin in 1993 (Oil Year 6). The facilities will be operational in 1994.

BUDGET (\$K)

	ADF&G
Personnel	\$ 37.6
Travel	8.0
Contractual	2.0
Commodities	2.4
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 50.0
General Administration	<u>5.7</u>
Project Total	\$ 55.7

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93022

Project Title: Evaluating the Feasibility of Enhancing Productivity of Murres by using Decoys, Dummy Eggs, and Recordings of Murre Calls to Simulate Normal Densities at Breeding Colonies Affected by the *Exxon Valdez* Oil Spill, and Monitoring the Recovery of Murres in the Barren Islands

Project Category: Manipulation and Enhancement; Restoration Monitoring

Project Type: Birds

Lead Agency: Department of the Interior - Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to December 31, 1993

INTRODUCTION:

A. Background on the Resource/Service

Murres were the species of higher vertebrates most heavily affected by the oil from the *Exxon Valdez* spill. These diving seabirds have continued to demonstrate abnormal breeding behavior and low reproductive output at several sites since the spill. Factors that normally result in increased breeding success of common murres are breeding in high-density concentrations and laying eggs in synchrony with neighbors. Being one of a crowd apparently reduces vulnerability to avian predators. Within a colony, birds in groups that breed early tend to be more productive than birds breeding later, and older birds tend to breed earlier and be more successful than young birds. Prior to laying, murres tend to be flighty. In cases where a small percentage of murres in a cluster have begun to incubate before others have laid, incubators tend to leave their eggs exposed to predators, joining the flock when panic flights occur. Nevertheless, as more birds lay there is a tendency for incubators, now apparently feeling safer with company, to remain with eggs when non breeders flush.

For reasons not yet fully understood, murres at colonies affected by the oil have not yet resumed normal breeding schedules. Apparently a relatively small proportion of birds have laid their eggs earlier than others, and egg predation by gulls has been high. Perhaps a substantial proportion of experienced breeders were killed in the spill so that the population now is composed of mostly young, inexperienced breeders. It is not well understood how crucial the presence of older birds is to the social facilitation of normal breeding, and it is possible that a shortage of experienced breeders is causing the abnormal timing and poor reproductive success. Another contributing factor could be reduced breeding densities, since populations were reduced by mortality of adults. The use of tape-recorded murre calls, placement of decoys, and dummy eggs could stimulate more normal breeding behavior.

B. Summary of Injury

Over 100,000 murres were killed by the oil, and counts of birds at colonies within the trajectory of the oil indicated reduced populations after the spill. In the 3 years following the spill, remaining murres at colonies affected by the oil have initiated laying up to 1 month late, if they laid at all, and reproductive output has remained much lower than would be expected. Three consecutive years of poor reproductive success is very unusual based upon other studies.

C. Location

Experiments would be conducted at murre colonies in the Barren Islands, located between the Kenai Peninsula and the Kodiak Archipelago.

WHAT

A. Goal

The purpose of this project is to evaluate the feasibility of using artificial means to stimulate normal breeding behavior, as measured by nesting chronology and success, in murres at colonies affected by the oil spill.

B. Objectives

1. Determine the feasibility of enhancing the breeding success of murres by using decoys, dummy eggs, and recorded murre calls.
2. Monitor the recovery of murres in the Barren Islands.

WHY

A. Benefit to Injured Resources/Services

If murres can be induced to resume nesting at normal dates and if predation were reduced, reproductive success should increase. Increased recruitment from birds produced at injured colonies is likely to provide the best opportunity for populations to recover from reductions caused by the *Exxon Valdez* oil spill. Pioneering from other colonies outside the spill area is not likely to contribute in a major way in the near future since murres exhibit a high tendency to return to their natal colonies to breed, especially if there are available nest sites. There would be available nest sites at colonies with reduced populations. The monitoring phase is essential to understand the results of the feasibility study and to assess the recovery of the colony as a whole following the oil spill. The underlying causes of the abnormal nesting behavior (e.g., delayed laying) are not yet understood, and monitoring data will provide the basis for testing various hypotheses. Understanding the impact of the oil spill may make it possible to minimize damage in future spills by directing clean up efforts appropriately. Moreover, documentation of the response of murres in the aftermath of the oil spill will provide a basis for predicting the extent of the injury from future spills.

Project Descriptions

B. Relationship to Restoration Goals

This project meets the Trustee Council goal of restoring the spill area to its pre-spill condition by providing information that could be used to develop a management action. If one or more of the experimental treatments prove to be feasible, it should be possible to implement the technique extensively enough to generate improved success for a portion of one or more colonies. At least for these portions, more young should be produced and ultimately begin the process of recovery to former population levels.

HOW

A. Methodology

Treatment and control plots would be selected at East Amatuli Light Rock and on Nord Island in the Barrens. Decoys, and solar powered sound players would be placed in selected locations prior to the arrival of murres on cliffs. It would be necessary to use technical climbing gear to accomplish the objective on Nord Island. Time-lapse cameras would be used to monitor plots on E. Amatuli Rock because access after murres have laid would disturb the birds.

B. Coordination with Other Efforts

The two subprojects included here are complimentary. Data from the monitoring program will be used to assess the effectiveness of this project, and a single project leader would guide both projects.

ENVIRONMENTAL COMPLIANCE

This is a non-intrusive project which appears to qualify for categorical exemption under NEPA.

WHEN

Jan. - April 1993	Plan and arrange logistics (e.g., boat charters), recruit seasonal employees, develop detailed study protocols, assemble field gear, purchase equipment
May 1993	Place decoys, players, dummy eggs, and time-lapse cameras in field
Jun. - August 1993	Conduct field studies
Sept. - Oct. 1993	Analyze data
Nov. - Dec. 1993	Write progress report
Dec. 15, 1993	Submit progress report

BUDGET (\$K)

USFWS

Personnel	\$ 84.5
Travel	9.0
Contractual	126.0
Commodities	15.0
Equipment	25.0
Capital Outlay	<u>0.0</u>

Sub-total	\$ 259.5

General Administration	<u>21.5</u>

Project Total	\$ 281.0

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93024

Project Title: Restoration of the Coghill Lake Sockeye Salmon Stock

Project Category: Restoration manipulation and enhancement

Lead Agency: Alaska Department of Fish and Game (ADF&G)

Cooperating Agencies: U.S. Forest Service (USFS)

Project Term: January 1, 1993 to December 31, 1997

INTRODUCTION

This project will attempt to restore the natural productivity of Coghill Lake through use of established lake fertilization techniques. Coghill Lake is located on the eastern side of Port Wells in the northwest region of Prince William Sound (PWS). The Coghill Lake sockeye salmon stock historically supported important sport and commercial fisheries. Returns have declined in recent years from a historical average of 250,000 to only 25,000 in 1991. Damage assessment studies on juvenile salmon suggest that the *Exxon Valdez* oil spill contributed to the decline of the Coghill sockeye stock. Salmon migration patterns indicate that juvenile sockeye smolt from Coghill Lake likely migrated through oil-contaminated areas in western PWS. Juvenile salmon similar in size to Coghill smolts utilized oiled nearshore nursery habitats. The growth and survival of juvenile salmon utilizing these habitats was reduced by oil contamination from the *Exxon Valdez* spill. The Coghill Lake stock is presently at extremely low levels. Action must be taken to restore the stock before any further decline occurs. The communities of Anchorage, Whittier, Valdez, and Cordova will benefit from this project. Coghill Lake sockeye have been heavily utilized by sport fishermen traveling from Whittier by boat and from Anchorage by air. Commercial fishermen from all of these communities have historically fished the Coghill Lake sockeye salmon stock. Restoration of Coghill Lake sockeye salmon will further improve management of important sockeye and chum salmon stocks returning to hatcheries in western PWS.

WHAT

The goal of this project is to restore the natural productivity of Coghill Lake and the resident sockeye salmon population through use of established lake fertilization techniques. The USFS will apply fertilizer to the lake each summer for five years (the USFS has already purchased the fertilizer from another funding source). The ADF&G will conduct limnological and fisheries studies needed to monitor and refine the fertilization program. These studies will focus on the effects of fertilization on primary and secondary production and the growth and survival of juvenile sockeye salmon in the lake. The ADF&G component of the project will achieve the following objectives each year:

1. Determine the response of lake nutrient levels, primary and secondary production, and plankton species composition to lake fertilization

2. Monitor changes in water temperature, light penetration, and water level in the lake
3. Determine the habitats utilized by sockeye salmon fry at various lifestages
4. Determine if fry prey composition, growth, and overwinter survival changes in response to lake fertilization
5. Estimate the effect of fertilization on lake carrying capacity and smolt-to-adult survival, and
6. Develop recommendations for refinement of the lake restoration program.

WHY

This project will restore an important natural resource and resource service in the *Exxon Valdez* oil-spill area. Restoration of the Coghill sockeye stock will further provide natural resource services to replace those once provided by other injured stocks. Damage assessment studies on juvenile salmon suggest that the *Exxon Valdez* oil spill may have contributed to the decline of the Coghill sockeye stock. Lake fertilization techniques have been successfully applied in Alaska and elsewhere to restore the productivity of sockeye salmon rearing lakes. The production of sockeye salmon populations is closely linked to the productivity of lakes where the fish rear for one to three years. The availability of food in rearing lakes determines the growth and size of smolts that emigrate to sea. Smolt size in turn determines ocean survival and subsequent adult returns. The fry food resources in Coghill Lake are currently very low. As a result, the lake cannot support large numbers of fry, and the smolts are very small. Fertilization is needed to increase lake productivity and boost fry food abundance until natural nutrient input from salmon carcasses is restored.

HOW

Limnological sampling will be conducted twice each month at two stations. Dissolved oxygen concentrations will be measured from the surface to a depth of 40 M. Eight liter water samples will be collected from the 1m stratum, chemocline, and monimolimnion. Replicate vertical zooplankton tows will be taken using a 153- μ m mesh conical net. Water samples will be analyzed for the following parameters: conductivity, alkalinity, calcium, magnesium, turbidity, total iron, filterable reactive phosphorus, total phosphorus, nitrate and nitrite, total Kjeldahl nitrogen, total nitrogen, and reactive silicon. Yearly phosphorus loading will be estimated. Euphotic zone depth and algal standing crop will be estimated. Zooplankton abundance will be estimated from triplicate counts of organisms in 1 ml subsamples. Zooplankton dry weight and biomass will be estimated by regression analysis using body length measurements on 10 individuals from each taxa. Light penetration will be measured at 1 m increments from the surface to a depth equivalent to 1% of the subsurface light. Water temperature in the epilimnion and water level will be continuously monitored by electronic recorders moored at 5, 15, and 25m depth.

Project Descriptions

The habitats used by sockeye salmon fry in the lake will be determined from visual surveys, beach seine and tow net catches, and hydroacoustic surveys conducted in June, August, and October. A 70-Khz echosounder will be used to determine the vertical distribution of fry in the lake during the day and at night. Twenty samples ($n=10$) of 10 sockeye salmon fry will be collected from various habitats during each survey for later analysis of stomach contents and otolith growth.

Stomach analysis will be conducted on sockeye fry ($n=200$) collected during each survey. Prey items in the stomach will be identified to the lowest possible taxonomic level. Prey body weight will be estimated by regression analysis using body length measurements on 10 individuals from each taxa. Stomach contents' weight will be estimated by the product of abundance and mean body weight for each taxa. Chi-square analysis will be used to test for differences ($P=.05$) in the proportion of stomach contents weight in each taxonomic group between three time periods. Analysis of covariance will be used to test for differences ($P=.05$) in stomach contents weight between three time periods.

Otolith microstructure analysis will be conducted on sockeye fry ($n=200$) collected during each survey. Thin sections of the otoliths will be prepared using established methods. A computer image analysis system will be used to collect data from the otoliths. A modified Fraser-Lee back calculation procedure will be used to reconstruct fish growth histories during weekly time periods. Weekly growth estimates obtained from otoliths will be regressed against weekly mean water temperatures obtained from electronic temperature recorders. Analysis of covariance will be used to test for differences ($P=.05$) in temperature-specific growth between Coghill Lake sockeye and fish fed an excess ration. Comparison of regression slopes will be used to determine if fry growth in Coghill Lake is limited by food abundance. This information will be used to monitor the growth response of the fish to fertilization and determine the carrying capacity of the lake.

The overwinter survival of juvenile sockeye will be estimated from fall fry and spring smolt population estimates. Fall fry population size will be estimated with a 120-khz echosounder towed along 10 randomly selected transects. A mid-water trawl will be used in conjunction with the hydroacoustic surveys to determine species composition, age, and size of fish targets. Sockeye salmon smolts emigrating from Coghill Lake will be enumerated using incline-plane traps. The traps will be operated continuously from early May through June. The catch efficiency of the traps will be determined by mark/recapture analysis. Age composition and size will be estimated from a sample of 40 smolts collected each day. Chi-square analysis and analysis of variance will be used to test for differences ($P=0.05$) in age composition and smolt size between years, respectively. A representative sample of smolts will be coded-wire tagged to enable later estimation of smolt-to-adult survival in the commercial fishery. The combined results from these investigations will be compiled in an annual report describing the success of the fertilization program and recommending refinements to the methodology.

ENVIRONMENTAL COMPLIANCE

An environmental assessment has been conducted to evaluate the various options for rehabilitating Coghill Lake and the resident sockeye salmon population. The assessment has concluded that a program of lake fertilization is the most appropriate method for rehabilitation in this case. Final approval of the environmental assessment is expected before the end of 1992.

WHEN

This project will be conducted over a five-year period which corresponds to the generation time for Coghill Lake sockeye salmon. Lake fertilization is expected to elevate lake productivity until carcasses from adult spawners can once again contribute significantly to the nutrient load in the lake. Project activities will take place throughout each year (Table 1).

May - June 1993	Enumerate outmigrant smolts and estimate smolt age and size
June - October	Apply fertilizer each week and conduct limnological sampling
June, Aug., Oct.	Determine fish habitat use and sample for otolith and stomach analysis
October	Estimate fall fry population size using hydroacoustic techniques
June - October	Conduct laboratory analyses of limnological, otolith, and stomach samples
October - Dec.	Analyze data and prepare annual report.

BUDGET (\$K)

	ADF&G	USFS	TOTAL
Personnel	\$ 104.7	\$ 10.2	\$ 114.9
Travel	1.3	5.4	6.7
Contractual	8.8	7.0	15.8
Commodities	14.0	0.7	14.7
Equipment	21.5	0.0	21.5
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 150.3	\$ 23.3	\$ 173.6
General	<u>16.3</u>	<u>2.0</u>	<u>18.3</u>
Project Total	\$ 166.6	\$ 25.3	\$ 191.9

EXXON VALDEZ OIL SPILL PROJECT PROPOSAL

Project Number: 93025

Project Title: Montague Island Chum Salmon Restoration

Project Category: Restoration Manipulation and/or Enhancement

Project Type: Fish/Shellfish

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: Alaska Department of Fish and Game

Project Term: October 1, 1992 to September 30, 1997

INTRODUCTION

Prior to the 1964 earthquake, Montague Island streams accounted for nearly 8% of the total chum salmon production in Prince William Sound. Habitat alterations caused by the uplift, combined with a number of environmental and man induced factors, led to the virtual extirpation of chums on the Island. While some of the Island's historic chum producing streams are thought to have stabilized over time to once again support chum salmon populations, others have been slow to recover. Many of the historic chum salmon producing streams were also moderate- to lightly oiled by the *Exxon Valdez* oil spill, which caused further degradation of chum salmon habitat, particularly in the inter-tidal spawning areas. There is also a lack of sufficient brood source to reestablish numbers of chums within Montague streams through natural straying and reproduction.

WHAT

A. Goal

The goals of the project are as follows:

1. To reestablish wild stock populations of chum salmon on Montague Island and maintain the genetic diversity of wild chum salmon stocks in Prince William Sound.
2. To provide mitigation to identified injured species through habitat restoration. Once the project is established, it could contribute an estimated 300,000 pounds of salmon annually to the common property fishery. Approximately 10 miles of stream habitat will be rehabilitated to provide excellent habitat not only for fish species, but many wildlife species as well. In addition, at least one artificial spawning channel will be created.

WHY

Chum salmon were not specifically studied to determine injury from the oil spill. However, chum salmon spawn in the same inter-tidal habitats as pink salmon which were studied and determined to be injured. Enhanced habitat will provide off-site mitigation for the more severely damaged areas of the Sound and replace pink and chum salmon runs injured by the oil spill. Montague Island remains as one of the best Prince William Sound locations for improving wild chum salmon production.

This project offers a means of minimizing impacts on fisheries within Prince William Sound by increasing chum salmon production. This meets the goals of restoration Option Number 2 (Intensify Management of Fish and Shellfish) and 18 (Replace Fisheries Harvest Opportunities by Establishing Alternative Salmon Runs). It also provides a means for implementing Restoration Option Number 11 (Improve or Supplement Stream and Lake Habitats for Spawning and Rearing of Wild Salmonids). The Forest Service has expertise in a variety of established techniques for salmonid habitat improvement.

HOW

A four-year cooperative chum fry stocking effort in the Chalmers river was completed in 1990. This stocking proved successful when more than 1,000 chums were observed returning to Chalmers river. Pending favorable spawning success of these fish, stocking efforts will be expanded to include all historic chum salmon producing streams on Montague Island. Cooperative work with the Alaska Department of Fish and Game and Prince William Sound Aquaculture Corporation will continue to identify a source for brood stock and eggs will be collected for culture by 1994.

During 1991, spawning habitat surveys were conducted at fourteen of the seventeen top historic chum salmon producing streams, using the Chugach National Forest standard methods for quantifying fish habitat within streams. During FY 92, the habitat assessments will be completed in the remaining three of the seventeen historic chum streams, using the same standard methods. Based on the information collected, recommendations will be made on possible habitat restoration projects for several of the chum salmon streams. These projects will be further evaluated in FY 92 for hydrologic feasibility, using the slope area method (USGS standards for data collection and analysis) and aerial photo interpretation. Projects will include instream structures in the form of large boulders, and log placements, spawning channel development, and riparian habitat management.

During FY 92, riparian forest habitat will be evaluated at three stream sites in the Port Chalmers area of Montague Island, using the R10 standard methods for assessment of plant associations within forested areas. Based on the data collected, a riparian forest prescription will be developed for each of the three streams in the Port Chalmers area. Riparian forest management will include tree planting and tree thinning of selected zones. Beginning in FY 93, forest riparian areas in the Montague Strait area will be developed for each of these streams, and silvicultural techniques will be applied during FY 94-Fy 97. Through effective silvicultural management these areas can be rehabilitated to provide excellent habitat not only for fish species, but many wildlife species as well.

Project Descriptions

ENVIRONMENTAL COMPLIANCE

Given the scope of the proposed activities for FY 93, a categorical exclusion would be appropriate. However, larger scale projects such as spawning channel development or instream work using heavy equipment may be developed based on information collected during FY 92 and FY 93 field seasons. These type projects will require environmental assessments and therefore will be evaluated on a project by project basis. Any environmental compliance documents will be budgeted in the program for FY 94 and FY 95 if funding is approved to continue.

WHEN

During FY 93, boulder and log placement will be completed in three streams in the Port Chalmers area. In addition, riparian habitat rehabilitation of 25 acres will be completed at the same streams.

Also, during FY 93, riparian forest assessment will begin at five stream sites in the Montague Strait area. Riparian forest management will begin at those sites in FY 94 and be completed by FY 97.

As fisheries and hydrologic assessments are completed in FY 92, projects will be developed for implementation in FY 95-97. Prior to implementation, design and NEPA documentation will be necessary in FY 93-94.

BUDGET (\$K)

USFS

Personnel	\$ 46.8
Travel	18.2
Contractual	0.0
Commodities	2.0
Equipment	7.5
Capital Outlay	<u>0.0</u>

Sub-total	\$ 74.5

General Administration	<u>7.0</u>

Project Total	\$ 81.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93026

Project Title: Fort Richardson Hatchery Water Pipeline

Project Category: Restoration Enhancement

Project Type: Fish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 1, 1993 to June 30, 1994

INTRODUCTION

Overescapement of sockeye salmon occurred in the Kenai River as a result of the Exxon Valdez oil spill. This has led to a dramatic reduction in smolt survival.

The Fort Richardson Hatchery currently uses only 50% of available fish rearing space because the existing water supply is limited. Construction of a water pipeline to connect the Fort Richardson Hatchery to the Municipal water system would allow immediate doubling of fish production. This increased production would then be used to provide alternative sport fishing opportunities as early as 1994, thus reducing the impact caused by the loss of the Kenai River sockeye salmon sport fishery.

The increased production of rainbow trout and king, coho, and pink salmon resulting from this project would be released into lakes and streams throughout Upper Cook Inlet and on the Kenai Peninsula providing direct alternative sport fishing opportunities for severely impacted fishermen. Completion of this project would also increase hatchery dependability and reduce cost per unit of production so all areas served by the Fort Richardson Hatchery would indirectly benefit.

WHAT

The goal of this project is to provide alternative sport fishing opportunities to reduce the social and economic impact of the loss of the Kenai River sockeye salmon sport fishery. As a result of the expected closure of the Kenai sockeye salmon fishery it is estimated that at least 100,000 angler days will be lost each year. Increased production at the Fort Richardson Hatchery would ameliorate this loss.

Fish production objectives are as follows:

<u>Species</u>	<u>Number</u>	<u>Size</u>	<u>Potential Angler Days</u>
Rainbow Trout	250,000	100.0 g	50,000
King Salmon	800,000	15.0 g	25,000
King Salmon (catchables)	50,000	100.0 g	20,000
Silver Salmon	600,000	20.0 g	32,000
Pink Salmon	2,000,000	0.15 g	15,000

WHY

The decrease of sport fishing opportunities for sockeye salmon on the Kenai River would have significant social and economic impact on the Cook Inlet area. Over 335,000 angler days were spent in pursuit of salmon on the Kenai River in 1990. A major portion of this effort was directed toward sockeye salmon with an average annual harvest of 107,500 sockeye salmon valued at approximately \$10,000,000.

The extremely low number of out-migrant smolts in 1991 and 1992 strongly suggests that sockeye salmon production in the Kenai River will be affected. It is possible that sockeye salmon fishing will be closed for a number of years starting in 1993. However, if immediate action is taken, the Fort Richardson Hatchery water pipeline project would provide alternative sport fishing opportunities during the years the Kenai River losses are expected to be most severe and would significantly reduce these impacts.

HOW

The main project objective would be met by constructing a water delivery system connecting the Municipal Water Utility with the hatchery. The main elements of this system include a cold water line running directly from the Municipal Water Plant to the hatchery and a second line that will provide heated water (via heat exchangers in the Sullivan Power Plant which is adjacent to the Water Plant) to accelerate fish growth.

An engineering feasibility study was completed in 1991 by F. Robert Bell and Associates. This study determined that this project was both technically and economically feasible. In a separate study the Anchorage Economic Development Corporation determined that this project would have a benefit/cost ratio of 2.8:1.

Fish cultural methodology will follow well established, standard Department of Fish and Game and FRED Division procedures and policies.

In the Fall of 1992, a peer review synthesis meeting will examine the proposed benefits and associated potential ecological risks of wild versus hatchery fish.

Construction permits will be required. They will be the responsibility of the contractor. The hatchery is on a military reservation. Access permits to the reservation may be required. This project may be required to meet requirements under Clean Water Act.

Project Descriptions

WHEN

If this project is approved by the Trustee Council, a minor amount of preliminary work would begin immediately. In cooperation with the Municipality we would solicit proposals for engineering and design for review so that an engineering firm could be hired as soon as an EIS was completed and funds were available. Major milestones are as follows:

Fall 1992	Project peer review synthesis meeting
January 1993	Environmental Impact Statement
January - March 1993	Public Review of EIS
March 1993	Contingent upon favorable public review and concurrence of the Trustee Council, design and construction funding is approved
March -- June 1993	Project design and engineering
April 1993	Collect rainbow trout eggs
June 1993	Award construction contract
July 1993	Collect king salmon eggs
September 1993	Collect coho eggs
January 1984	Water system on-line to support additional fish
June 1984	Release fish

ADDENDUM

1. The Municipality of Anchorage (which strongly supports this project) has an easement for this pipeline route; the corridor already contains an existing powerline.
2. After the pipeline is completed, the program will be partially operated by federal funding as it currently is; consequently, the NEPA public review process has been and will be followed before fish are released. This review process has been incorporated into the development of the ADF&G "Statewide Stocking Plan for Recreational Fisheries" (copy available upon request from FRED Div., Alaska Dept. of Fish and Game, 333 Raspberry Rd., Anchorage, AK 99518-1599). This document has been scheduled for review and updating in 1993. In addition, before any new release location is approved, it is also subjected to another ADF&G review process that addresses fish genetics, fish disease and fisheries management concerns (Fish Transport Permit or FTP process). Thus all releases are subject to both the federal NEPA and state FTP processes currently and will be in the future.

BUDGET (\$K)

	ADF&G
Personnel	\$ 30.0
Travel	0.0
Contractual	3,500.0
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 3,530.0
General Administration	<u>87.0</u>
Project Total	\$ 3,617.0

EXXON VALDEZ OIL SPILL PROJECT PROPOSAL

Project Number: 93028

Project Title: Restoration and Mitigation of Wetland Habitats for Injured Prince William Sound Fish and Wildlife species

Project Category: Restoration manipulation and/or enhancement

Project Type: Birds/mammals/fish

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: None

Project Term: January 10, 1993 to September 30, 1997

INTRODUCTION

Past events associated with the 1964 earthquake drained the 250 ha lake within the San Juan Bay Drainage on Montague Island. Since the uplift, periodic flooding occurs during periods of high, nearly continuous rainfall or in combination with snow melt. With this altered water regime the uplifted lake is undergoing a rapid succession from a sedge/grass community to a spruce/hemlock community. At the same time, downcutting of the San Juan Creek has changed the character of the stream along a major portion of its course through the former lake bed. Pool habitats important for anadromous fish rearing have been reduced and adjacent sedge meadows are undergoing plant succession to shrub and forest communities. Opportunities exist for long term improvement of PWS waterfowl, furbearer and anadromous fish habitat within the stream and in the adjacent wet meadow zones.

WHAT

A. Goal

The purpose of this project is to restore the wetland habitats used by waterfowl, anadromous fish and furbearing species impacted by the oil spill in Prince William Sound.

B. Objectives

1. Maintain a wetland component by flooding the uplifted lake bed and reversing succession from a forested habitat type to an early succession grass/sedge community.
2. Create pools and ponds in riparian and flood plain areas to restore associated aquatic vegetation.

WHY

This project has the potential to improve habitat for waterfowl and anadromous fish by creating

wetlands. Some intertidal wetlands were injured by the *Exxon Valdez* oil spill. This project would provide an equivalent resource replacement for those injured wetlands. This project will implement restoration option number 11 (improve or supplement stream and lake habitats) and number 25 (protect or acquire upland forest and watersheds, established or extend buffer zones for nest birds) identified in the Restoration Framework Document.

HOW

This project will be accomplished through the following sequence of events:

1. Feasibility

This consists of conducting the following analyses:

- A. Hydrologic analysis to determine subsurface flow regimes
- B. Soils analysis to determine soils types and,
- C. Channel morphology analysis. Monthly surveys will determine wildlife use of the area from spring through fall.

2. Inventory Existing Habitat

This will be accomplished by low-level aerial photography of San Juan Bay area. This will be coordinated with proposal number 29854. Vegetation surveys will be conducted to determine existing plant community type.

3. Project Design

After feasibility and inventory studies are completed, vegetation objectives will be established specific to the targeted species and engineering design will be completed to meet those objectives.

4. Environmental Analysis

An Environmental Analysis will be conducted prior to a decision for any action. The scope of the Environmental Analysis will depend on the result of public scoping and issues developed.

5. Implementation

If the decision is made to implement the recommended engineering design after the Environmental Analysis this project could be accomplished over the following three years.

6. Monitoring

Monitoring will continue for five years after completion of the project to determine if the vegetation objectives were met.

Project Descriptions

ENVIRONMENTAL COMPLIANCE

Given the scope of this project an Environmental Analysis will be required. The first year's work is design work only and is categorically exempt from formal documentation in an environmental analysis.

WHEN

The following is the proposed schedule:

Jan. 1 - Feb. 15, 1993	Hydrologic Analysis
June 1 - June 15, 1993	Fly for Low Aerial Photography
June 15 - June 30, 1993	Soils Analysis
April 1 - Oct. 1, 1993	Wildlife Surveys
June 1 - June 30, 1993	Engineering Data Collection
Sept. 1 - Sept. 30, 1993	Project Design
Jan. 1 - April 1, 1994	Environmental Analysis
Jan. 1, 1994 - Dec. 1998	Implementation (project construction)
Jan. 1, 1994 - Dec. 1998	Monitoring

BUDGET (\$K)

	USFS
Personnel	\$ 44.1
Travel	18.0
Contractual	5.0
Commodities	0.0
Equipment	8.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 75.1
General Administration	<u>7.0</u>
Project Total	\$ 82.1

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93029

Project Title: Prince William Sound Second Growth Management

Project Category: Restoration Manipulation and/or Enhancement

Project Type: Birds/Mammals

Lead Agency: U.S. Department of Agriculture, Forest Service

Cooperating Agencies: None

Project Term: January 10, 1993 to September 30, 1997

INTRODUCTION

The Prince William Sound area has several watersheds on National Forest Lands where timber harvest occurred in the early 1970's. These harvest areas have removed a portion of the old-growth vegetation in the *Exxon Valdez* oil spill area. The second-growth vegetation present on these areas can now be managed to improve habitat for certain wildlife and fish species and accelerate the return to old-growth vegetative conditions. Habitat for old-growth dependent oil spill injured species such as river otter, marbled murrelet, and harlequin duck can therefore be improved.

WHAT

A. Goal

The purpose of this project is to provide mitigation through habitat enhancement to identified injured wildlife species in Prince William Sound.

B. Objectives

1. Maintain understory vegetation components throughout the successional stages of second growth.
2. Increase successional trends in key wildlife habitat areas to develop old growth structure. Approximately 2,500 acres of second growth habitat will be evaluated for enhancement opportunities.

WHY

This project has the potential to improve habitat for pink and chum salmon, harlequin duck, marbled murrelet river otter and bald eagle. These species were injured by the *Exxon Valdez* oil spill. This project falls within the category of habitat protection and acquisition and manipulation

of resources since the objective is to enhance habitats for injured species. This project will implement restoration option number 11 (improve or supplement stream and lake habitats) and number 25 (protect or acquire upland forests and watersheds, established or extend buffer zones for nesting birds).

HOW

This project will be accomplished through the following sequence of events:

1. Inventory existing data base.

This consists of compiling existing data on Prince William Sound second growth, establishing date of harvest, and entering GIS data base.

2. Inventory existing habitat.

This will be accomplished by low level aerial photography of all second growth sites and field sampling to determine existing vegetation community type and site potential.

3. Define vegetation objectives.

After the second growth areas have been described, vegetation objectives will be established specific to the targeted injured species.

4. Site Prescription

Prescriptions will be developed identifying recommended treatment to meet the vegetation objectives. Treatment options could consist of pre-commercial thinning at varied spacing to maintain understory vegetation throughout the rotation.

5. Environmental Analysis

An environmental analysis will be conducted prior to a decision as required by the National Environmental Policy Act.

6. Implementation

If the decision is made to implement the recommended treatment after the Environmental Analysis this project could be accomplished over the following three years.

ENVIRONMENTAL COMPLIANCE

Given the scope of this project an environmental analysis will be required. This years proposed work is survey and project design work only which is categorically exempt from documentation in an environmental analysis.

Project Descriptions

WHEN

The following is the proposed scheduled:

Jan. 1 - Feb. 15, 1993	Inventory Existing Data Base
June 1 - June 15, 1993	Develop Low Aerial Photography
June 1 - Sept. 1, 1993	Inventory Habitat
Sept. 1, - Sept. 15, 1993	Define Vegetation Objectives
Sept. 15 - Sept. 30, 1993	Write Site Prescriptions
Nov. 1, - March 1, 1994	Environmental Analysis
Contract 1994-1997	Implementation of Prescriptions

BUDGET (\$K)

	USFS
Personnel	\$ 34.2
Travel	6.0
Contractual	10.0
Commodities	0.0
Equipment	6.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 56.2
General Administration	<u>5.8</u>
Project Total	\$ 62.0

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93030

Project Title: Red Lake Restoration

Project Category: Restoration, Manipulation and/or Enhancement

Project Type: Fish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 7, 1993 to September 30, 1997

INTRODUCTION

Red Lake, located on the southwest side of Kodiak Island, has historically been one of the most consistent producers of sockeye salmon for Kodiak's commercial purse seine fishermen. The Department of Fish and Game's annual escapement goal for the system ranges from 200 to 300 thousand. Since 1980, the catch has ranged from 25,000 to 1.5 million with an average of 450,000. This fishery has had an average annual value to fishermen of about \$2.2 million.

Careful management of the number of spawning fish is required to maintain this fishery at a high level. Young sockeye salmon spend at least their first year of life (up to 3 years) living and growing in lakes where they rely on microscopic-sized animals (plankton) for food. These animals, in turn, graze on tiny plants. If too many adult salmon spawn in the lake system, an overabundance of the young sockeyes will deplete their limited food source before they migrate to sea. When this happens, large numbers of young salmon die, survivors grow more slowly and smaller numbers migrate to the ocean to mature. So, large numbers of spawners in one year may result in an unusually small run in the next cycle.

In 1989, as a result of the *Exxon Valdez* oil spill, commercial salmon fishing was closed over most of Kodiak Island waters. The closure resulted in an escapement of 768,000 sockeye salmon into Red Lake, a 2.5 fold increase over the maximum desired. Data gathered showed low survival for the 1989 escapement year. Surveys showed low numbers of juveniles in the lake in the fall of 1990; and, in the spring of 1991, reduced number of migrant smolts were observed. This means that very low numbers of sockeye will return as four-, five-, and six-year olds in 1993, 1994, and 1995. It is anticipated that adult salmon return may be depressed to the extent that the escapement may fall below 150,000. If this happens during one or more of these years, supplemental production would be implemented immediately to restore the population.

If immediate actions are taken, we will have the capability to restore Red Lake sockeye salmon production. As a result of the oil spill, sockeye salmon returns are expected to be so low in 1993 and 1994 that minimum spawning population goals will not be achieved. If this were to happen, the productivity of this lake would be underutilized, and the fisheries would be seriously impacted in future years.

Restoration will involve taking a total of six million early run sockeye salmon eggs at Red Lake by August 30 each year. The eggs will be transported and incubated in a module at the Pillar Creek Hatchery in Kodiak. Fry will be reared until emergence and then released into Red Lake in May of each year.

The commercial purse seine fleet will benefit from this project as well as all associated fishing communities on Kodiak Island. The Red Lake sockeye fishery has historically provided a stable, significant source of income for Kodiak fishermen, consequently, restoration of this system is extremely important.

WHAT

Contingent upon the finding of a sockeye salmon synthesis meeting, this project is intended to supplement natural sockeye fry production in Red Lake with fry plants if escapement levels fall below minimum levels.

Project objectives are as follows:

1. Increasing the incubation and rearing capacity of Pillar Creek Hatchery to support additional Red Lake eggs and fry.
2. Collecting six million early run Red Lake sockeye eggs, beginning in 1993 and continuing through 1995, contingent upon Red Lake escapement falling below the minimum escapement goal of 150,000 by August 1.
3. Incubation of six million Red Lake sockeye eggs at Pillar Creek Hatchery with 90% survival from green to eyed eggs.
4. Rearing of approximately 5.4 million Red Lake sockeye fry at Pillar Creek Hatchery to the size of .25 grams with 90% survival.
5. Evaluating freshwater survival and the success of hatchery fry plants, by thermally marking otoliths of fry prior to stocking into Red Lake.
6. Stocking of approximately 4.9 million fed fry (.25 gram) into Red Lake with timing parallel to the period of wild stock recruitment.
7. Producing approximately 146,000 adult red salmon from annual fry plants (3% fry to adult survival).

WHY

The project restoration activity will result in restoration by allowing wild and cultured fry to enter the lake at the same period. A forecasted survival rate of 3% from fry to adult could result in 146,000 adults returning each year to the Red Lake system.

Project Descriptions

This project should be funded because immediate actions are needed to restore Red Lake sockeye salmon production if expected damage from the oil spill is realized. This damage is expected to result in weak return in 1993 and 1994, when minimum escapement goals may not be achieved. If this happens, the productivity of the lake would be underutilized and the fishery and economy would be seriously impacted in future years.

HOW

Pillar Creek hatchery will be modified by the addition of an incubation module and 24 Kitoi box incubators to allow receipt of Red Lake eggs. Additional raceways will be installed to short-term rear emergent fry. Net pens, frames, seines and other egg take gear will be purchased and staged in Kodiak in July each year, after the initial purchase in 1992. If escapement into Red Lake is below 150,000 by August 1 (beginning in 1993) an egg take will proceed. Eggs will be collected, with a goal of 6,000,000, in August and transported to Pillar Creek Hatchery for incubation. During incubation, between the eyed and hatched stages, eggs will be marked by thermally induce otolith banding. Fry will be reared in aluminum raceways until reaching a weight of .25 grams and then will be transported by float plane for release into Red Lake. Smolt samples will be collected via NRDA #27 smolt enumeration project and checked for marks to determine hatchery fry contribution and project success.

This project will be operated in close association with NRDA Study #27 which monitors the effects of the 1989 overescapement on the productivity of Red Lake. This monitoring will assist with forecasting returns and, in association with the ADF&G weir, will help coordinate this project's restoration activities. Also, Pillar Creek Hatchery enhancement and rehabilitation activities in other areas of Kodiak Island will provide technical assistance to this project.

Red Lake lies within the boundaries of the Kodiak National Wildlife Refuge. Other projects of this type on refuge lands have required an environmental analysis (EA) and a "finding of no significant impact." The EA will be completed prior to implementation of this project.

WHEN

July 1992 -	Jan. 1993	Purchasing incubators, raceways, pipeline, and plumbing
Jan. 1993 -	Feb. 1993	Purchasing egg take supplies
Nov. 1992 -	Dec. 1992	Annual project status report
Mar. 1993 -	June 1993	Preparation of PCH for receiving of eggs; incubator, raceways, and pipeline installation, egg take camp set up, supply ordering
July 1993 -	Aug. 1993	Egg take site preparation
Aug. 1993 -	Sep. 1993	Red Lake sockeye egg take and site breakdown
Nov. 1993 -	Dec. 1993	Annual project status report
Aug. 1993 -	May 1994	Red Lake sockeye incubation and rearing
May 1994 -	May 1994	Red Lake stocking

Repeat above sequence until end of project.

BUDGET (\$K)

	ADF&G
Personnel	\$ 32.3
Travel	0.9
Contractual	7.2
Commodities	14.8
Equipment	16.6
Capital Outlay	<u>0.0</u>
Sub-total	\$ 71.8
General Administration	<u>5.4</u>
Project Total	\$ 77.2

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93031

Project Title: Red Lake Mitigation for Red Salmon Fishery

Project Category: Restoration, Manipulation and/or Enhancement

Project Type: Fish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 10, 1993 to September 30, 1996

INTRODUCTION

Red Lake, located on the southwest side of Kodiak Island, has historically been one of the most consistent producers of sockeye salmon for Kodiak's commercial purse seine fishermen. The Department of Fish and Game's annual escapement goal for the system ranges from 200 to 300 thousand sockeye salmon. Since 1980, the catch has ranged from 25,000 to 1.5 million with an average of 450,000. This fishery has had an average annual value to fishermen of about \$2.2 million and has reached as high as \$10 million.

Careful management of the number of spawning fish is required to maintain this fishery at a high level. Young sockeye salmon spend at least their first year of life (up to 3 years) living and growing in lakes where they rely on microscopic-sized animals (plankton) for food. These animals, in turn, graze on tiny plants. If too many adult salmon spawn in the lake system, an overabundance of the young sockeyes will deplete their limited food source before they migrate to sea. When this happens, large numbers of young salmon die, survivors grow more slowly and smaller numbers migrate to the ocean to mature. So, large numbers of spawners in one year may result in an unusually small run in the next cycle.

In 1989, as a result of the *Exxon Valdez* oil spill, commercial salmon fishing was closed over most of Kodiak Island waters. The closure resulted in an escapement of 768,000 sockeye salmon into Red Lake, a 2.5 fold increase over the maximum desired. Data gathered showed low survival for the 1989 escapement year. Surveys showed low numbers of juveniles in the lake in the fall of 1990 and 1991; and in the spring of 1990, 1991, and 1992 reduced numbers of migrant smolts were observed.

The 1989 brood year failure could result in very low returns of sockeye salmon in 1993, 1994, and 1995. Minimum escapements may not be reached resulting in fishery closures and the purse seine fleet being displaced to other fishing areas. Fishing will not return to normal until several years after the numbers of outmigrating smolts have returned to normal. Therefore, if outmigrating smolt numbers are within the normal range in June and July of 1993, it will not be necessary to continue this project, though approved, because adequate numbers of adults for escapement goals and fisheries will be expected to return in the same years as the mitigation

fisheries this project would create. Conversely, until outmigration has been demonstrated to have returned to normal, it will be necessary to produce hatchery smolts for a mitigation fisheries.

This project will be undertaken at Kitoi Bay Hatchery where early run sockeye will be net pen-reared in brackish water for accelerated growth and released as age zero smolt. Returns from smolt releases will provide a fishery in Northeast Afognak district. The commercial purse seine fleet and associated business communities of Kodiak Island will have an opportunity to benefit from this project. Village residents of Afognak Island and other areas will also have increased subsistence fishing opportunities. The expected return of 4.8 million smolt released annually will be 100,000 sockeye. At a value of \$1.00/pound and 5-pound average, the total value of the program is \$500,000.

WHAT

A. Goal

Contingent upon the results of the sockeye salmon synthesis meeting, this project will be funded to provide an alternative commercial fishery to mitigate the impact of lost fishing opportunities as a result of very low returns of sockeye salmon in 1996 and beyond.

B. Objectives

The objectives of this project are as follows:

1. Modify existing incubation modules at Kitoi Bay Hatchery for receiving Afognak Lake sockeye eggs.
2. Collect 6 million early run sockeye salmon eggs from Afognak Lake and transport them to Kitoi Bay Hatchery.
3. Increase sockeye fry/smolt rearing capabilities at Kitoi Hatchery to accommodate 5 million fry/smolt.
4. Mark 10 - 15% of fry prior to net pen rearing for evaluation of returns, imprinting success and possible straying.
5. Net pen rear fry/smolt in brackish water to a target size of 4-5 grams and release by June 30.
6. Evaluate growth, diet and behavior of age zero smolt releases at Kitoi Bay until migration is complete.
7. Evaluate survival, imprinting and straying of returning adults in 1996 and 1997 by operating weirs at Little Kitoi, Paul's Bay; sampling at Afognak Lake weir; sampling at Little Afognak Lake.

Project Descriptions

WHY

If immediate actions are taken, alternative commercial sockeye salmon fishing opportunities can be provided beginning in 1996. The focus is to develop alternative fisheries in other areas where returns would be most manageable and wild stocks would be least affected. This proposal will mitigate the impact of the *Exxon Valdez* oil spill on future Red Lake commercial sockeye fisheries.

The Trustees should fund this project because immediate action is needed to offset the fishery losses due to overescapement of the 1989 brood adults.

HOW

Kitoi Bay Hatchery will be modified by the addition of an incubation module and incubation water disinfection capability. Six million early run Afognak lake sockeye eggs will be collected in August under sockeye culture guidelines, and transported by float plane to Kitoi Hatchery for incubation. After emergence and ponding in freshwater troughs, 10 -15% of the total sockeye fry will be marked by ventral fin clipping, prior to rearing in brackish water net pens. Marking quality will be monitored to assure valid marks. Following seawater challenge tests, fry (fingerlings) will be ponded into net pens in Little Kitoi Bay and reared to achieve 4 - 5 gram smolt with growth rate monitored on a weekly basis. Smolt will be released into Little Kitoi Bay after achieving target size and timed to parallel Afognak smolt outmigration timing. Once released, smolt movements will be monitored, samples will be collected for stomach content analysis and additional growth information. To evaluate returns from smolt releases as well as imprinting, a weir will be operated at Little Kitoi where escapement will be enumerated and age, sex and length data collected. Returning adults will be examined for marks. Also, the commercial harvest will be sampled in the same manner. Returning sockeye at Paul's Bay, Little Afognak, and the parent system at Afognak Lake will be sampled to assess possible straying. Paul's Bay will be weired and returns will be examined for marks as well as age, sex and length data collected. At Little Afognak, samples will be collected by beach seining and post spawning surveys. Samples will be collected and examined for marks at the Afognak River weir currently operated by ADF&G.

This project will be coordinated with NRDA F/S 27 which will continue damage assessment of Red Lake. Information from this study will determine the long term effects of overescapement, and the length that mitigation for fishing loss will be necessary. Also, a current zero check sockeye program in place at Kitoi will provide technical assistance in the mitigation project.

ENVIRONMENTAL COMPLIANCE

The following steps will be taken to comply with environmental regulations:

1. Completion of General Waterway/Waterbody application to be submitted to Habitat Division of ADF&G for the weirs at Little Kitoi and Paul's Bay.
2. Completion of Coastal Zone Consistency Review Questionnaire to be submitted to State of Alaska for both weired systems.

WHEN

Jan. 3, 1993 - Feb. 1, 1993	Permitting (FTP, Habitat)
Jan. 3, 1993 - Mar. 31, 1993	Kitoi modifications (incubation, rearing)
June 1, 1993 - July 1, 1993	Egg take preparation and supply orders
July 15, 1993 - Aug. 1, 1993	Egg take at Afognak Lake (6 million eggs)
Aug. 1, 1993 - Mar. 1, 1994	Incubation of eggs at Kitoi
Mar. 1, 1994 - Apr. 15, 1994	Marking of fry
Apr. 15, 1994 - May 30, 1994	Net pen rearing of fry
June 1, 1994 - June 15, 1994	Smolt released in Little Kitoi Bay
May 1, 1994 - Aug. 31, 1994	Adult weirs installed and operated at Little Kitoi and Paul's Bays
Sep. 1, 1994 - Oct. 1, 1994	Report writing

BUDGET (\$K)

	ADF&G
Personnel	\$ 59.4
Travel	0.7
Contractual	5.1
Commodities	16.8
Equipment	62.4
Capital Outlay	<u>0.0</u>
Sub-total	\$ 144.4
General Administration	<u>9.3</u>
Project Total	\$ 153.7

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93032

Project Title: Pink and Cold Creek Pink Salmon Restoration

Project Category: Restoration, Manipulation and/or Enhancement

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 10, 1993 to September 30, 1994

INTRODUCTION

This project will target Pink Salmon stocks (will also indirectly target Coho salmon at Cold Creek) at Cold and Pink Creeks on Afognak Island (see map). Pink Creek drains into Afognak River which enters Afognak Bay on southeast Afognak Island. Cold Creek drains into Danger Bay, adjacent to Duck and Izhut Bays on northeast Afognak Island. Restoration Study 105 surveyed these systems in 1992 to determine fishpass feasibility. A falls blocks pink salmon from reaching a potential spawning area in Pink Creek. Cold Creek has a steep gradient that blocks upstream migration at low to moderate water periods. Spawning area above the barrier at both Pink and Cold creeks has been determined to be of good to excellent quality and in sufficient quantity to support 3,000 and 9,000 spawners, respectively. Both systems currently have limited Pink Salmon production due to these barriers preventing access to spawning areas. Escapements to each of these systems have been limited to several hundred spawners each year.

Afognak Bay, Izhut Bay and other areas on northeast Afognak as well as Shuyak Island were oiled in 1989 and oil still remained in these areas in 1990. Resource damage assessment was not conducted in these areas, however, in Prince William Sound, damage to pink salmon eggs and juveniles has been documented under similar conditions of oil contamination.

This project will be undertaken at Pink Creek (252-342) and Cold Creek (252-331) which are located on Afognak Island. The benefits from this project will be realized by increased Pink (and Coho) returns to these systems, providing up to 17,000 (pinks) for commercial and subsistence harvest. The villages of Port Lions, Ouzinkie, and the City of Kodiak will benefit economically from this project through direct fishery receipts and all associated fisheries business enhancement.

WHAT

A. Goal

The goal of this project is to increase Pink salmon spawning capability, and overall pink salmon (and coho) returns, by enhancing fish passage above barriers in Pink and Cold creeks.

B. Objectives

The objectives of this project are as follows:

1. Evaluate pink salmon escapement and spawning distribution in Cold and Pink creeks.
2. Bypass barriers in Cold and Pink creeks by installing steep pass sections or cutting channels in substrate.
3. Evaluate fish passage through barrier bypasses by conducting peak spawning surveys.

WHY

This project will be an economical way to increase wild Pink and Coho stocks in specific areas contaminated by oil or areas in close proximity to impacted areas. In PWS, Pink salmon eggs and fry were injured by oil contamination. These injuries were documented in PWS. In the waters near Afognak and Shuyak Islands, similar impacts may have occurred. Since a significant amount of spawning area is presently unavailable to Pink (and Coho) salmon on these systems due to barrier falls, this project will realize a measurable benefit by making these areas available to spawning Pink salmon.

HOW

Initially prior to construction, a peak spawning survey would be conducted to define peak salmon distribution in Pink and Cold creeks. Bypass construction materials would be staged at each project site. Construction would require steep pass sections resulting in a 15-foot rise to bypass the barrier falls at both Cold and Pink creeks. Channels also would be cut leading into the upstream end of the steep passes. Water diversion structures such as gabions, reinforced with steel pipe and rebar, would divert water into the channels and steep passes. Cables would be anchored into the rock substrate to secure the steep passes. This project would be evaluated by stream surveys during the peak pink salmon spawning period.

This project will be directly related to previous feasibility work conducted through Restoration Project 105. Feasibility stages of this project were defined through R105. In addition, Alaska Department of Fish and Game, FRED Division, in cooperation with Kodiak Regional Aquaculture Association operates other fishpass projects on Afognak Island. Efforts for this project will be assisted through technical assistance and offered by these ongoing projects.

MATCHING ELEMENTS

The Department of Fish and Game has already purchased from other funding sources the needed steep pass components which are valued at approximately \$70,000.

Project Descriptions

ENVIRONMENTAL COMPLIANCE

The following steps will be taken to comply with environmental regulation:

1. Completion of General Waterway/Waterbody application to be submitted to Habitat Division of ADF&G for both Pink and Cold Creeks.
2. Completion of Coastal Zone Consistency Review Questionnaire to be submitted to State of Alaska for both creeks.
3. Compliance with any environmental land use regulations imposed by Afognak Natives (land owners) will be strictly adhered to.

WHEN

Nov. 1, 1992 - Dec. 1, 1992	DSP
Jan. 1, 1993 - Jan. 15, 1993	Habitat application
	Equipment order, steppass
Feb. 15, 1993 - Feb. 30, 1993	Fabrication
	Stage steppass section
Mar. 15, 1993 - Mar. 30, 1993	at sites
	Construction, steppass
July 1, 1993 - Aug. 1, 1993	installation
Aug. 15, 1993 - Aug. 31, 1993	Peak spawning survey
Nov. 1, 1993 - Dec. 1, 1993	Report writing
	Follow up construction
July 1, 1994 - Aug. 15, 1994	modification
Aug. 1, 1994 - Aug. 31, 1994	Final peak spawning survey
Nov. 1, 1994 - Dec. 1, 1994	Final report writing

BUDGET (\$K)

	ADF&G
Personnel	\$ 21.3
Travel	0.0
Contractual	3.6
Commodities	2.3
Equipment	5.4
Capital Outlay	<u>0.0</u>
Sub-total	\$ 32.6
General	<u>3.5</u>
Administration	
Project Total	\$ 36.1

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93033

Project Title: Harlequin Duck Restoration Monitoring Study in Prince William Sound, Kenai, and Afognak Oil Spill Areas

Project Category: Restoration Monitoring

Project Type: Birds

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Park Service; U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration; National Marine Fisheries Service, Auke Bay Laboratory; Alaska Department of Natural Resources

Project Term: January 10, 1992 to September 30, 1995

INTRODUCTION

The *Exxon Valdez* oil spill (EVOS) significantly affected Harlequin Ducks (Histrionicus histrionicus). Not only was there direct mortality of at least 200 Harlequins in Prince William Sound (PWS), but there has been a nearly complete reproductive failure of residents of the western PWS oil spill area from 1990 to 1992. (No study was conducted in 1989). This is a significant and unexpected long-term effect. Because some Harlequins spend their entire lives in the oil spill area, where they breed, feed, and overwinter, it is possible to detect and study this impact of EVOS. (Non-resident Harlequins and other seaducks that over-winter in oiled areas may be similarly affected, but because they breed in areas remote from the spill, it is impractical to study them.)

Harlequins are intertidal feeding diving ducks. The Harlequin Duck population in the Prince William Sound, Kenai, and Afognak areas contains both residents and non-resident migrants. The residents breed along forested streams within a few kilometers of saltwater, molt in secluded bays and lagoons, and roost on offshore rocks. Broods are found with hens on saltwater in summer. Non-resident Harlequin Ducks which winter on the south coast of Alaska breed elsewhere on mountain streams. They arrive in the south coastal area in October and depart in May. Harlequin Ducks return to the same breeding and wintering areas year after year.

Breeding Harlequin Ducks were formerly distributed throughout PWS, including the oil spill area, with broods commonly observed in shoreline habitats (Isleib and Kessel, 1973; Isleib, pers. comm.). Subsequent to the oil spill, Harlequin Ducks have failed to breed in western Prince William Sound, and their population has declined in the oil spill area.

In contrast, these ducks reproduced normally in unoiled areas of Prince William Sound, and their population has remained stable. A few broods were found on the periphery of the EVOS area in 1991-92.

The reproductive failure of Harlequin Ducks in the oil spill area is postulated to be a chronic effect of petroleum exposure through contaminated intertidal food. Blue mussels (Mytilus) appear to be the most likely source of contamination. They are well known to concentrate and hold pollutants in their tissues. Restoration Study #103 has documented high concentrations of polynuclear aromatic hydrocarbons (PAHs) in mussel flesh, byssal thread mats, and underlying substrates in western PWS in 1992. Because Harlequin Ducks consume entire mussels, ingesting petroleum hydrocarbons in mussel tissue, on the shell surface, and in attached byssal threads and sediment, Harlequin Ducks collected in 1989-90 in western PWS and SW Kodiak contained oiled food items in their gullets and petroleum residues in liver tissue and bile. Experimental studies have demonstrated that single small doses of petroleum can cause reproductive failure in some seabirds. A search of the files of U.S. Coast Guard Federal On-Scene Coordinator indicated that approximately 130 blue mussel beds may retain EVOS oil in western PWS. However, field evidence collected in 1992 has shown additional previously unreported oiled mussel beds in PWS and along the Kenai coast. EVOS oil also remains associated with dispersed blue mussels in a number of sheltered locations currently under investigation. Damage Assessment studies of Harlequin Ducks through 1992 have been limited to Prince William Sound. Additional work is needed on Afognak and the Kenai coast. Extensive oiling of Kenai Fjords National Park is well documented, and there may be continuing injury to Harlequin Ducks occupying suitable habitat in this park unit.

WHAT

A. Goals

1. Study Harlequin reproductive failure in western PWS
2. Characterize Harlequin Duck nesting habitat on the outer Kenai coast and Afognak Island;
3. Determine whether there is reproductive failure elsewhere in the oiled area (Kenai coast and Afognak Island).

B. Objectives

1. Radio-track Harlequin Ducks to nest sites on the outer Kenai coast and Afognak
2. Determine the distribution of breeding Harlequins, using pair counts and brood surveys, in oiled and non-oiled areas
3. Compare characteristics of streams on which successful Harlequin reproduction is occurring in unoiled areas to those of similar streams, in both oiled and unoiled areas, having no Harlequin reproduction
4. Identify food items in Harlequin Ducks found dead during the oil spill
5. Obtain new information on movements of resident breeding and non-breeding Harlequins, including documentation of spring and summer habitat use, home ranges, foraging behavior and nest site selection
6. Determine petroleum residues in tissues of collected and live-trapped Harlequin Ducks
7. Determine the diet of collected Harlequin Ducks.

Project Descriptions

WHY

The ultimate goal of this project is the restoration of breeding Harlequin Ducks to the oil spill area. To achieve restoration requires the following:

1. Determine the geographic extent of the reproductive failure
2. Define habitat requirements to guide restorations, and
3. Determine whether hydrocarbon residues are currently present in Harlequins in order to clarify the link to persistent oil contamination. If the observed failure of reproduction is related to the contaminated food chain, remaining oil may need to be treated to make other restoration efforts more effective. In some cases these mussel beds remain grossly contaminated. Technical knowledge of habitat requirements of breeding Harlequin Ducks may prove valuable for habitat acquisition and mitigation measures, protection of non-Federal lands in National Park Service areas, development of marine sanctuaries, or other restoration actions.

HOW

ADF&G will use methodology developed during previous Harlequin Duck studies. The 1993 project will concentrate on nesting habitat characterization along the outer Kenai coast and Afognak Island but will also monitor the reproductive failure in PWS. The same methodology will also determine whether the reproductive failure extends outside PWS. The expanded geographical area will involve less survey intensity per unit area, but will include initial boat surveys for identification of pairs at stream mouths in late spring, followed by trapping of selected stream estuaries. Harlequin females flying to streamside nest sites in early summer will be mist-netted and radio-tagged. Using new radio telemetry techniques, nine Harlequin nests have been located in unoiled PWS 1990-91. The nests were located on steeply sloping stream banks in old growth forest. Nest sites, broods, and feeding areas on the Kenai coast and Afognak Island will be located by following the radio-tagged hens through the summer nesting and brood-rearing period. Brood count surveys will be conducted in shoreline habitats in late summer in western PWS and selected areas of the outer Kenai coast and Afognak Island. Breeding survey results from the oil spill areas will be compared to unoiled control areas on Afognak Island. As nests are located in the Kenai - Afognak area, habitat characterization work will be conducted at each site. Blood samples will be collected from breeding Harlequins in unoiled areas and from molting Harlequins in oiled areas. Blood and tissue samples may also be taken from collected ducks. Blood samples will be analyzed for normal blood parameters and presence of elevated levels of haptoglobins and interleukins. Tissue samples (fat, liver, bile) from 40 collected ducks from the Prince William Sound and Afognak oil spill areas will be analyzed for presence of petroleum hydrocarbons. Feather samples will be examined for presence of vanadium, a trace metal indicating petroleum exposure. Fecal samples from flightless birds trapped during the molt will be collected to determine presence/absence of recent petroleum exposure (i.e. through contaminated blue mussels) by means of fluorescence testing. The Harlequin diet will be studied by examination of gullet contents of Harlequin carcasses from the EVOS bird morgue in Anchorage. This project will coordinate with Restoration Study # 051 (Quantification of Stream Habitat for Harlequin Ducks from Remotely Sensed Data) to ground-truth aerial photographs and

satellite imagery in the PWS and Afognak areas. There is no financial or operational overlap with project #93051.

ENVIRONMENTAL COMPLIANCE

This project will comply with requirements of the National Environmental Policy Act. No environmental analysis is required to conduct this study, because it is a research project. State and Federal collecting permits will be obtained through regular procedures.

WHEN

This project will be conducted during 1993-1995. Field work will be completed each year by August 30. Report preparation will begin in September, and the annual progress report will be completed before January 30. Literature review and study plan revisions will be conducted during February. Preparation for field work will continue during March-April. Field work and camp set-up will begin in early May. Resident pair counts will be conducted in late May. Stream sampling, capture and radio-tracking of females will be carried out during June; radio-tracking non-breeders will continue until mid-July. Molt surveys will be carried out between July 15-August 15. Capture and blood sample of flightless molters will take place July 20-August 10. Brood counts will take place between August 15-September 1. Final Report Preparation will be between September 1, 1994-January 29, 1995.

BUDGET (\$K)

(The Trustee Council, at the September 21, 1993 meeting, added an additional component identifying Harlequin duck habitat on the Kenai Peninsula, but directed that the budget figures for this component be identified separately.)

	ORIGINAL ADF&G	KENAI COMPONENT	ADF&G TOTAL
Personnel	\$ 239.0	\$ 59.0	\$ 298.0
Travel	23.0	4.0	27.0
Contractual	156.8	105.0*	261.8*
Commodities	21.0	7.0	28.0
Equipment	20.0	20.0	40.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 459.8	\$ 195.0	\$ 654.8
General Administration	<u>46.8</u>	<u>16.3</u>	<u>63.1</u>
Project Total	\$ 506.6	\$ 211.3	\$ 717.9

* U.S. Department of Interior vessel may be available for the Kenai component of this project at no cost, resulting in a reduction in contractual costs of \$ 50K.

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93034

Project Title: Pigeon Guillemot Colony Survey

Project Category: Habitat Protection and Acquisition

Project Type: Birds

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to December 31, 1993

INTRODUCTION

A. Background and Summary of Injury

The pigeon guillemot (*Cepphus columba*), a diving seabird, feeds in nearshore waters and nests in numerous small colonies on rocky shores throughout the eastern North Pacific. The U.S. Fish and Wildlife Service began studies of pigeon guillemots at Naked Island in the center of Prince William Sound (PWS) during the late 1970s when oil tanker traffic began through the sound. These studies have provided baseline data for evaluating the effects of the spill on guillemots.

An estimated 2,000 to 3,000 guillemots were killed as a direct result of the *Exxon Valdez* oil spill. These birds may have represented as much as 10% of the cataloged pigeon guillemot population in the Gulf of Alaska, and 33% of the 1991 estimated PWS population. Pigeon guillemots are one of six seabird species that showed significantly greater declines in the oiled area of PWS. The PWS summer population has declined from over 15,000 in 1972 to 6,585 in 1991. At Naked Island, guillemot numbers declined more in oiled areas, and a complete colony census in 1992 showed continuing decline. Adults were contaminated internally, and unhatched eggs showed internal and external contamination in 1989 and 1990. On a daily basis throughout the summer, guillemots perch on intertidal and supratidal rocks at nesting colonies, and researchers have hypothesized that guillemots were, and continue to be, contaminated by shoreline oiling.

Knowledge of the distribution of guillemot colonies and of the number of birds breeding at these colonies is very limited. Because guillemots often represent only a small number of the birds nesting at large multispecies colonies, researchers typically only list guillemots as present, and good estimates of their numbers are not often made. In addition, guillemots nest at many locations where the other more abundant seabirds do not breed, thus the majority of guillemot colonies are missed completely.

Within the spill area, censuses specific for pigeon guillemots have been conducted only in very limited areas around Naked Island and Afognak Island (1992 only). Although Bird Study 2 provided a population estimate for PWS guillemots, these surveys were not designed to identify breeding colonies. Information on the location and degree of oiling at guillemot colonies would

identify areas where protection management actions might be appropriate or where additional cleanup could benefit guillemots.

B. Location

This project will be conducted in PWS with efforts focused primarily in the western sound.

WHAT

A. Goal

The goal of this project is to enhance recovery of pigeon guillemot populations injured by the *Exxon Valdez* oil spill. This goal will be accomplished by identifying important breeding areas for possible protection or additional cleanup.

B. Objectives

1. Identify and map pigeon guillemot colonies within the trajectory of the *Exxon Valdez* oil spill.

WHY

A. Benefit to Injured Resources/Services

This project will benefit injured pigeon guillemot populations by identifying and censusing guillemot colonies throughout the spill area. Important breeding areas must be identified to enable protective measures or land acquisition which will benefit guillemot restoration. Guillemots nest in crevices among supratidal talus, on cliffs, or in the cavities formed by the roots of trees at the forest/cliff edge. Guillemot nest sites are sensitive to logging operations or other shoreline developments, since they utilize forest edges and beach talus. Because guillemots tend to feed near their nest sites, adjacent foraging areas could also be impacted by such activities as logging, tailings from mining operations, intensive commercial fishing, barge or dredging operations, and recreation activities. Thus, foraging areas near large guillemot colonies might be included in a marine sanctuary system or be protected by an extended buffer strip.

B. Relationship to Restoration Goals

This project meets the Trustee Council goal of restoring the environment to its pre-spill condition by identifying management actions that will help restore an injured marine bird species.

HOW

A. Methodology

Pigeon guillemot colonies will be located and censused by cruising the shoreline when birds are at their colonies. The optimum time for locating colonies is prior to incubation, in May and early June, at 0400-0800 h or at high-tide. In PWS, three teams of two observers operating from 25-

Project Descriptions

foot boats will find colonies by cruising close to shore during the appropriate hours. About 60 km of shoreline can be covered per boat per day during appropriate hours, so that much of the west side of PWS can be covered in May and early June. Colony locations will be marked on topographic maps and lat/long recorded using the Global Positioning System. Colonies will also be censused. Habitat, nest accessibility and onshore oiling at each colony will be recorded.

B. Coordination with Other Efforts

This project will use existing distribution and abundance data collected by the PWS boat survey project (former Bird Study 2) to determine likely guillemot colony locations. This project will also share personnel and equipment with the proposed 1993 boat survey project (Project 93045), assuming both projects are approved. Data on colony locations will be added to the Catalog of Alaskan Seabird Colonies. The catalog, including updated information such as will be collected by this proposed project, will be used as a data layer for the oil spill area geographic information system being developed under proposed project 93060 (Accelerated Data Acquisition for Habitat Protection/Acquisition).

ENVIRONMENTAL COMPLIANCE

This project relies on non-intrusive methods and appears to qualify for a categorical exemption from the requirements of the National Environmental Policy Act.

WHEN

March - April 1993	Study Design and Logistical Planning
May - June 1993	Colony Census
Sept. - Dec. 1993	Data Analysis, Report

BUDGET (\$K)

	USFWS
Personnel	\$ 53.0
Travel	10.0
Contractual	55.0
Commodities	21.0
Equipment	15.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 154.0
General Administration	<u>11.8</u>
Project Total	\$ 165.8

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93035

Project Title: Potential Impacts of Oiled Mussel Beds on Higher Organisms: Contamination of Black Oystercatchers Breeding on Persistently Oiled Sites in Prince William Sound

Project Category: Restoration Monitoring/Restoration Manipulation

Project Type: Birds

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to March 15, 1994

INTRODUCTION

A. Background

The Shoreline Assessment Program which has monitored the recovery of beaches impacted by oil from the *Exxon Valdez* spill has documented the existence of persistent oil contamination in dense blue mussel (*Mytilus edulis*) beds at more than 100 sites throughout western Prince William Sound (PWS). The oil has been trapped under the mussels in the byssal mats that anchor the mussels to each other and to the substrate. In this anaerobic environment, the oil has not degraded. Sheening from these beds has been observed, and aromatic compounds are still present.

The black oystercatcher (*Haematopus bachmani*) is a large shorebird that lives on rocky intertidal shores throughout the North Pacific. They nest in the open on rocky points and islets and rely on cryptic egg coloration and distractive behaviors to avoid predation of eggs and chicks. After hatching, adults feed their chicks until the chicks are capable of feeding themselves; the total length of this rearing period is unknown, but may last two or more months. During the early rearing period, the adults and chicks occupy a feeding territory in the vicinity of the nesting site. Black oystercatchers feed on a variety of intertidal mollusks, including mussels which form a significant portion of the diet of both adults and chicks. In PWS, oystercatchers favor gravel shorelines, and mussel beds embedded in sand/gravel beaches are an important foraging habitat. The mussel beds used by oystercatchers in PWS occur in low energy environments where oil persists. Because oystercatcher chicks are fed food items from a restricted area near their natal site, oystercatcher chicks are excellent subjects for monitoring how oil from the *Exxon Valdez* spill is affecting the physiology and reproduction of a higher vertebrate species. Because of their complete dependence on rocky intertidal areas and the importance of mussels in their diet, black oystercatchers can serve as an indicator species for assessing the condition of rocky intertidal habitats and the continuing presence of oil in such habitats.

B. Summary of Injury

Oil from the *Exxon Valdez* contaminated rocky shorelines used by black oystercatchers for feeding and nesting. Based on initial studies in PWS at Green Island, the oiling affected black oystercatchers by reducing the number of breeding pairs and by reducing egg volume. Subsequent studies demonstrated that oystercatcher chicks raised on oiled beaches, despite being delivered a larger biomass of food, grew slower than chicks raised on unoiled beaches. Based on studies with captive birds, ingestion of oil can decrease growth because energy that would otherwise be used for growth is used to fuel the metabolic processes that detoxify oil. The reduced growth rates of chicks raised at sites with persistent oil contamination is still occurring, suggesting continuing injury due to the presence of *Exxon Valdez* oil in rocky intertidal habitats.

C. Location

This study will be conducted in Prince William Sound. Study sites will include Montague Island (unoiled), Green Island (oiled) and Knight Island (oiled):

WHAT

A. Goal

The goal of this study is to determine whether black oystercatchers breeding on shorelines with persistent oil contamination in Prince William Sound are affected by their use of these habitats. This study will determine if there is a link between use of oiled mussel beds by oystercatchers and their reproductive success, as evidenced by chick growth rates and recruitment. This project will only be undertaken if the review of the results of the 1992 work indicates a need for further work on this species.

B. Objective

1. To determine if the continued persistence of hydrocarbons in mussel beds is being transferred to chicks via the food chain and is responsible for depressed growth rates.

WHY

A. Benefit to Injured Resources

This study will be beneficial to the restoration of black oystercatchers because the study will determine whether continuing injury or recovery is occurring at oiled sites. If recovery is not occurring, the study is designed to reveal whether a cause of the continuing injury to oystercatchers is use of oiled mussel beds for feeding. This study will identify specific mussel beds and their characteristics which result in the continuing injury to oystercatchers. These data could be used to identify sites needing additional treatment. Treatment of such sites will eventually benefit oystercatchers by returning their foraging areas to a normal condition.

Project Descriptions

B. Relationship to Restoration Goals

This study meets two Trustee Council restoration goals: restoration monitoring and restoration manipulation. This study will determine whether black oystercatchers are continuing to be adversely affected by persistent oil contamination. This information is necessary to plan meaningful restoration actions. This study will also identify areas with persistent contamination and document the effects of that contamination on a higher trophic level organism. These data could be used by the Trustee Council to identify specific areas needing additional treatment so that the contamination can be eliminated.

HOW

A. Methodology

Study methodology will follow previous study plans. From June to late August, study personnel will operate from field camps at Herring Bay, Knight Island, Montague Island, and Green Island. Chicks raised on Montague Island will serve as unoiled controls.

Chicks will be banded with individually-recognizable color bands when ≥ 7 days old and will be reweighed twice before fledging. At ≥ 25 days, blood samples will be collected from chicks. Fecal samples from chicks will be collected and analyzed to determine the presence of hydrocarbons ($n = 50$).

Recruitment of young into the breeding population and overwinter survivorship will be determined by relocation of color-banded birds marked in previous years by this study ($n = 140 +$).

Samples of mussels from mussel beds used by black oystercatchers for feeding will be collected for hydrocarbon analysis by the NOAA oiled mussel bed project.

B. Coordination with Other Efforts

This study continues damage assessment and restoration projects on black oystercatchers in 1989, 1991 and 1992. As in 1992, the study will coordinate with the proposed NOAA oiled mussel bed study to ensure that oiled mussel beds used by oystercatchers are included in the NOAA sampling program. This study will also coordinate with the proposed harlequin duck study.

ENVIRONMENTAL COMPLIANCE

This study is a non-intrusive study primarily involving observations and infrequent handling of live birds. No birds will be collected. Samples of oystercatcher fecal material and food items will be collected for analysis of hydrocarbon content. This study appears to qualify for a categorical exemption from the requirements of the National Environmental Policy Act.

WHEN

March 1993	Hire Project Leader
March - May 1993	Logistical Planning
June 1, 1993	Commence Field Work
August 31, 1993	Complete Field Work
Sept. - Dec. 1993	Data Analysis
January 1994	Draft Report
March 1994	Final Report

BUDGET (\$K)

	USFWS
Personnel	\$ 38.0
Travel	4.0
Contractual	45.0
Commodities	7.0
Equipment	5.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 99.0
General Administration	<u>8.9</u>
Project Total	\$ 107.9

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93036

Project Title: Recovery Monitoring and Restoration of Intertidal Oiled Mussel Beds in Prince William Sound and the Gulf of Alaska Impacted by the *Exxon Valdez* Oil Spill.

Project Category: Restoration Monitoring and Restoration Manipulation

Project Type: Coastal Habitat

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: National Park Service; U. S. Fish & Wildlife Service; Alaska Department of Fish and Game; and Alaska Department of Environmental Conservation

Project Term: January 1, 1993 to December 31, 1997

INTRODUCTION

A. Background on the Resource/Service

The persistence of *Exxon Valdez* crude oil underlying some densely packed mussel (*Mytilus trossulus*) beds in Prince William Sound, Alaska, began to cause concern, 1991, among scientists from state and federal agencies. With the encouragement of the Restoration Team and the Trustee Council, staff from several agencies conducted a field survey and sampled mussels and underlying sediments from several sites in June of 1991. Subsequent sampling trips were conducted by NOAA in August and September of that year and several times to date in 1992.

Preliminary analytical data indicate total aromatic hydrocarbon concentrations as high as 470 ppm dry weight in sediments and 5.5 ppm dry weight in mussels. Natural recovery of oiled mussel beds appears to be minimal.

B. Summary of Injury

High concentrations of oil in mussels from oiled mussel beds may provide a source of continued exposure to petroleum hydrocarbons through ingestion by higher consumers. There may be possible linkage to 2 species of birds - harlequin ducks and black oystercatchers; and possibly river and sea otters. The presence of these contaminated beds is also of concern for human subsistence.

C. Location

Identified and verified oiled, densely packed mussel beds are located throughout the western and southwestern part of Prince William Sound. The National Park Service has also surveyed and sampled mussels and sediments from oiled sites along the Kenai Peninsula and proposes to continue the monitoring in 1993. NPS expects to extend the geographic area of site survey to the Kodiak area.

WHAT

A. Goal

The overall purpose of this project is to document continued bioavailability of petroleum hydrocarbons to consumers of contaminated mussels, and determine the rate of recovery of oiled mussel beds with and without manipulation. Restoration/recovery methodology will be tested to accelerate cleansing of oiled mussel beds.

B. Objectives

- 1.a. To measure recovery of petroleum hydrocarbon concentrations to background levels in mussel bed sites manipulated in 1992. This involves three sites treated by NOAA and two sites manipulated by ADEC in 1992; and additional sites if cleaning mussel beds is initiated by ADEC in 1993 under Project 93038. [NOAA]
- b. To test the feasibility of new, minimally intrusive manipulative techniques at 3 oiled mussel bed sites within Prince William Sound; and to conduct restorative manipulations at selected sites in the Gulf of Alaska. [NOAA, NPS]
2. To measure natural recovery in levels of petroleum hydrocarbons in mussels and underlying sediments and oiled mussel beds identified and sampled in 1991 and 1992 and to sample mussel beds in areas newly identified by other agency field investigators. [NOAA, NPS]
3. To measure the physiological and reproductive injury of mussels, with and without treatment. [NOAA]

WHY

A. Benefit to Injured Resources/Services

This project will provide data on the efficacy of natural recovery processes and the efficacy of on-site cleaning or manipulation to hasten return to background levels.

Documentation of the level of hydrocarbons in oiled mussel beds or recovery of oiled mussel beds is necessary to evaluate continued linkage to injury seen in consuming species - harlequin ducks, black oystercatchers, river and sea otters; and, will provide necessary information for human subsistence purposes.

B. Relationship to Restoration Goals

If petroleum hydrocarbon concentrations remain high in these beds in 1993; further action may be necessary to minimize or eliminate these mussels as a pathway of oil being incorporated into the food chain of consuming mammals and birds. Recovery monitoring is necessary to insure that petroleum hydrocarbon levels in sediments and mussels have returned to background levels and are no longer a source of contaminated prey.

Project Descriptions

HOW

A. Methodology

Sampling of mussels and sediments for petroleum hydrocarbons will follow protocol established by NOAA and the NRDA process. NOAA's Auke Bay Lab has successfully established a fast screening method (UV Fluorescence) for sediment hydrocarbons. Using this technique, we have documented that hydrocarbon distribution within a heavily oiled mussel bed appears to be patchy and probably related to grain size of the sediment. Rapid turn around of hydrocarbon data allows targeting manipulative areas in a timely manner. Most sediment samples will be analyzed using this method and only selected sediment samples (mostly for method verification) and mussel samples (based on UV levels found at particular sites) will be analyzed by gas chromatography/mass spectroscopy.

Samples for histopathological analyses have been collected several times at manipulated and control sites in 1992 and we propose to process them and have them examined for anomalies, particularly precancerous conditions associated with long-term exposure to petroleum hydrocarbons. Data for condition and reproductive indices for mussels from selected sites will be calculated using accepted standard methods.

Byssal thread extrusion rates were measured in May 1992 and again in June 1992 in mussels from selected sites and data from these trials are currently being analyzed. Depending on results, we may again repeat this test in May 1993. Thread extrusion rates can be a sensitive indication of overall physiological health. These tests incorporate hydrocarbon depuration while mussels are exposed to clean seawater.

Maps will be produced showing within site variation of petroleum hydrocarbon concentrations at manipulated sites. These will show a time series to illustrate changes in concentrations at 30 days, 90 days and 1 year. Standard statistical analytical methods will be used on data and will be tested at the $P = .05$ level. Guidance here will come from that given by the NRDA peer reviewers.

B. Coordination with Other Efforts

Close coordination with principal investigators of species affected by ingestion of oiled mussels will be maintained to identify new areas of continued contamination.

ENVIRONMENTAL COMPLIANCE

This is a field research project in which routine data collection will take place which is limited in context and intensity. Consequently, this project is categorically excluded from being required to provide an Environmental Impact Statement or Environmental Assessment.

WHEN

Analytical Analyses: GC/MS analyses will be conducted at the completion of all NRDA samples still in the analytical queue. Selected mussel and sediment analysis are scheduled to begin in

December 1992 and expected to continue on an as needed basis through 1993. UV fluorescence screening will be done on an as needed basis. This technique produces data within 10 days. We estimate processing around 500 samples by this method in 1993.

Biological and physiological measurements and data from 1992 will be analyzed during Jan-Mar 1993.

Field work on manipulated sites is scheduled to occur during May with follow up evaluation at 30 days and at the end of the field season. Resampling of oiled mussel sites already identified and any new sites proposed by other agency field personnel will be sampled at a suitable low tide series - probably in late June. Some of this site sampling may be coordinated with the other trips.

BUDGET (\$K)

	NOAA	USNPS	ADEC	TOTAL
Personnel	\$ 126.0	\$ 31.5	\$ 0.0	\$ 157.5
Travel	23.0	6.0	0.0	29.0
Contractual	70.0	45.0	0.0	115.0
Commodities	26.6	7.6	0.0	33.6
Equipment	34.0	4.0	0.0	38.0
Capital Outlay	<u>0.0</u>	<u>4.0</u>	<u>0.0</u>	<u>4.0</u>
Sub-total	\$ 279.0	\$ 94.1	\$ 0.0	\$ 373.1
General Administration	<u>23.8</u>	<u>7.9</u>	<u>0.0</u>	<u>31.7</u>
Project Total	\$ 302.8	\$ 102.0	\$ 0.0	\$ 404.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93038

Project Title: Shoreline Assessment

Project Category: Restoration Monitoring

Project Type: Coastal Habitat

Lead Agency: Alaska Department of Environmental Conservation

Cooperating Agencies: Trustee Agencies

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

Shorelines treated during spill response activities need to be monitored to ensure recovery is proceeding at an acceptable rate and that winter storms have not brought subsurface oil to the surface. Shorelines treated in 1992 and other potentially oiled sites need to be evaluated to determine if the shorelines responded to treatment, or if additional treatment is required to restore resources and services. Technical experts with *Exxon Valdez* spill experience from the state and federal agencies along with the local communities will evaluate impacted shorelines for the presence of *Exxon Valdez* hydrocarbons. The evaluation will document the amount of remaining hydrocarbons and determine if the remaining oil impacts shoreline activities.

This project is divided into two phases. Phase 1 is the physical survey of selected shorelines. This project will use the assessment procedures developed and refined during the *Exxon Valdez* spill clean up. Agency surveyors and upland landowners will evaluate shorelines and determine if additional activities would be of net benefit to restore resources and services. Phase 2 is the restoration of land and resource uses, if necessary. Light duty restoration activities would be performed during and after the survey by the surveyors where feasible. Larger scale treatment work, if necessary, would be identified on work orders and restoration crews from Chenega, Port Graham or other areas would be hired to perform the identified work.

This project will assess *Exxon Valdez* impacted shorelines in Prince William Sound and the Gulf of Alaska. The principal areas are Knight, Latouche, Evans, Elrington, Green, and Disk Islands in Prince William Sound and Tonsina Bay, Windy Bay, and Chugach Bay in the Gulf of Alaska. These areas are in proximity to Chenega Village, Whittier, Port Graham, Seward and Homer.

WHAT

The overall purpose of the project is to ensure that shorelines have recovered sufficiently to facilitate normal shoreline activities. The project objectives are to assess the shoreline hydrocarbon concentrations and, where appropriate, to carry out necessary treatment either during the survey or following the survey using local work crews to perform the identified work.

The shoreline assessment will utilize the process developed and refined since the 1989 spill:

1. Survey shorelines for the presence of *Exxon Valdez* hydrocarbons.
2. Determine if resource uses are affected by hydrocarbons.
3. Perform light duty manual treatment to restore resource use if necessary and feasible.
4. Write work orders for local crews to treat the shoreline if necessary.
5. Document field activities.

WHY

This project will assess shorelines and determine if resources and services are still impacted and the need for additional treatment, if any. The public, land owners, and resource managers need to have current and accurate field information for operation and management. If resources are impacted and need to be restored, technical experts need to survey the sites and determine the best course of action to correct the problem and not cause further damage. Impacts on resources will be corrected and resource use will be restored. Public complaints about the presence of hydrocarbons can be assessed and addressed through the framework of this project.

Information collected by this project will assist Trustee Council review of other projects submitted for funding. This project will provide current, accurate information about shoreline conditions that will help with funding decisions for other activities. Accurate field information will be used by Restoration Team members to identify areas with persistent hydrocarbon concentrations that may slow restoration activities.

HOW

The Alaska Department of Environmental Conservation, in conjunction with the other Trustee Agencies and in consultation with the U. S. Coast Guard, will review the 1992 shoreline survey information and produce a list of subdivisions to be surveyed in 1993. This list will then be circulated to subsistence users by Project 93017 (Subsistence) and to land owners and resource managers to identify additional sites to be included on the 1993 survey. Agency personnel will review the proposed survey list and ensure that oiling conditions at each segment warrant an assessment. The survey list will be prioritized based on resources affected and projected oil concentrations. For planning purposes, we have assumed that 80 sites or less will be recommended for survey. After a final list is developed, the survey list will be sent to land and resource agencies for their approval and clearance to assess the sites.

Phase 1 is the physical survey of the shorelines. Agency technical experts and the upland owners will assess the shoreline segments and document oiling conditions. The survey team will be berthed on a vessel and use skiffs to access the shoreline. Float planes will provide logistics support. Previous *Exxon Valdez* surveys have used these logistics as the most cost effective and time efficient support structure. Agency representatives will be chosen for their environmental and habitat experience. Each person will have extensive *Exxon Valdez* spill experience. Surveys will be conducted daily during both low tide windows with appropriate weather and light conditions. Field information will be recorded on forms previously generated during *Exxon Valdez* surveys to facilitate comparison and familiarity of the existing databases.

Project Descriptions

Phase 2 is the restoration of resources and services, if necessary. Agency personnel with input from the landowner will determine if treatment is necessary based on established State and Federal standards. Such a determination would include consideration of the resources impacted by the oil, the area and concentration of remaining oil, the cost effectiveness and technical feasibility to treat the oil, the services such as subsistence provided by the shoreline segment, and a reasonable expectation that the treatment will not cause more damage than allowing the oil to remain in place. Such a determination would be made by the Agencies in consultation with the Chief Scientist. The State On-Scene Coordinator will resolve disagreements between Agencies. Any light duty restoration work that is determined to be necessary would be completed during and after the survey by the surveyors which have proven to be the most cost effective method of treatment. Additional restoration treatment would be identified with work orders and the treatment will be performed using local work crews. Necessary treatment would usually consist of hand labor using shovels, rakes, and bags. A determination of appropriate restoration activities, if any, to be done in oiled mussel beds would be based upon results from the 1992 mussel bed study (R-103), the 1993 spring survey of project 93036 (Monitoring of Oiled Mussel Beds), and other completed and ongoing damage assessment and restoration studies. Any treatment work done in oiled mussel beds will be conducted in conjunction with Project 93036 to ensure appropriate treatment methods are used and to monitor the effectiveness of treatment.

The need for shoreline treatment work, if any, in 1993 cannot be determined until the 1993 shoreline assessment is completed and the results of several damage assessment and restoration studies become available this winter and next spring. Because of the necessity of preplanning logistics support, we will assume limited treatment work will be necessary. If treatment is found not to be necessary, the logistics support will not be used, and the money will be returned to the Trustee Council for use in other restoration activities. If treatment is found to be necessary at a level greater than initially authorized, we will request additional funds from the Trustee Council to expand the effort.

Surveyors and work crews will be required to attend Hazwoper training.

Wastes generated during restoration activities will require treatment at approved facilities.

ENVIRONMENTAL COMPLIANCE

As in prior years, permits and notifications will be required by several permitting agencies. All permits will be obtained prior to commencement of field work.

WHEN

The duration of this project will be determined by yearly surveys of contaminated sites. The project will be recommended for termination as soon as conditions warrant. Funds expended in 1993 will be proportional to the amount of restoration work necessary. Unexpended funds will be returned for use on other projects in later years. If work is necessary in future years, milestones would be similar for each year. Costs would vary in future years due to the size of the survey and type of restoration activities.

January 15 - February 15, 1993	Solicit input from landowners and resource agencies on sites to be surveyed.
March 1, 1993	Produce final list of survey sites for Trustees.
March 7, 1993	Submit request for bids for vessel and float plane.
March 30, 1993	Receive approvals from land and resource agencies to access shoreline for survey and restoration activities.
April 15, 1993	Secure contracts for vessel and float plane.
May 15, 1993	Surveyors, landowner representatives, and work crews receive Hazwoper training.
June 1 - July 15, 1993	Perform survey.
August 15, 1993	Complete restoration activities, if any.
September 30, 1993	Complete report and documentation.

BUDGET (\$K)

	ADEC	ADF&G	ADNR	USFS	USDOI	NOAA	TOTAL
Personnel	\$ 147.1	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	\$ 197.1
Travel	6.0	0.0	0.0	0.0	0.0	0.0	6.0
Contractual	252.1	0.0	0.0	0.0	0.0	0.0	252.1
Commodities	16.5	0.0	0.0	0.0	0.0	0.0	16.5
Equipment	5.0	0.0	0.0	0.0	0.0	0.0	5.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 426.7	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	10.0	\$ 478.7
General Administration	<u>36.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>44.0</u>
Project Total	\$ 463.2	\$ 11.5	\$ 11.5	\$ 11.5	\$ 11.5	\$ 11.5	\$ 520.7

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93039

Project Title: Herring Bay Experimental and Monitoring Studies

Project Category: Restoration Manipulation and Enhancement, and Restoration Monitoring

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 1996

INTRODUCTION

Marine intertidal communities were the largest single category of habitat affected by the *Exxon Valdez* oil spill. Experiments conducted at Herring Bay, Knight Island, and throughout the EVOS impact area since 1990 clearly indicate that one of the consequences of the oil spill and resultant clean-up activities was injury to intertidal algal and invertebrate populations, especially in the mid- to upper-intertidal zones. The dominant organism in this community is the seaweed *Fucus gardneri* which provides habitat and food for a variety of invertebrates. These invertebrates in turn serve as an important food source for marine mammals, birds, and fishes. This project is designed to examine the impact of oil on relationships between and among intertidal invertebrates and plants, to investigate means of restoring *Fucus* populations and to provide detailed monitoring of the recovery of intertidal communities over the long term.

A. Summary of Injury

Studies to date indicate that plants and animals living in the upper portion of the intertidal zone suffered extensive injury. In fact, data from 1991 show that some species were still declining in abundance. The upper intertidal is where oil was deposited on rocks and sediments during ebbing tides and where clean-up activities were focused. The dominant alga, *Fucus gardneri*, was greatly reduced in many of these areas, and experiments indicate that several years will be required for its recovery in the lower- and mid-intertidal zones. Recovery of this species in the upper intertidal will require an even longer period. Oil inhibits recruitment of *Fucus* and other algae, and *Fucus* does not recruit successfully onto the cleaned, bare rock surfaces. Grazers such as limpets were also reduced by the spill/clean-up and have been unable to recover, due to lack of food and shelter normally provided by the algae. Barnacles have recruited on oiled surfaces, even tar, but our studies show poor subsequent survival. Our data show some recovery in the mid- to lower-intertidal zone, but recruitment is not consistent between locations and years. Recruitment variability appears to have a greater impact on intertidal community structure in Alaska than at lower latitudes.

B. Location

The proposed restoration, monitoring, and experimental studies will be conducted in Herring Bay, Knight Island. Intertidal studies were initiated in Herring Bay in May 1990 and have continued through the 1992 season. Herring Bay was heavily oiled in 1989, and was a central area for cleanup efforts. The Bay was chosen for experimental studies because of its oiling history and proximity to non-oiled sites used as controls.

WHAT

A. Goals

1. To understand what factors limit and/or facilitate recolonization of the intertidal by algae, especially *Fucus*, and invertebrates such as barnacles, mussels, and limpets.
2. To provide controlled, long-term natural recovery monitoring of inter-tidal communities such that natural variability can be differentiated from oil/clean-up effects.

B. Objectives

1. Quantify recruitment rates, survivorship, and population dynamics of barnacles and other sessile invertebrate species on oiled, oiled and cleaned, and non-oiled substrates and at matched oiled and non-oiled sites.
2. Determine the recovery rate of important community members dependent upon other species reduced or eliminated by the spill, i.e., second-order impacts. And determine the recovery rates of species with poor dispersal capabilities, e.g., the predators *Nucella* and *Leptasterias*.
3. Quantify the population structure and population dynamics of *Fucus* in oiled, oiled-cleaned, and control sites to monitor and to project recovery rates, especially in the upper intertidal zone areas denuded by the oil spill/clean-up activities.
4. Develop techniques for restoring *Fucus* by reducing heat and desiccation stress with a biodegradable substratum.

WHY

A major goal of restoration is to ensure that "injured resources have been restored to their pre-spill baseline conditions." Many plant and animal species were damaged directly by the fresh crude oil of the EVOS and/or the subsequent cleanup activities. Previous work in Herring Bay has shown that some populations continued to decrease in 1991 (1992 data not in yet), suggesting continuing expression of the original impact or additional damage due to residual oil. Experimental studies on the impact of the oil spill on intertidal community structure and recovery dynamics have been conducted in Herring Bay since 1990 and should be continued. A long-term

Project Descriptions

monitoring commitment within Prince William Sound will provide several benefits, including (A) an understanding of the year-to-year variables that affect intertidal community structure, (B) an understanding of long-term consequences of an oil spill, and (C) establishing baseline data and an understanding of complex community structuring mechanisms at monitoring locations strategically located within Prince William Sound, should there be a future perturbation.

HOW

Population dynamics of *Fucus*, sessile invertebrates, and grazers (limpets) will continue to be quantified in established quadrats at oiled and unoiled sites. Recruitment of algae and invertebrates on tarred, cleaned, and control substrata will be determined, with and without grazing. The impact of grazing on algal recruitment and the role of algae in providing food or shelter on survival or recruitment of other species will be examined in enclosures and exclosures.

Growth rates of tagged *Fucus* plants will be determined. Studies will be continued on *Fucus* egg dispersal, survival, and recruitment at oiled and unoiled sites. Experiments will be conducted on the effects of substrata heterogeneity, herbivory, shading by *Fucus* canopy, and tide level on settlement and recruitment of *Fucus* embryos.

Data from the Damage Assessment studies in Herring Bay have shown that the recovery of damaged *Fucus* populations in rocky habitats on steep south-facing beaches has been very slow. The extent of this type of damage throughout PWS will be estimated using data contained in the Department of Natural Resources Oil Spill GIS database. New data on beach aspect and beach slope in PWS will be generated under a technical services contract to DNR. The GIS model to estimate the areal extent of damage will be developed by Coastal Resources Associates. Field verification of the model and data quality assurance will be conducted in Herring Bay and in nearby sheltered rocky intertidal habitats.

For the *Fucus* restoration study, we will use biodegradable erosion-control fabric that has been seeded with *Fucus* embryos. A series of tests will be conducted to determine the optimum fabric type, of the several varieties available, to maintain sufficient moisture for embryo survival, yet provide enough open space for light for the growth of juvenile plants. We will eliminate the potential problem of lack of natural settlement by seeding the fabric with *Fucus* embryos for adding fertile adult plants. Unseeded strips will be used to test whether embryo seeding is necessary. The cost effectiveness of this procedure for large-scale restoration will be assessed.

ENVIRONMENTAL COMPLIANCE

We anticipate that this project will be categorically excluded.

WHEN

Each year of the study, the field season will commence on a low-tide series in late April. Approximately two weeks will be required to record winter results and initialize experiments for the season. Three subsequent 10 day visits will be made to Herring Bay during the summer low tides. Our objectives will be to collect quantitative data from the experiments and to monitor our restoration efforts. Reports will be prepared by March 1 of each year.

BUDGET (\$K)

	ADF&G
Personnel	\$ 7.5
Trayel	0.0
Contractual	478.7
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 486.2
General Administration	<u>21.3</u>
Project Total	\$ 507.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93041

Project Title: Comprehensive Restoration Monitoring Program Phase 2: Monitoring Plan Development

Project Category: Restoration Monitoring

Project Type: Monitoring

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: Alaska Department of Fish and Game; Alaska Department of Environmental Conservation; Alaska Department of Natural Resources; U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Fish and Wildlife Service; U.S. Department of Interior, National Park Service

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

A. Background on the Resource

Resources to be monitored include affected floral and faunal assemblages as well as impacted substrates upon which they depend. Services arising from injured natural resources will also be monitored inclusive of, but not limited to, recreation, subsistence, and wilderness and intrinsic values. Finally, injured archaeological resources will be monitored.

B. Summary of Injury

The *Exxon Valdez* oil spill occurred just prior to the most biologically active season of the year. During the four-month period following the spill, critical life stages of algae, invertebrates, fish, birds, and mammals encountered the most concentrated, volatile, and potentially toxic forms of the spilled oil. While different species demonstrated varying levels of injury, sea otters and marine birds (common and thick-billed murre, sea ducks) were particularly hard-hit. Portions of 1200 miles of coastline were oiled resulting in impacts to intertidal and shallow subtidal resources. Oil reached shorelines nearly 800 miles from Bligh Reef, the site of the spill. Of continuing concern, resources are exposed to oil remaining in the intertidal zone or transported to the subtidal zone. Following the spill, recreational use of public lands and waters declined and archaeological resources along the shoreline also were injured. For a more detailed account of injuries to individual species, habitats and services, see Chapter IV of the *Exxon Valdez Oil Spill Restoration Volume 1: Restoration Framework*.

C. Location

Monitoring will be conducted on and in surface waters, on tidelands, and on adjacent uplands

including their watersheds in Prince William Sound and the Gulf of Alaska.

WHAT

A. Goal

This project will establish the design of the monitoring component of the Restoration Plan. The goal is to develop a comprehensive and integrated restoration monitoring program that will follow the progress of natural recovery, evaluate the effectiveness of restoration activities, and establish an ecological baseline from which future disturbances can be evaluated.

Implementation of this multifaceted program requires central coordination and management. To successfully implement an ambitious and wide-ranging program as contemplated, a high degree of organization is needed to create the design, to analyze, interpret and disseminate the data generated, and to assure that all aspects of the program are carried out as designed.

B. Objectives

This program will assist the Trustees in various organizational and coordination activities in support of developing a comprehensive, interdisciplinary and integrated program of restoration monitoring aimed at:

1. assessing the rate of natural (unassisted) recovery of injured resources and services;
2. evaluating the effectiveness of restoration activities, identifying where additional restoration activities may be appropriate, and determining when injury is delayed, and;
3. following the dynamics of other ecological components (those important in the food webs of injured species) to document long-term trends in the environmental health of the affected ecosystem.

To fulfill these objectives, a three-phase program is planned. Phase 1 is being conducted in early FY-93 and focuses on the development of a "conceptual" plan for monitoring¹. Phase 2, which is the focus of this proposal, will be conducted over essentially the second-half of FY-93 and deals with developing the technical plans for monitoring. Phase 3 provides for management of the monitoring program following full implementation (FY-94 thru FY-2203).

WHY

Monitoring is necessary to assess the adequacy of natural recovery. Resources and associated services that are found to be recovering at an unacceptable rate may have to be reconsidered as candidates for restoration action. Likewise, resources and services that are found to be

¹ Environmental Protection Agency pass-through money in 1991.

Project Descriptions

recovering faster than anticipated may allow for an earlier completion of a restoration endpoint. Monitoring of important physical, chemical and biological properties will establish an environmental baseline for the affected ecosystem. This baseline then can be used to assess the anticipated effects of human activities and to improve our ability to manage affected resources and services over the long-term.

HOW

Phase 1:

In Phase 1, which is being conducted this year (1 September 1992 thru 31 January 1993), a consultant will be asked to assist the Trustees in developing a "conceptual" design for the required monitoring plan. This will provide for more technical planning in Phase 2, which is the focus of this proposal. The conceptual planning in Phase 1 will address but will not be limited to such issues as goals and objectives, what resources and services to monitor, what process is required for management, what relationships need be established with other monitoring programs in the spill zone, and how can monitoring be funded over the long-term. Phase 1 planning also addresses the need to identify which current cleanup, damage assessment and restoration science studies would best serve the purpose of the intended restoration monitoring program.

Phase 2:

In Phase 2 (1 January 93 thru 30 September 93), a consultant will again be asked to assist the Trustees. With an approved "conceptual" plan, the consultant will develop a "detailed" monitoring plan that will be presented as a "strawman" plan for review by technical experts at a workshop. This phase focuses on the technical requirements of an integrated monitoring plan and assumes a close working relationship with the Trustee agencies and contracted peer reviewers. It is further assumed that the Trustee agencies will implement monitoring once this phase of planning is completed and a Final Restoration Monitoring Plan is approved. Phase 2 will establish:

1. what the bounds (magnitude) of the monitoring effort will be;
2. the locations (fixed and rotating) where monitoring should be conducted;
3. a technical design for each monitoring component (e.g., sediments, invertebrates, fish, birds, mammals, and services [recreation, subsistence, aesthetics, etc.]) that specifies how and when data will be collected, analyzed, interpreted, and reported;
4. a data management system to support the needs of the Trustees and other decision makers, planners, researchers and the public. This assumes a system that facilitates a variety of retrieval and analysis functions and is flexible and expandable to meet new and changing needs;
5. a rigorous quality assurance program to ensure that monitoring data produces defensible answers to management questions and will be accepted by scientific researchers and the public;

6. cost estimates for each monitoring component;
7. coordination of this monitoring plan with other monitoring programs that may exist or be proposed; and
8. a strategy for review and update to ensure that the most appropriate and cost-effective monitoring methods are applied.

A workshop approach will be used to establish a model for specific technical requirements. The consultant will then work directly with representatives of the Trustee agencies and peer reviewers to produce definitive monitoring protocols. After completion of a Draft Restoration Monitoring Plan, a program of peer review will be organized and implemented. Subsequently, the draft plan will be issued for public review and comment.

It is proposed in Phase 2 that NOAA/NMFS will assist the Trustees in various organizational and coordination activities pursuant to developing the Draft Final Restoration Monitoring Plan. NOAA/NMFS will design and prepare the RFP to solicit services of a consultant to provide technical expertise. NOAA/NMFS also will design procedures for evaluating the resulting technical proposals and chair a proposal review committee to select a consultant. NOAA/NMFS with the assistance of the consultant also will design and implement a workshop to develop a framework for detailed monitoring protocols, a data management system, a QA/QC program, costs, and a review strategy, etc.

The Trustee agencies will be expected to attend the workshop and to work with NOAA/NMFS and the consultant to provide detailed input to the comprehensive monitoring plan.

Phase 3:

Following development of the Restoration Monitoring Plan, 1994 and beyond will be devoted to Phase 3 - monitoring and management, including audits, annual reviews, data management, and reports.

ENVIRONMENTAL COMPLIANCE

This activity should fall under a categorical exclusion within NEPA because this proposed project is essentially a planning exercise. This does not, however, obviate the responsibility for each Trustee agency to conduct additional NEPA reviews as various components of the comprehensive and integrated monitoring plan are implemented in Phase 3.

WHEN

Phase 1 planning begins 1 September 1992 and will essentially be complete 1 February 1993. Phase 2 planning which is the focus of this proposal will begin 1 February 1993 and essentially be complete 30 September 1993. Phase 3, a fully expanded and integrated monitoring program, will be implemented in the 1994 field season and will continue for the life of the Restoration Monitoring Program (FY-95 thru FY-2004).

Project Descriptions

BUDGET (\$K)

NOAA

Personnel	\$ 79.0
Travel	15.0
Contractual	100.0
Commodities	15.0
Equipment	10.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 219.0
General Administration	<u>18.9</u>
Project Total	\$ 237.9

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93042

Project Title: Recovery Monitoring of Prince William Sound Killer Whales Injured by the Exxon Valdez Oil Spill Using Photo Identification Techniques

Project Category: Restoration Monitoring

Project Type: Marine Mammals

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: None

Project Term: July 1, 1993 to September 30, 2002

INTRODUCTION

A. Background

The killer whale, *Orcinus orca*, occurs in all oceans of the world. Population estimates, based on photo-identification studies, are available for 4 North Pacific regions (inland waterways of Washington, British Columbia, southeast Alaska, and Prince William Sound). Current killer whale population estimates for Prince William Sound are 11 resident pods (representing 245 whales) and eight transient pods (representing 52 whales). Of these killer whale pods, AB pod is the most often encountered pod in Prince William Sound. The resident killer whale pods of Prince William Sound are a valued wildlife resource contributing substantially to the wilderness, aesthetic, tourism, and recreational values of the region.

B. Summary of Injury

The whales of Prince William Sound were studied intensively before the spill, and their social structure and population dynamics are well known. Damage assessment studies of killer whales involved boat-based photo-identification surveys in Prince William Sound. Photographs of killer whales were compared to the Alaska killer whale photographic database for the years 1977 to 1989 to determine the changes in whale abundance, seasonal distribution, pod integrity, mortality and natality rates.

One of the Prince William Sound pods, AB pod, had 36 whales when last sighted before the spill in September 1988. When sighted on March 31, 1989, seven days after the spill, seven individuals were missing. Six additional whales were missing from AB pod in 1990. Assuming that whales missing for two consecutive years are dead, the mortality rates for the AB pod were 19.4 percent in 1988-1989 and 20.7 percent in 1990-1991. The average annual mortality in AB pod in 1984 to 1988 was 6.1 percent. An additional whale was missing in 1991, but a calf was also born into the pod. The approximate calving interval of killer whales is four years, so some long-term effects may not be obvious for many years.

Several of the missing whales from AB pod were females which left behind juveniles; such abandonment of juveniles is unprecedented in killer whales. As a consequence, the social structure of AB pod has changed and significant mixing of maternal subgroups has been documented.

Killer whales, which may have died as a result of the oil spill, probably would have sunk and not been found by researchers. So, it has not been possible to directly link the missing whales of AB pod with the Exxon Valdez oil spill.

WHAT

A. Goal

The purpose of this study is to obtain photographs of individual killer whales occurring in AB pod and to document natural recovery. Photographs collected will be compared to the National Marine Mammal Laboratory's photographic database for the years 1989 to 1991 to determine if changes continue to occur in whale abundance, pod integrity, mortality and natality rates.

B. Objectives

1. Count the number and individually identify killer whales within AB pod.
2. Test the hypothesis that pre- and post-spill killer whale pod structure and integrity within AB pod have remained constant.
3. Determine killer whale reproductive rates and trends in abundance for AB pod within Prince William Sound.

WHY

Researchers have documented a decline in Prince William Sound's AB pod in 1989 and again in 1990. The AB pod has been the predominant resident pod of killer whales in Prince William Sound. It is important to pursue studying AB pod despite the difficulty of proving the link of injury to the Exxon Valdez oil spill because of its high intrinsic value as a wildlife resource of the Sound. Continued monitoring of the status of AB pod in Prince William Sound through photo-identification studies is required to document natural recovery of the injured population. The information gained from this work may lead to initiating additional actions to protect killer whales by protecting sensitive habitats, minimizing fishery interactions, reducing or redirecting other human-use impacts, and promoting public education.

Because killer whale recovery rates are essentially unknown (it may take 25-30 years or more), there is a clear need to continue monitoring population trends for killer whales in the spill area. Since the historical database was found inadequate to reliably predict killer whale movements or habitat requirements to support decisions to implement restoration options (habitat protection), additional habitat-use investigations (beyond satellite tagging) may be necessary in the future.

Project Descriptions

HOW

1. Personnel from the National Marine Mammal Laboratory (NMML) will develop and coordinate all killer whale research activities with this monitoring study. NMML has had extensive involvement in all phases of this research since 1989 and will provide the needed scientific continuity required for this research. Field studies will be conducted by NOAA and contract personnel who have recognized expertise in the study areas of concern. A shore-based camp (equipped with a suitable small boat for whale identification work) will be used in Prince William Sound to conduct photo-identification studies on killer whales from July to September 1993. Study areas will be similar to those worked when assessing injury to killer whales from 1989 through 1991. The camp would be fully self-contained with necessary items for safety and staffed by at least two biologists. For consistency in data collection, key personnel remain in the field throughout the study period.

Weather permitting, field personnel will spend an average of 8 to 10 hours per day conducting boat surveys searching for AB pod. When encountered, other pods of killer whales should be photographed as well. Specific areas, known for whale concentrations, are investigated first. However, if reports of whales are received from other sources, those areas are examined. If AB pod is not located in "known" areas and opportunistic sighting reports are not available; a general search pattern is developed and implemented. Travel routes typically taken by AB pod will be surveyed. When whales are sighted, researchers stop further search efforts and approach the whales to collect photo-identification information. When whales are encountered, researchers select a vessel course and speed to approximate the animals' course and speed to facilitate optimal photographic positioning.

2. Association patterns of individual whales/maternal subgroups will be examined to evaluate the current social structure of AB pod. Whale association patterns will be compared to the three-year database available at NMML (1989-1991) to determine if changes have occurred in AB pod structure and integrity.
3. Mortality (number of missing whales) and natality (number of births) will be calculated from the 1993 season through photo-identification studies. The 1993 vital rates will be compared to NOAA's historical database on Prince William Sound killer whales to determine trends in abundance.

ENVIRONMENTAL COMPLIANCE

This is a field research project in which routine data collection will take place which is limited in context and intensity. Consequently, this project is categorically excluded from being required to provide an Environmental Impact Statement or Environmental Assessment.

Permits required by the Marine Mammal Protection Act will be obtained prior to the field season.

WHEN

Apr. 1, 1993	Contract negotiation
Jun. 1, 1993	Select contractor
Jul. 15, 1993 to Sep. 15, 1993	Field research
Dec. 30, 1993	Draft report
Feb. 15, 1994	Final report

BUDGET (\$K)

NOAA

Personnel	\$ 18.8
Travel	4.2
Contractual	89.0
Commodities	6.0
Equipment	0.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 118.0

General 9.1
Administration

Project Total \$ 127.1

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93043

Project Title: Sea Otter Population Demographics and Habitat Use in Areas Affected by the *Exxon Valdez* Oil Spill

Project Category: Restoration Monitoring/Restoration Habitat Protection

Project Type: Marine Mammals

Lead Agency: Department of the Interior - Fish and Wildlife Service

Cooperating Agencies: None

Project Term: April 1, 1993 to March 31, 1994

INTRODUCTION

A. Background on the Resource/Service

The sea otter (*Enhydra lutris*) is a well-known marine mammal species in Alaska. They historically occurred throughout coastal waters of the Pacific, but as a result of fur harvests in the 18th and 19th centuries, they came close to extinction. They have since increased in abundance and distribution, and presently are found in most coastal areas of southern Alaska. Sea otters prey on a variety of invertebrate species, including mussels, clams, crabs and sea urchins, and may have a strong influence in structuring prey populations.

B. Summary of Injury

Immediate losses of sea otters due to the *Exxon Valdez* oil spill probably ranged from 3,500 to 5,000 animals. Current sampling of sediments and sea otter prey items indicate exposure of otters to hydrocarbons may be continuing. The results of several NRDA studies indicate that this exposure, at a minimum, may be affecting sea otters at an organismic level and, at a maximum, may be affecting survival and therefore recovery of the population. Comparisons of post-spill sea otter surveys found no change in abundance between July 1990 and July 1991, with significantly lower densities in the oil spill area compared to non-oiled areas. The age distribution of sea otter carcasses recovered in oiled areas of Prince William Sound continues to reflect elevated mortality in prime-age sea otters, and a 1990-91 study determined the survival rate of weanling sea otters was significantly lower in oiled than nonoiled areas of PWS. This evidence, together with results from blood and contaminant analyses, suggests that the sea otter population within the spill zone may still be compromised by exposure to oil and that recovery to pre-spill levels is not occurring.

C. Location

The major focus of this project will be on sea otters in Prince William Sound.

WHAT

A. Goals

The overall goal of this project is to restore sea otter populations affected by the Exxon Valdez oil spill by determining what is limiting their recovery and identifying areas with high value for sea otter habitat within Prince William Sound for possible protection. Results from 1991 and 1992 preliminary studies on survey techniques will be evaluated prior to initiating 1993 surveys.

B. Objectives

1. Monitor the recovery of sea otters in oiled areas by determining their abundance, distribution and mortality
2. Construct a population model to evaluate the potential recovery of the sea otters
3. Identify patterns of habitat use
4. Identify and evaluate areas with high value of sea otter habitat within PWS for possible protection

WHY

Studies to date have determined that initial damages to the sea otter population were severe (a loss of 3,500 to 5,000 sea otters), and suggest that chronic damages to sea otters are also occurring, delaying recovery of affected populations. Through monitoring of affected populations and evaluation of patterns of habitat use, this restoration project will guide the development of strategies to aid in the recovery of the otters. The various project activities will enhance our understanding of the demographics of sea otter populations, and identify potential sites for protection of sea otter habitat. Protection of habitats important to sea otters (including foraging, pup rearing, pup weaning and haulout areas) will promote population recovery over the long-term as well as provide protection for other members of the nearshore marine community.

HOW

A. Methodology

In order to evaluate recovery of the sea otter population affected by the oil spill, annual monitoring will be undertaken. Since the spill, detailed data on population size has been collected primarily in the Prince William Sound portion of the spill area. Efficient standardized survey techniques to increase precision and accuracy of population estimates were being developed through RESTORATION FEASIBILITY PROJECT #3, which was conducted in 1991 but not in 1992. The project evaluated the feasibility of using a small float-equipped airplane (Piper P-18 super-cub) as a survey platform in a strip transect survey of sea otters. The design involves counting otters along transects according to a strict protocol and conducting "intensive searches" at pre-determined intervals to estimate the proportion of animals that remain uncounted (e.g., due to diving) during the strip count. Through the information gleaned in the feasibility project and subsequent work by the USFWS, this census technique can be implemented within Prince William Sound in 1993. Survey methodology will be field tested outside Prince William Sound in 1993, and an extended monitoring program may be implemented in subsequent years. In addition to

Project Descriptions

aerial surveys, mortality surveys (recovery of beach-cast carcasses) will be continued as part of this project. The mortality surveys will build on data collected over a decade in PWS.

A population model will be developed based on age structure and age specific reproduction and survival rates estimated from the carcasses recovered following the oil spill. Model parameters will be modified to reflect available information on post-spill population size, reproduction and survival rates (including data from a 1992-93 USFWS study on juvenile sea otter survival in PWS) to predict recovery rates under a range of assumptions, including those related to potential restoration or management strategies. Data collected in subsequent years will be used to refine and update the model and predictions. This work will be conducted cooperatively with Service personnel and other individuals having expertise in modeling sea otter populations.

The habitat evaluation component of the project will 1) utilize data from a 1992-93 USFWS juvenile survival study to develop a data base on sea otter movements and patterns of habitat use, 2) integrate this information with other sea otter data on distribution and abundance (pre- and post-spill), and 3) evaluate available data on commercial, recreational, and subsistence uses of PWS. Continuing efforts (planned for 1994-95) will utilize the data base compiled on habitat use patterns to identify and evaluate potential areas of high habitat value in PWS for protection.

B. Coordination with Other Efforts

To date, aircraft and boat surveys have not been conducted concurrently. Collection of survey data by both methods in 1993 would complement both projects by providing a basis for comparison of methods and continuity of data collection in subsequent years. Data from both surveys will contribute to the analyses of habitat use patterns.

ENVIRONMENTAL COMPLIANCE

This project does not involve capture or handling of sea otters, or any other methods that are intrusive. It appears to qualify for categorical exclusion under the National Environmental Policy Act.

WHEN

The first year of the project will be April 1, 1993 to March 31, 1994. The population and reproductive surveys will be conducted in the summer of 1993. Mortality surveys will be conducted in the late spring of 1993. The population modeling and evaluation of habitat use patterns do not involve field work. Data compilation and analyses for these components of the project will occur throughout the year. Progress reports for all components of the project will be produced by January 30, 1994, and "final" reports on 1993 activities will be produced by March 31, 1994. The identification of potential sites for habitat protection would occur in 1994-95. Monitoring of population recovery (through abundance, distribution, reproduction and mortality, and continued modeling) is planned as a long-term activity, extending through 2001 (pending availability of continued funding), or through recovery.

A. Milestones

April 93	Data compilation and entry; preparation for field work
April - Nov. 93	Compilation and analysis of existing data for habitat and population modeling work
May - Sept. 93	Field activities for population, reproductive and mortality survey work
Sept. 93 - Jan. 94	Data entry, analysis, report preparation
Jan. 30, 94	Annual Report due on progress to date
March 31, 94	Final Report on 1993 activities due

BUDGET (\$K)

	USFWS
Personnel	\$ 154.5
Travel	14.5
Contractual	50.2
Commodities	17.1
Equipment	27.5
Capital Outlay	<u>0.0</u>
Sub-total	\$ 263.8
General Administration	<u>28.1</u>
Project Total	\$ 291.9

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93045

Project Title: Surveys to Monitor Marine Bird and Sea Otter Populations in Prince William Sound during Summer and Winter

Project Category: Restoration Monitoring

Project Type: Birds, Marine Mammals (Sea Otters)

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to March 15, 1994

INTRODUCTION

A. Background on the Resource/Service

The U.S. Fish and Wildlife Service conducted boat surveys of marine bird and sea otter populations in Prince William Sound in the early 1970s, the mid-1980s and in 1989, 1990 and 1991 following the *Exxon Valdez* oil spill. These surveys documented overall declines in Prince William Sound marine bird populations between 1972-1973 and the years after the spill for grebes, cormorants, northern pintail, harlequin duck, oldsquaw, scoters, goldeneyes, bufflehead, black oystercatcher, Bonaparte's gull, black-legged kittiwake, arctic tern, pigeon guillemot, marbled murrelet, Kittlitz's murrelet, and northwestern crow. For five of these species or groups--cormorants, harlequin duck, black oystercatcher, pigeon guillemot and northwestern crow--populations declined more in the oiled area than in the non-oiled area, suggesting an oil spill effect. Specific studies of three of these species--harlequin duck, black oystercatcher and pigeon guillemot--have corroborated the population changes found by the survey project. In addition, these studies have investigated how the reproduction and foraging ecology of these species have been affected by the spill. These studies have also examined hydrocarbon contamination in these species. Links between the oil spill and effects on these species are still being investigated.

Relative to sea otters, the boat surveys documented declines in sea otter density and abundance in shoreline habitats of Prince William Sound following the spill. The surveys also detected a continuing pattern of significantly lower sea otter densities in oiled coastal areas, suggesting that mortality or displacement of sea otters from these areas was considerable.

B. Summary of Injury

About 35,000 birds and 1,000 sea otters were recovered following the spill. Based on modeling studies using carcass, search effort, and population data, the total number of marine birds killed by the spill was between 300,000 and 645,000 birds, with the best approximation between 375,000 and 435,000 birds. The majority of birds killed were murres. The total number of sea otters killed by the spill in Prince William Sound was estimated to be between 3,500 and 5,000

otters. These estimates reflect direct mortality occurring in the first five months after the spill and do not include chronic effects or loss of reproductive output.

C. Location

This study will be conducted in Prince William Sound. The entire sound, including oiled and unoiled areas, will compose the study area.

WHAT

A. Goal

The purpose of this study is to obtain annual estimates of the summer and winter populations of marine birds and sea otters in Prince William Sound to determine whether species whose populations may have declined due to the *Exxon Valdez* oil spill are recovering.

B. Objectives

1. To determine distributions and estimate abundances, with 95% confidence limits, of marine birds and sea otters in Prince William during summer and winter.
2. To estimate trends in populations of marine bird species whose populations declined more in oiled areas than in unoiled areas of Prince William Sound since the early 1970s, specifically cormorants, harlequin ducks, black oystercatchers, and pigeon guillemots.
3. To support restoration studies on harlequin ducks, black oystercatchers, pigeon guillemots, marbled murrelets, other marine birds and sea otters by providing data on population changes, distribution and habitat use of Prince William Sound populations.

WHY

A. Benefit to Injured Resources/Services and Relationship to Restoration Goals

This study meets the Trustee Council restoration goal of restoration monitoring. Restoration of marine bird and sea otter populations will require population estimates to determine whether recovery is occurring or if declines are continuing. This project will benefit marine birds and sea otters by revealing species that show continuing injury due to the *Exxon Valdez* oil spill; this information is necessary to plan meaningful restoration actions.

This project will also provide valuable information on the distribution and habitat use of these species. Survey data from this project have been used for these purposes by investigators of harlequin ducks, marbled murrelets, black oystercatchers and sea otters. Survey methods are flexible enough to provide for collection of more detailed information (such as age class data) if such information is requested by investigators of those species.

Project Descriptions

HOW

A. Methodology

Boat surveys will be conducted using methods developed by NRDA Bird Study 2. Surveys will be conducted in March (winter) and July (summer) of each year. Surveys will be conducted using three 25-foot boats each staffed by an operator and two crew members. All three will serve as observers. Observers will record all birds and mammals within 100m of each side of the boat within survey transects, and whether the animal is in the water, on land or in the air. The survey window will extend approximately 40-50m ahead of and 100m above the moving boat, but will be extended for animals that exhibit strong avoidance behavior when the boat is more than 50m away (e.g., scoters, murrelets, harlequin ducks, harbor seals). Surveys will be conducted only when seas are less than two feet. Date and time of survey, and environmental variables including wind velocity and direction, air and water temperature, weather, observation conditions, sea state, tide, presence of oil, and presence of human activity will be recorded for each transect.

A stratified random sampling design using shoreline, coastal/pelagic and pelagic strata will be used. The current design is powerful enough to detect small population changes (e.g., 15%) for some species. Data collected previously will be used to improve the design for other species, possibly lowering costs at the same time. The size of individual blocks in pelagic and coastal/pelagic strata will be decreased, and blocks reselected, to decrease variances. Such alteration will not affect our ability to compare population estimates among years.

Analyses aimed at reducing survey variances, detecting population changes, and identifying habitat use and distribution will continue. Such analyses include exploration of post-stratification by habitat (using shoreline type or bathymetry to define habitats), examination of differences among observers' abilities to identify and count animals, and calculation of optimal sampling unit size and number of samples. Future analyses should include the effects of survey vessel disturbance and distance from the vessel on counts of different species.

B. Coordination with Other Efforts

This study will provide data on distribution and abundance of selected species for use by restoration study investigators (assuming these studies are approved). Proposed studies that would use data collected by this project include the following: sea otters, black oystercatchers, pigeon guillemots, habitat (marbled murrelet portion), murrees, and habitat acquisition.

ENVIRONMENTAL COMPLIANCE

This study relies on observations from boats and is a non-intrusive study. Based on a review of the CEQ regulation 40 CFR 1500-1508, this study appears to be categorically exempt from the requirements of NEPA in accordance with 40 CFR 1508.4.

WHEN

This project will require, at minimum, 15 months to complete. Surveys are proposed to continue for several years. The need to continue the surveys on an annual basis, and the need to conduct both winter and summer surveys in each year, will be evaluated.

January 1	- March 1, 1993	Logistical Planning
March 1	- March 20, 1993	Winter Survey - data collection
April 1	- May 30, 1993	Data compilation
July 1	- July 20, 1993	Summer Survey - data collection
Aug. 1	- Sept. 15, 1993	Data compilation
Sept. 15	- Dec. 31, 1993	Data analysis
Jan. 1994		Draft Report
March 1994		Final Report

BUDGET (\$K)

USFWS

Personnel	\$ 108.5
Travel	12.0
Contractual	80.0
Commodities	10.0
Equipment	30.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 240.5

General 21.9
Administration

Project Total \$ 262.4

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93046

Project Title: Habitat Use, Behavior, and Monitoring of Harbor Seals in Prince William Sound, Alaska

Project Category: Restoration Monitoring, Habitat Protection

Project Type: Marine Mammals

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Marine Fisheries Service (NMFS)

Project Term: January 10, 1992 to September 30, 1995

INTRODUCTION

Harbor seals (*Phoca vitulina*) occur year-round in Prince William Sound (PWS) where they often haul out on rocks, reefs, beaches, and glacial ice. They pup, breed, molt, and feed in the Sound. During extensive surveys of PWS in 1991, 2,500-3,000 harbor seals were counted on haulouts. Another 1,700 were counted in the Copper River Delta and Orca Inlet. This under-estimates the population since some seals were in the water and some small haulouts were not surveyed. From 1984 to 1988, harbor seal numbers at trend sites in PWS declined by 43% for unknown causes. The decline continued in 1989-1990, exacerbated in oiled areas by the *Exxon Valdez* oil spill (EVOS); 1990 counts were 57% lower than in 1984. Following the oil spill, counts of harbor seals at oiled trend count sites declined by 35%, compared to 13% at unoiled sites, indicating a reduction of about 20% at oiled haulouts. It is likely that over 200 harbor seals were killed by the EVOS in PWS. Although molting surveys in 1991 suggested that numbers might be increasing, pupping counts were 10% lower in 1992 than in 1991. Whether there are long-term effects is unknown.

Harbor seals are important to residents of PWS for subsistence. In 1987-1989, they made up 13%-19% of the total harvest of subsistence foods in Tatitlek. In Chenega Bay in 1985-1986, harbor seals accounted for 27% of the total pounds harvested. Harbor seals are also watched by tourists and recreational users of PWS and they interact with and are incidentally killed in commercial fisheries. Like all marine mammals, they have special federal protection under the Marine Mammal Protection Act. If the current decline continues or if up-to-date population data are not available, harbor seals could be placed in a more restrictive legal classification.

The proposed study will take place in PWS. The information obtained will benefit residents of Tatitlek, Chenega Bay, and other PWS communities who use harbor seals for subsistence, and tourists and other recreational users by providing information on trends in abundance, biology of the seals, and insight into possible causes for the ongoing decline. Data will benefit PWS fishermen by ensuring that restrictive measures regarding incidental take of harbor seals are not implemented unnecessarily due to lack of data. Information contributed by this study may lead to management recommendations will ensure that human activities do not have further impacts on harbor seals.

WHAT

A. Goals

The goals of this study are as follows:

1. to monitor the abundance and trends of harbor seals in oiled and unoled areas of PWS in order to determine trends in numbers since their decline following the EVOS; and
2. to characterize habitat use and hauling out and diving behavior of harbor seals so that important habitat can be identified and properly managed.

B. Objectives

The objectives are as follows:

1. to conduct aerial surveys of harbor seals at 25 trend count sites in PWS during pupping and molting in 1993 and 1994;
2. to compare data from surveys to data collected following the EVOS to determine whether seals are recovering; 3) to describe hauling out and diving behavior, and by inference, feeding behavior of satellite-tagged seals in PWS relative to date, time of day, and tide; 4) to describe use of and frequency of movements between haulouts; and 5) to determine movement patterns within PWS and between PWS and adjacent areas.

WHY

We cannot assume that the number of seals in oiled areas will return naturally to pre-spill levels. It is necessary to have current data to know whether seal numbers in PWS have stabilized or are continuing to decline. The proposed surveys will provide such information. To date, the data are equivocal: 1991 molting counts increased slightly but 1992 pupping counts declined. Molting counts in oiled areas were 30% lower in 1991 than they were in 1988 before the EVOS. By comparison, counts at unoled sites were approximately the same in 1988 and 1991. Overall since 1984, there has been a decline of more than 50% in numbers that have left much of the harbor seal habitat in PWS vacant. Subsistence hunters and other local residents complain about the scarcity of seals and want to know why there has been a decline.

While count data are essential for monitoring trends in abundance, they are of little help in explaining the decline or designing conservation and management measures to facilitate recovery. There is no information on site fidelity, movements between sites, seasonal changes, habitats used for feeding, or feeding behavior. It is clear based on data from harbor seals that were satellite-tagged as part of a pilot EVOS restoration study that some seals in PWS make unexpectedly long movements in short periods of time, and that there is more interchange among seals in PWS and the Copper River delta than was anticipated. Areas of particular biological significance must be identified and appropriately managed to be able to aid recovery in any way

Project Descriptions

possible.

Under federal law, subsistence is the priority use of marine mammals. Data on seal abundance should be shared with PWS residents so that hunters can regulate their seal harvest to ensure that the harvest is sustainable. If data are not current and adequate to determine that subsistence takes and fisheries removals are sustainable, this could result in very restrictive incidental take regulations for PWS salmon fisheries. While it is not clear what caused the declines prior to the EVOS, there is little question that the EVOS compounded the decline. Consequently, post-spill monitoring must continue until residual effects of the EVOS are no longer evident. This project will complement other activities of NMFS on conservation and management of harbor seals.

HOW

We are proposing a two-year field study (1993, 1994) with final data analysis and reporting to take place in year three. Harbor seal abundance will be monitored by flying aerial surveys during pupping (June) and molting (August/September). A fixed-wing aircraft will be used to fly a survey of 25 trend count sites at an altitude of 500 feet. These 25 sites have been used for PWS harbor seal trend counts since 1984, including NRDA studies in 1989-1991. The observer will count all seals and photograph large groups. Pups will be counted separately in June. We will attempt to survey each site 7-10 times during a survey period to reduce statistical variance of the counts. Methodology and observers will be the same as those used in 1989-1991 NRDA studies. Several surveys will also be conducted of seals in the Copper River Delta to gain understanding of the relationship between seal counts in PWS and the Delta. Counts will be compared to data collected prior to and during the EVOS in order to document whether and how rapidly recovery in the oiled area occurs. Project investigators will travel to Chenega Bay and Tatitlek at least once each year to exchange information with village residents.

Satellite-linked time-depth recorders (PTTs) will be attached to 12 seals per year (6 each in spring and autumn) at a variety of locations in PWS in order to better evaluate geographical and seasonal differences in movements and behavior. Seals will be caught by in nets placed near haulouts and PTTs will be glued to their backs with epoxy resin. Each PTT will transmit signals to polar-orbiting satellites when the seal is hauled out or when it surfaces for a sufficient time. Sensor information will indicate when the animal is hauled out, and how deep and for how long it dives. PTTs will be shed during the annual molt in autumn. Pilot studies demonstrated that the project is feasible. During 1991-1992, PTTs were attached to eight seals and data were received for 3-67 days. Several seals made substantial movements within PWS and to the Gulf of Alaska and the Copper River Delta.

Aerial survey data will be analyzed using the trimean statistic as the measure of central tendency. Between-year comparisons of pup production and abundance during the fall molt will be done using a Repeated Measures Analysis of Variance (ANOVA) performed on the trimeans of site count data. Hypotheses will be tested using orthogonal contrasts derived from the specialized ANOVA. Data on geographic location and movements will be plotted by computer. Rates of movement and average lengths and depths of dives will be calculated depending on location, date, and size of the seal. Hauling out periods relative to tidal stage will be examined by analyzing sensor data that indicates whether the seal is on land or at sea.

ENVIRONMENTAL COMPLIANCE

No environmental analysis is required for this study. As required by the Marine Mammal Protection Act, ADF&G has been authorized under Permit No. 700 to instrument up to 100 harbor seals with PTTs during the period 1992-1995. No additional permits are required.

WHEN

This project will be conducted during 1993 and is proposed for 1994 also, with final report submission in either 1994 or 1995 depending upon whether the second year of field effort is conducted. Aerial surveys will be conducted during June and August/September of each year. Each survey period will be 7-14 days, depending on weather and tides. One of the investigators will visit Chenega Bay and Tatitlek once a year to discuss survey results with residents. Satellite tags will be attached during 10-14 day periods in May and September of each year. Because a lead time of 3-6 months is required to obtain PTTs, we will have to order PTTs by November of 1992 and 1993. Satellite data acquisition costs must be prepaid to Service ARGOS by February of each year. Data are received monthly and preliminary analysis will begin as soon as data diskettes are received. Final analyses cannot be completed until the PTTs have ceased to function (April-June 1995). A report of field activities will be submitted in letter form within 30 days following any field activity. Annual progress reports will be submitted by 31 December 1993 and 1994. A final report will be submitted by 30 September 1995. Results will be prepared for publication in a peer-reviewed journal.

BUDGET (\$K)**ADF&G**

Personnel	\$ 104.7
Travel	10.2
Contractual	46.7
Commodities	49.9
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 211.5
General Administration	<u>19.0</u>
Project Total	\$ 230.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93047

Project Title: Subtidal Monitoring: Recovery of Sediments, Hydrocarbon-degrading Microorganisms, Eelgrass Communities, and Fish in the Shallow Subtidal Environment.

Project Category: Restoration monitoring

Project Type: Subtidal

Lead Agency: National Oceanic and Atmospheric Administration.

Cooperating Agencies: Alaska Department of Fish and Game; Alaska Department of Environmental Conservation

Project Term: March 1, 1993 to September 30, 1995

INTRODUCTION

A. Background on the Resource/Service

This project will monitor the recovery of subtidal sediments, hydrocarbon-degrading microorganisms, eelgrass communities, rockfish, and bottom fish from SHALLOW subtidal areas of Prince William Sound. An important component of this study is tracking the loss of oil from the environment and from organisms in the spill area.

Hydrocarbons were found in the shallow subtidal sediments and in species (rockfish, flounders) associated with the shallow bottom sediments. Investigators attempting to restore or monitor recovery of populations of shallow subtidal organisms following the *Exxon Valdez* oil spill will want to know what concentrations of petroleum hydrocarbons are present in sediments, and if they continue to contaminate the organisms and have sublethal impacts.

We anticipate that complete recovery to background levels of hydrocarbons in subtidal sediments in the Sound is likely to take several years.

B. Summary of Injury

Subtidal sediments have been found to be contaminated by oil at no fewer than 15 sites within Prince William Sound by June 1990. Hydrocarbon contamination of sediments had reached a depth of 20 m at least 8 sites. Evidence of hydrocarbon movement down-slope into subtidal sediments was detected by 1991; further oil movement to greater depths is suspected (from weathering, cleaning, etc.) but is unknown.

A few dead rockfish were found after the spill. Species exposure in rockfish and flounders (contaminated bile) was documented between 89-91, but not since. Eelgrass beds in oiled areas were affected by the spill. Persistence of hydrocarbons and their impacts on associated species were not examined in 1992, and the current status of recovery is unknown.

C. Location

All locations of the study will be in Prince William Sound (PWS; except for potential control sites outside PWS if needed). All projects within the study will sample the same oiled sites all of which were sampled in previous years. Five oiled and five reference sites will be studied intensively by all agencies cooperating in the project.

The oiled sites will include Herring Bay, Northwest Bay, Sleepy Bay, Snug Harbor, and Bay of Isles. The control sites will include Drier Bay, Lower Herring Bay, Moose Lips Bay, Olsen Bay, and Zaikof Bay. All sites were sampled repeatedly under the NRDA program. Sites will be sampled in June/July 1993 and 1994.

WHAT

A. Goal

Monitor recovery of sediments, hydrocarbon-degrading microorganisms, eelgrass beds, and shallow fish species in the subtidal environment.

B. Objectives

1. National Oceanic and Atmospheric Administration
 - A. Determine Hydrocarbons concentration and composition in subtidal sediments in PWS by GC-MS (6 depths; 10 sites).
 - B. Determine hydrocarbon movement down slope in three oiled bays (150 samples per bay, all from 0-20 meters) by fast screening UV-Fluorescence procedures.
 - C. Determine changes in exposure of fishes to hydrocarbons by monitoring bile, MFO activity and histopathological lesions in near-shore bottom fish.
2. Alaska Department of Environmental Conservation
 - A. Measure the numbers of hydrocarbon-degrading microorganisms and their activity as an indicator of persistence of biodegradable oil in PWS sediments.
3. Alaska Department of Fish and Game
 - A. Determine impacts and recovery of shallow eelgrass communities in western PWS that were impacted by the spill.
 - B. Determine changes in exposure of fishes to hydrocarbons by monitoring bile, MFO activity and histopathological lesions in Rockfish.

Project Descriptions

WHY

A. Benefit to Injured Resources/Services

The sediment hydrocarbons sub-project will determine the recovery of oiled sediments, if any, and the movement of subtidal oil, if any. The other sub-projects will determine if contamination continues in species, and if responses to contamination or impacts continues.

Management of species and habitats may be influenced by the level of recovery (e.g., no contamination or detectable responses would permit higher rates of harvest for target species). Information on rates of recovery of contaminated habitats and species is needed to protect those habitats and species.

HOW

A. Methodology

All of the sites proposed for sampling by this project were sampled by the cooperating agencies between 1989-91. None of the sub-projects proposed here were implemented in 1992. All sub-projects will use methods comparable to the methods they employed in 1989-91 to insure temporal comparability of the results. The project will be limited to 10 sites within PWS.

Specific methods vary considerably between sub-projects. Sediments will be collected primarily by divers (some grab samples will be taken at greater depths) and will be analyzed by GC-MS. All sediment samples will be screened using the UV-Fluorescent procedures developed for analyzing sediments from the mussel bed study. Details of the methods for monitoring biological impacts/contamination will be given in detailed study plans and will follow the methods used in previous years.

Chain of custody procedures will be followed after collection of all samples.

B. Coordination with Other Efforts

The sub-projects will coordinate closely with each other to insure concurrent sampling dates and similar stations between studies. Also, this project will coordinate with the mussel bed project, and will make use of the shoreline evaluations particularly to identify stations for the intense subtidal sampling at 3 oiled bays.

ENVIRONMENTAL COMPLIANCE

It is not anticipated that this study will have a significant effect on the environment and an Environmental Impact Statement or Environmental Assessment will not be necessary.

WHEN

All field work will be conducted in June/July 1993 and 1994. An interim progress report will be completed by 1 Dec. 1993 and 1994. Final reports for sub-projects with one field season will be completed by 1 May 1994; those for sub-projects with two field seasons will be completed by 1 May 1995.

BUDGET SUMMARY

All sub-projects are self-contained. Budgets include analytical costs, vessel-field logistics, university overhead, and final analyses/interpretation/write up.

Note: Because the summer field season occurs in the fourth quarter of the fiscal year, much of the sample analysis will fall in the first two quarters of the next fiscal year.

BUDGET (\$K)

	NOAA	ADEC	ADF&G	TOTAL
Personnel	\$ 230.6	\$ 2.5	\$ 38.1	\$ 271.2
Travel	20.8	0.0	1.9	22.7
Contractual	185.0	62.4	313.0	560.4
Commodities	51.0	0.0	6.5	57.5
Equipment	9.0	0.0	0.0	9.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 496.4	\$ 64.9	\$ 359.5	\$ 920.8
General Administration	<u>47.6</u>	<u>4.7</u>	<u>27.7</u>	<u>79.9</u>
Project Total	\$ 544.0	\$ 69.6	\$ 387.2	\$ 1,000.7

EXXON VALDEZ OIL SPILL BRIEF PROJECT DESCRIPTION

Project Number: 93050

Project Title: Update: Restoration Feasibility Study #5 (*Identification and Recordation of Information Sources Relevant to Land and Resources Affected by the Exxon Valdez Oil Spill*)

Project Category: Technical Support

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: None

Project Term: March 1, 1993 to May 31, 1993

INTRODUCTION

Restoration planning and implementation projects proposed to enhance and accelerate the recovery of areas affected by the *Exxon Valdez* oil spill require information on natural resources, land status, and damage assessment. In a previous study, Restoration Feasibility Study #5, DNR compiled information identifying available sources of information pertaining to land status, existing and proposed uses of both public and private lands, natural and cultural resource inventories, existing infrastructure, management plans, maps and other resource documents that were relevant to the restoration process. Since this project was completed in March 1991, much damage assessment and other ancillary information has become available. To facilitate the restoration process it is necessary to identify available damage assessment information, locate its source, determine its availability and evaluate its relevance within the context of restoration.

Information will be collected and added to an existing DNR database and be published as an Update to Restoration Feasibility Study #5, *Identification and Recordation of Information Sources Relevant to Land and Resources Affected by the Exxon Valdez Oil Spill*. This document would then be made available to Principle Investigators, Restoration Planners and the public.

WHAT

A. Goal

The goal of this project is to identify sources of existing information pertinent to the *Exxon Valdez* Oil Spill Restoration Process. Specific objectives include the following:

1. Identify location and source of damage assessment studies and update the existing document to reflect new information.
2. Identify the sources and locations of maps, management plans, and other resource documents pertaining to land status, public resources, land use patterns, ownership, existing and proposed land use, vegetation, fish and wildlife populations, habitat, recreational value, commercial resources and cultural resources.

3. Produce a selected bibliography identifying the source and location of reports, maps, scientific literature, management plans and studies relevant to the restoration process.

WHY

In order to properly plan for the design and implementation of appropriate restoration projects, it is necessary to review and make accessible existing information about land and resource status, damage assessment in the affected area, and existing and proposed land use. This information should be updated to reflect new and recently released damage assessment studies. The restoration team should consider updating this publication on a yearly basis to provide a complete body of knowledge for Restoration Planners, Principle Investigators and the public.

HOW

A survey of existing and ongoing damage assessment studies will be conducted as well as an update of previously compiled information published in Restoration Feasibility Study #5. Information collected will be added to the existing DNR database and an Update to Restoration Feasibility Study #5 will be published. Technicians collecting information for this study will coordinate with other agencies in order to provide a comprehensive survey of existing information.

ENVIRONMENTAL COMPLIANCE

The project qualifies for a categorical exclusion under the National Environmental Policy Act.

WHEN

The project will begin March 1, 1993 and be completed May 31, 1993.

March 1, - April 1, 1993	Survey damage assessment studies.
April 1, - May 15, 1993	Update RFS #5 database.
May 15, - May 31, 1993	Prepare database for publishing.

BUDGET (\$K)

ADNR

Personnel	\$ 6.9
Travel	0.0
Contractual	1.5
Commodities	0.4
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 8.8
General	<u>1.4</u>
Administration	
Project Total	\$ 10.2

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93051

Project Title: Habitat Protection Information for Anadromous Streams and Marbled Murrelets

Project Category: Habitat Protection and Acquisition

Project Type: Survey

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: Alaska Department of Fish and Game; Department of Interior, Fish and Wildlife Service

Project Term: October 1, 1992 to September 30, 1994

INTRODUCTION

This project will acquire detailed information on the locations and characteristics of habitats and services of injured resources so that habitat/protection or acquisition options can be evaluated. Data collection efforts will focus on anadromous fish and murrelets. Anadromous fish were affected by the oil spill in a number of ways: pink salmon had high egg and fry mortalities, reduced growth rates, and possible morphological abnormalities; sockeye salmon suffered poor smolt survival due to overescapement. Murrelet populations were impacted by initial mortalities and continue to be depressed.

This project will encompass lands throughout the spill-affected area.

WHAT

This project has two components:

1. Murrelet nesting habitat assessment; and,
2. Stream habitat assessment.

1. Murrelet Nesting Assessment

The purpose of this sub-project is to help restore murrelet populations injured due to the *Exxon Valdez* oil spill by providing information that could be used to protect, through acquisition or other means, murrelet nesting habitat. This sub-project will further characterize the nesting habitat of

marbled and Kittlitz's murrelets in the spill-affected area. Two objectives will be implemented to achieve this goal:

- A. Determine habitat features that are reliable indicators of high density murrelet nesting areas in the spill-affected area.
- B. Determine feasibility of using radio telemetry to determine nesting habitat of murrelets in the spill-affected area.

2. Stream Habitat Assessment

The stream habitat assessment project is intended to be a comprehensive survey of anadromous fish stream resources that will provide basic information needed to evaluate candidate lands for restoration, protection, enhancement or acquisition actions.

The project is composed of two sub-projects:

- A. Stream Habitat Assessment Study: Surveying anadromous fish distribution and documenting the total number and extent of anadromous fish streams on candidate lands.
- B. Stream Classification Study: Developing channel typing procedures that will allow comparative evaluations of stream habitat on private and public lands.

WHY

Marbled murrelets and anadromous fish, were injured by the oil spill. Murrelets nest in trees throughout the spill area but little is known about their nesting requirements. Work conducted in 1992 is providing some information on nesting requirements but additional information is needed before nesting habitat can be reliably determined. Any habitat protection applied to uplands for murrelets would be dependent on the ability to accurately estimate the quality and quantity of nesting habitat.

Anadromous fish, such as pink salmon were also injured by the oil spill. The surveying portion of the project will locate and map new anadromous streams within candidate lands that may require habitat protection. The stream classification study will provide a GIS based tool that will allow comparative evaluations of streams throughout the spill area. This component will also provide a level of information that can be expanded upon through additional field work should such information become necessary.

HOW

Based on results from the 1992 season, selected habitat types will be tested for predicted levels of murrelet activity, particularly behaviors indicating occupation of the habitat for nesting. Potential nesting areas will be surveyed using intensive dawn watches along elevational or distance-from-water gradients. Previously monitored high-density nesting areas will be surveyed to determine the relative level of murrelet upland activity for 1993. The U.S. Forest Service will

Project Descriptions

determine forest cover attributes (specifically, forest structure, volume and stand class as well as plant associations) for dawn watch sites within each survey area. These data will be used to determine the habitat characteristics of occupied and unoccupied sites. The study area for this portion of the project will include Prince William Sound (PWS) and areas outside PWS (Kenai Peninsula, Kachemak Bay, Afognak Island). The specific areas to be studied outside of PWS will be determined after results from 1992 field work are available.

Radio-telemetry could be a useful technique for determining the nesting areas of murrelets, however, capture methods, radio life-span and ability to track murrelets are still experimental. We propose to conduct a pilot study on capturing and tagging murrelets to determine the feasibility of using radio-telemetry to determine the nesting habitat of murrelets in the spill zone. Given the experimental nature of this work, we propose to conduct the study in Kachemak Bay, which is relatively accessible and has a high density of both murrelet species.

Streams within candidate private lands will be walked to determine the extent of anadromous fish habitat. Concurrent with the streams walks, information on channel types will be collected and entered into the stream classification study.

The stream classification study will use existing air photographs to classify streams within the spill area. Selected sites will be surveyed during the field season to verify and correct the maps. All the maps will be placed into an ARC-INFO based GIS.

ENVIRONMENTAL COMPLIANCE

The proposed project qualifies for a categorical exclusion under terms of the National Environmental Policy Act.

WHEN

Several of the planned project components are continuing studies previously funded by the Trustee Council. The general timelines for the individual components are as follows:

1. Stream habitat assessment: Present - September 1994.
2. Murrelet nesting habitat assessment: Present - September 1994
3. Stream channel typing: January - September 1994

BUDGET (\$K)

	USFS	ADF&G	USFWS	TOTAL
Personnel	\$ 260.7	\$ 182.8	\$ 98.2	\$ 541.7
Travel	19.0	15.0	30.0	64.0
Contractual	190.0	101.0	86.0	377.0
Commodities	21.0	1.0	10.0	32.0
Equipment	42.5	1.5	14.0	58.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 533.2	\$ 301.3	\$ 238.2	\$ 1,072.7
General Administration	<u>52.5</u>	<u>34.4</u>	<u>20.7</u>	<u>107.1</u>
Project Total	\$ 585.7	\$ 335.7	\$ 258.9	\$ 1,179.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93052

Project Title: Identification and Protection of Important Bald Eagle Habitats.

Project Category: Restoration Habitat Protection and/or Acquisition.

Project Type: Birds

Lead Agency: U.S. Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 1995

INTRODUCTION

Bald eagles are closely associated with intertidal habitats. They use these areas for feeding, and they nest almost exclusively within 200 meters of the beach. The *Exxon Valdez* oil spill caused direct mortality to an estimated 800-900 bald eagles throughout the spill area and significant losses to productivity in Prince William Sound. This project would complete the nest inventory in Prince William Sound which was begun during damage assessment studies; nest tree marking and other habitat protection work would be undertaken cooperatively with landowners, emphasizing areas likely to be developed in the near future. Identification of important feeding or seasonal concentration areas may involve areas from the Kenai Peninsula to Cape Yakataga. Primary benefits would be to bald eagles and other species dependent on timbered, shoreline habitats in Prince William Sound. Secondary benefits would occur in areas outside Prince William Sound, which are deemed critical to bald eagles.

WHAT

A. Goal

The goal of this project is to identify and protect threatened or important bald eagle habitats to ensure the recovery of bald eagles from the *Exxon Valdez* oil spill, and maintain healthy bald eagle populations over the long term.

B. Objectives

1. Inventory and mark bald eagle nests, emphasizing areas likely to be developed.
2. Provide land managers with maps depicting locations of bald eagle nest sites on their lands.
3. Develop a list of lands that require additional measures to ensure protection, such as conservation easements or outright acquisition.

- 4 Monitor a sample of radio-tagged bald eagles to gain a better understanding of shoreline use for feeding and nesting, improve management guidelines, and to identify important concentration areas for bald eagles.

WHY

Bald eagle habitats within the spill area have been identified in development plans for timber, minerals, oil and gas, and other types of uses that may not be compatible with eagle nesting, feeding, and roosting requirements. Some threats to habitat are imminent, such as logging of which might be essential bald eagle habitat in Prince William Sound, Copper River Delta, Kenai Peninsula, Cape Suckling, and Afognak Island. The timely identification and protection of threatened habitats will enhance the recovery of bald eagles from the *Exxon Valdez* oil spill, and maintain healthy bald eagle populations over the long term.

This study will improve the rate of recovery and prevent further degradation of critical bald eagle habitat. Data acquired from this study will provide input for an overall habitat protection strategy for the spill area, which will benefit not only bald eagles, but any species dependent upon timbered shoreline, old growth forest, and intertidal or riparian areas. This study represents an essential step toward justifying and prioritizing specific lands for acquisition.

HOW

The study will have three main elements: (1) inventory and marking of bald eagle nest trees, (2) distributing maps of eagle nests to landowners and providing guidelines for protection of habitats, and (3) continuing to monitor a sample of eagles radio-tagged during the damage assessment study to document shoreline use and identify important concentration areas.

The first element will involve habitat reconnaissance by helicopter to locate bald eagle nests. These efforts would concentrate in areas not previously surveyed in Prince William Sound during damage assessment studies. Areas with nests would later be visited by boat to mark the tree and record the characteristics of the site. The location would be verified using a Global Positioning System (GPS) receiver. These data would be entered into the GIS database.

The second element would provide land owners with a map of nests on their lands and a copy of the regional guidelines for bald eagle management. Lands under imminent threat of logging would be targeted for initial reconnaissance and subsequent cooperative habitat protection work with landowners.

The third element of this project will involve monitoring a sample of radio-tagged adult and immature eagles to document habitat use throughout the year. Flights will be conducted weekly and specific locations will be mapped for individuals in each age group. These locations will be examined to determine the extent and types of habitats that eagles use as requirements for food and shelter shift throughout the year. Nests of tagged adults will represent an unbiased sample, which will be characterized to assess nesting habitat. Information will be gathered on concentration areas as they are observed, recording the location and cause of the concentration. Low level surveys will be conducted to determine the numbers of eagle using concentration areas.

Project Descriptions

Information acquired through this study will complement data collected during the damage assessment study on bald eagles. It will help identify important eagle habitats, and contribute to other efforts directed at assessing the relative value of certain habitat or specific areas to wildlife.

ENVIRONMENTAL COMPLIANCE

The proposed project is a non-intrusive study that appears to qualify for a categorical exclusion from the requirements of the National Environmental Policy Act.

WHEN

This project should be initiated immediately because 1) some lands containing high densities of eagle nests are targeted for logging in the immediate future, 2) this information is necessary to guide decisions on land acquisitions or other types of habitat protection, and 3) a huge investment in time, resources, and money was made to capture and radio-tag a large sample of bald eagles from 1989 to 1991, as part of the damage assessment process. A delay in initiating this project will result in the loss of these transmitters as their battery life is consumed, and a valuable investment will be wasted.

Monitoring of radio-tagged birds would be resumed as soon as funds are available, and continued weekly for 12 months. Contacts with landowners would begin during winter 1993. Nest surveys will be conducted in May 1993. Tree marking, focusing on areas with the greatest threat of logging, would be conducted during the summers of 1993 and 1994. Mapping and GIS work will be accomplished during winters.

BUDGET (\$K)

	USFWS
Personnel	\$ 55.5
Travel	3.0
Contractual	89.0
Commodities	2.0
Equipment	25.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 174.5
General Administration	<u>13.5</u>
Project Total	\$ 188.0

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Project Descriptions

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93053

Project Title: Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the *Exxon Valdez* Oil Spill

Project Category: Technical Support

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 2000

INTRODUCTION

A. Background on the Resource/Service

The analytical expertise of this project was developed through rigorous performance criteria and quality control/quality assurance standards imposed on participating analytical labs during the damage assessment process. Several thousand environmental samples have been collected and analyzed for hydrocarbons in support of the *Exxon Valdez* NRDA effort, and it is anticipated that at least several hundred more samples will be collected and analyzed as part of Restoration efforts to evaluate the recovery of areas affected by the spill. The data from completed NRDA analyses are stored in a database at the Auke Bay Laboratory, where methods are under continuing development to distinguish samples containing oil from the *Exxon Valdez* oil spill from samples containing oil from other sources, and to determine the oil concentration and weathering status of *Exxon Valdez*-oiled samples. The results of these efforts provide numerical correlates that are directly related to oil, and that may be used by principal investigators (PI's) of other Restoration projects, by other governmental agencies, and by the public, to assess associations of observed biological effects with concentrations of *Exxon Valdez* oil. The purpose of the proposed project is to apply and extend these hydrocarbon interpretation methods to samples analyzed for the Restoration effort, and to insure the comparability of analytical and interpretive results with those of the NRDA effort.

B. Summary of Injury

This project provides technical support to other projects addressing injuries resulting from the *Exxon Valdez* oil spill. This project will provide fundamental interpretive services to all Restoration PI's, governmental agencies, and the public at large, and as needed.

C. Location

This project will be undertaken at the Auke Bay Laboratory in Juneau, Alaska.

WHAT

A. Goal

This project will support the measurement of other restoration projects performances with respect to achieving standards and success criteria of those projects. The goal of this project is to estimate the amount of *Exxon Valdez* oil that is present in environmental samples analyzed for hydrocarbons that are collected for the Restoration effort, such that the methods used and the results are comparable with those used for *Exxon Valdez* NRDA samples and to continue maintenance of results in a database for access by all appropriate parties. This project will not be responsible for archival and disposal of collected samples.

B. Objectives

1. Provide a statistically defensible basis for deciding which environmental samples analyzed for hydrocarbons contain oil from the *Exxon Valdez* spill;
2. Estimate the original concentration of *Exxon Valdez* oil in environmental samples that have been determined to contain *Exxon Valdez* oil;
3. Assess the weathering status of sediment hydrocarbon samples; and
4. Archive these results in a database extension of the NRDA database and as physical maps.

WHY

A. Benefit to Injured Resources/Services

This project will make possible the evaluation of the following:

1. the recovery of areas affected by the oil spill by identifying the amount of *Exxon Valdez* oil remaining, and
2. the association of continuing biological impacts of the spill with *Exxon Valdez* oil remaining in impacted areas.

B. Relationship to Restoration Goals

The Trustees should fund this project so that they can determine the extent of recovery (here defined as absence of *Exxon Valdez* oil) of areas oiled by the spill.

Project Descriptions

HOW

A. Methodology

Hydrocarbon data from environmental samples will be examined using pattern recognition techniques related to principal component analysis. The pattern of hydrocarbon measurements in a sample will be compared with the pattern in samples of pure and of weathered *Exxon Valdez* oil, and the pattern variance of known samples of weathered *Exxon Valdez* oil will be used to evaluate the likelihood that the pattern observed in an environmental sample could have derived from *Exxon Valdez* oil contamination. Samples with patterns that could likely have derived from *Exxon Valdez* oil will be presumed to contain *Exxon Valdez* oil, and the concentration of oil initially present will be determined after correction for weathering or biological alteration, by calculating the minimum concentration of *Exxon Valdez* oil necessary to explain the observed hydrocarbon pattern in the sample. Sample archival and database procedures will follow NRDA. NRDA and restoration databases will be merged and placed on a database server to facilitate data retrieval.

B. Coordination with Other Efforts

This project will provide basic, interpreted hydrocarbon results that will be of great use to all other projects that either monitor the persistence of *Exxon Valdez* oil in affected areas, or assess the biological effects of persistent *Exxon Valdez* oil. In addition, this project will promote consistency among published results by providing a uniform and consistent approach to hydrocarbon interpretation.

ENVIRONMENTAL COMPLIANCE

This is not a field study nor does it have any significant effect on the environment. Consequently, an Environmental Impact Statement nor Environmental Assessment need not be provided.

All federal, state, and local laws are followed in the management of chemical analysis.

WHEN

The project will continue as long as samples are collected and need interpretation. Restoration sample data will be interpreted as received. Therefore there is no set beginning or ending time. We intend to work with PI's to interpret and map their data to their needs on an ongoing basis. We anticipate this need to continue as long as restoration hydrocarbon samples are collected. We propose to interpret and analyze a set of data within several months of receipt.

BUDGET (\$K)

NOAA

Personnel	\$ 82.9
Travel	6.2
Contractual	0.0
Commodities	4.0
Equipment	0.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 93.1

General	<u>12.4</u>
Administration	

Project Total \$ 105.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93057

Project Title: Damage Assessment GIS

Project Category: Technical Support

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: None (USF&WS considered separately)

Project Term: March 1, 1993 to September 30, 1993

INTRODUCTION

A. Background on Injured Resource/Service

This project provides a baseline information repository (shoreline, oiling, Environmental Sensitivity Index, shore type, ownership, salmon streams, bathymetry data) for statistical analysis and mapping in support of damage assessment projects scheduled for completion during this last budget period, and for final database and product documentation, repository storage, and distribution and dissemination.

WHAT

A. Goal

Complete statistical analysis and GIS mapping support for existing damage assessment studies, and provide a quality controlled and documented database of baseline information for restoration study use and data publication.

B. Objectives

Complete statistical reports and maps for shoreline assessment; produce updated land status maps and anadromous streams maps; deliver fully documented, digital GIS database of oil spill related themes for final public release, and for use by restoration and habitat acquisition projects; provide direct technical support to PI's on document graphics and maps. Workload and analysis based on those projects scheduled for completion by September 1993.

WHY

A. Benefit to Injured Resource/Service

Completing the damage assessment database of baseline information will provide restoration studies with information relevant to their projects: current ownership and designated use status, oiled areas, oiling change over time, beach treatment areas, geographic links to injury determinations, baseline information critical to habitat acquisition objectives.

HOW**A. Methodology**

Complete major documentation project to prepare data layers for final publication. Quality control newly acquired data, and produce statistical reports and maps for the shoreline assessment study, against spring 91 and spring 92 data. Acquire current ownership data from various sources (BLM, DNR, USFS), synthesize data, produce most current land status maps, and distribute to damage assessment and restoration studies.

ENVIRONMENTAL COMPLIANCE

ADNR GIS is a technical service project, and is subordinate to the environmental compliance of the damage assessment projects supported.

WHEN

Data publication, ready for public distribution by August of 1993. Spring 91 shoreline data maps quality controlled, and produced spring 93. Produce shoreline maps and reports from spring 92 data within 3 to 4 months of receipt and quality control of data. Technical assistance to PI's subject to PI deadlines, all work complete by October 93.

BUDGET (\$K)

	ADNR
Personnel	\$ 53.0
Travel	0.0
Contractual	5.0
Commodities	1.5
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 59.5
General Administration	<u>8.0</u>
Project Total	\$ 67.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93059

Project Title: Habitat Identification Workshop

Project Category: Habitat/Land Protection

Project Type: Technical Support

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: Alaska Department of Environmental Conservation; Alaska Department of Fish and Game; National Oceanic and Atmospheric Administration; Alaska Department of Natural Resources; U.S. Department of the Interior

Project Term: January 10, 1992 to September 30, 1993

INTRODUCTION

Public comment, to date, has overwhelmingly supported use of the Habitat Protection and Acquisition option as a method of preventing further harm to, and assisting the recovery of, natural resources and services injured by the oil spill. Numerous proposals or nominations of lands believed to be deserving of protection or acquisition were received from the public as FY 93 work plan proposals.

In response, where an imminent threat is determined to exist, this project accelerates important elements of the Habitat Protection and Acquisition option within the context of maintaining the integrity of the overall Restoration Planning process and accompanying compliance with NEPA and other legal and regulatory requirements. An imminent threat is defined as a change in land use which (1) is likely to foreclose restoration options, and (2) can reasonably be expected to occur before adoption and implementation of the Restoration Plan.

WHAT

A. Goal

The goal of this project is to identify those parcels of non-public lands within the oil spill affected area which contain critical habitats necessary for the recovery of natural resources and services injured by the oil spill and which are determined to be under imminent threat.

WHY

The Habitat Protection and Acquisition option is but one of a number of restoration tools being considered in the draft Restoration Plan scheduled for release for public review and comment in February 1993. A final Restoration plan is expected in May 1993. In the interim, protection of key parcels of non-public lands which contain critical habitats is needed to ensure that the Habitat Protection and Acquisition option is not foreclosed by events preceding Trustee Council adoption and implementation of a final Restoration Plan.

HOW

1. BY NOVEMBER 1, 1992 - The Habitat Protection and Acquisition workgroup, in cooperation with The Nature Conservancy, will conduct and document a series of workshops to be attended by scientists and other resource specialists for the purpose of (1) assessing the rate and degree of recovery of resources and services injured by the oil spill, and (2) identifying and characterizing the habitats associated with the recovery of injured resources or services.
2. BY NOVEMBER 1, 1992 - The Habitat Protection and Acquisition workgroup will identify those parcels of non-public land within the oil spill affected area which face an imminent threat.

If the threat analysis indicates that there is no imminent threat, further analysis of the nomination may be deferred to the more detailed evaluation process emanating from the Restoration Planning process.

ENVIRONMENTAL COMPLIANCE

This project, which is initial data gathering, is categorically excluded from formal documentation in an environmental impact statement or environmental analysis.

WHEN

The project will commence October 1, 1992. The initial imminent threat analysis is expected to be completed by January 1993. Each subsequent year lands will be evaluated for imminent threat and, if necessary and appropriate, protection tools will be applied.

BUDGET (\$K)

	USFS	
Personnel	\$	0.0
Travel		0.0
Contractual		39.5
Commodities		0.0
Equipment		0.0
Capital Outlay		<u>0.0</u>
Sub-total	\$	39.5
General Administration		<u>2.8</u>
Project Total	\$	42.3

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93060

Project Title: Accelerated Data Acquisition

Project Category: Habitat Protection

Lead Agency: U.S. Department of Agriculture Forest Service

Cooperating Agencies: Alaska Department of Environmental Conservation, Department of Interior, Alaska Department of Natural Resources, National Oceanic and Atmospheric Administration and Alaska Department of Fish and Game.

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

This project, in cooperation with The Nature Conservancy, accelerates the collection, and compilation of existing resource data needed for evaluation of proposals for habitat protection and acquisition and for other restoration activities.

WHAT

A. Goal

Facilitate acceleration of the Habitat Protection and Acquisition option by collecting and organizing existing resource data needed to evaluate habitat protection and acquisition proposals and for other restoration activities.

WHY

A substantial amount of data on injured resources and services is essentially unusable in its present form due to the data being located in a variety of different federal and state agencies and in a variety of different and sometimes conflicting formats. A common data base usable by all of the Trustee Agencies is needed for these data to be most useful in analysis and identification of critical habitats in the spill affected area.

HOW

The Nature Conservancy, in cooperation with the Trustee Council Agencies and others, will complete collection and compilation of existing resource data from the oil spill affected areas into a data base having the following characteristics and "layers":

DATA BASE CHARACTERISTICS

The data base will be compatible with existing Trustee agency hardware and software. Database "layers" will include, but are not exclusive to the following:

DATA BASE "LAYERS"	SOURCE
Line graph (shoreline corrected post-earthquake)	DNR
Cities, towns, villages, roads	DNR (update with current
Land ownership (surface and subsurface; (2.5 acre resolution outside of built up areas)	DNR, FS, FWS, BLM, NPS
Hydrography (remote sensing update)	DNR, FS, USGS, FWS
Hypsography (elevation)	USGS, FS, DNR
Vegetation	FS
Anadromous streams	DFG, FS, DNR
Wildlife habitat	FWS, DFG, FS, NPS, NMFS
Shoreline oiling	DNR, DEC
Management boundaries, conservation units	DNR, FS, FWS, NPS
Easements	BLM, FS, DNR, FWS, NPS
Land use activities	DFG, COE, DNR, DEC, DGC
Bathymetry	DNR
Spruce Bark Beetle Infestation	DNR, FS

ENVIRONMENTAL COMPLIANCE

This project is categorically excluded from formal documentation in an environmental impact statement or environmental analysis under Department of Agriculture and Forest Service regulations.

WHEN

The project will start October 1, 1992 and be completed by January 31, 1993.

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93060

Project Title: Accelerated Data Acquisition

Project Category: Habitat Protection

Lead Agency: U.S. Department of Agriculture Forest Service

Cooperating Agencies: Alaska Department of Environmental Conservation, Department of Interior, Alaska Department of Natural Resources, National Oceanic and Atmospheric Administration and Alaska Department of Fish and Game.

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

This project, in cooperation with The Nature Conservancy, accelerates the collection, and compilation of existing resource data needed for evaluation of proposals for habitat protection and acquisition and for other restoration activities.

WHAT

A. Goal

Facilitate acceleration of the Habitat Protection and Acquisition option by collecting and organizing existing resource data needed to evaluate habitat protection and acquisition proposals and for other restoration activities.

WHY

A substantial amount of data on injured resources and services is essentially unusable in its present form due to the data being located in a variety of different federal and state agencies and in a variety of different and sometimes conflicting formats. A common data base usable by all of the Trustee Agencies is needed for these data to be most useful in analysis and identification of critical habitats in the spill affected area.

HOW

The Nature Conservancy, in cooperation with the Trustee Council Agencies and others, will complete collection and compilation of existing resource data from the oil spill affected areas into a data base having the following characteristics and "layers":

DATA BASE CHARACTERISTICS

The data base will be compatible with existing Trustee agency hardware and software. Database "layers" will include, but are not exclusive to the following:

DATA BASE "LAYERS"	SOURCE
Line graph (shoreline corrected post-earthquake)	DNR
Cities, towns, villages, roads	DNR (update with current
Land ownership (surface and subsurface; (2.5 acre resolution outside of built up areas)	DNR, FS, FWS, BLM, NPS
Hydrography (remote sensing update)	DNR, FS, USGS, FWS
Hypsography (elevation)	USGS, FS, DNR
Vegetation	FS
Anadromous streams	DFG, FS, DNR
Wildlife habitat	FWS, DFG, FS, NPS, NMFS
Shoreline oiling	DNR, DEC
Management boundaries, conservation units	DNR, FS, FWS, NPS
Easements	BLM, FS, DNR, FWS, NPS
Land use activities	DFG, COE, DNR, DEC, DGC
Bathymetry	DNR
Spruce Bark Beetle Infestation	DNR, FS

ENVIRONMENTAL COMPLIANCE

This project is categorically excluded from formal documentation in an environmental impact statement or environmental analysis under Department of Agriculture and Forest Service regulations.

WHEN

The project will start October 1, 1992 and be completed by January 31, 1993.

Project Descriptions

BUDGET (\$K)

USFS

Personnel	\$ 0.0
Travel	0.0
Contractual	41.0
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 41.0
General Administration	<u>2.9</u>
Project Total	\$ 43.9

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93061

Project Title: New Data Acquisition

Project Category: Land/Habitat Protection

Lead Agency: U.S. Department of Agriculture Forest Service

Cooperating Agencies: Alaska Department of Environmental Conservation; Alaska Department of Natural Resources; Alaska Department of Fish and Game; National Oceanic and Atmospheric Administration; U.S. Department of Interior

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

The purpose of this project is to acquire currently unavailable data needed for evaluation of proposals for habitat protection and acquisition and for other restoration activities.

WHAT

A. Goal

Fill gaps in existing data that are needed to evaluate habitat protection and acquisition proposals and for other restoration activities.

WHY

It is important that the Trustee Council be able to evaluate proposed habitat protection options in terms of the relative contribution that each option will have toward furthering restoration objectives. Existing data, though useful, may be inadequate for evaluation of habitat protection options - particularly long-term and acquisition.

HOW

BY JANUARY 1, 1993 - The Habitat Protection workgroup will evaluate the existing data base and determine additional data elements necessary for the base to be fully functional as an analytical tool for identifying and evaluating critical habitats being considered for protection. Specific projects to acquire needed data will then be developed and presented to the Trustee Council for approval as revisions to this project. Such projects may involve field data collection, remote sensing, digitizing or other techniques as appropriate.

WHEN

The project will start October 1, 1992 and be completed by January 1993.

COST

It is difficult to determine the cost of this project until such time as the evaluation of the existing data base is completed in April 1993. However, the necessity of collecting at least some additional data at a cost in the range of \$500,000 is a reasonable probability.

The lead agency(s) and appropriate general administrative costs will be determined and approved by the Trustee Council when approving revisions to this project for collection of specific additional data.

BUDGET (\$K)

	USFS	ADNR	TOTAL
Personnel	\$ 0.0	\$ 0.0	\$ 0.0
Travel	0.0	0.0	0.0
Contractual	250.0	250.0	500.0
Commodities	0.0	0.0	0.0
Equipment	0.0	0.0	0.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 250.0	\$ 250.0	\$ 500.0
General Administration	<u>17.5</u>	<u>17.5</u>	<u>35.0</u>
Project Total	\$ 267.5	\$ 267.5	\$ 535.0

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93062

Project Title: Restoration GIS

Project Category: Technical Support

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: None (USF&WS considered separately)

Project Term: March 1, 1993 to September 30, 1993

INTRODUCTION

A. Background on the Resource/Service

Alaska Department of Natural Resources (ADNR) is currently a major repository for EVOS damage assessment GIS data, most of which is highly relevant to restoration analysis and planning. ADNR GIS provides the most comprehensive, automated land status ownership data available. ADNR also has extensive experience dealing with the various land status implications that result from state and native selection rights, inholdings and access, and entitlement rights such as navigability and tidelands. ADNR GIS also has extensive experience providing the multi-thematic GIS analysis and mapping that will be required as habitat protection and acquisition becomes a central focus of the Restoration Team.

WHAT

A. Goal

Provide statistical and spatial analysis, and GIS mapping support for approved restoration projects. Products will be map series, data transmittal, and online query support. Consistent, current, and quality control repository services will be provided for this comprehensive geographic database.

B. Objectives

Acquire, convert, and process necessary incremental resource themes that must be integrated geographically to support restoration. For example, acquire slope/aspect data, perform needs analysis with PI, and perform the programming and data synthesis necessary to identify ideal habitats for *fucus* recovery. Provide maps and statistical analysis products, data repository services and data dissemination. Report to the Restoration Team GIS Review Committee.

WHY**A. Benefits**

Using GIS for restoration project support will allow the most informed analysis of geographically dependent information. Using ADNR GIS will allow the current economies of highly specialized personnel, database access, system and project management to transition from the historic damage assessment themes to the restoration focus. ADNR has access to, both directly and through multi-agency contacts, land use planning and land cover databases. Complex restoration alternatives may be rapidly evaluated using a GIS approach.

HOW**A. Methodology**

ADNR GIS will work directly with the PIs directing the approved Restoration projects to assess necessary GIS and analysis support. The Restoration Team has provided a tentative list of data themes required for *habitat protection*. These themes are referenced and evaluated below.

<u>Line graph</u>	- Complete as of date.
<u>Cities, towns, villages</u>	- Complete as of date.
<u>Land ownership</u>	- Mostly complete as of date, precision and currency may need to be updated and revised to consider specific project needs.
<u>Hydrography</u>	- Currently being completed, 1:63360, KAP area outstanding only.
<u>Hypsography</u>	- Currently requested from USFS/USGS.
<u>Vegetation</u>	- Currently have some land cover in the affected area, will require largest data gathering and acquisition process for restoration needs.
<u>Anadromous streams</u>	- Currently integrating this information with the hydrography above. Some is complete, with the rest currently scheduled for completion.
<u>Wildlife habitat</u>	- Some of this information is already available via damage assessment studies. Habitat information for uplands will need to be acquired, converted and processed; this work may require extensive effort.
<u>Shoreline oiling</u>	- Complete as of date.
<u>Easements</u>	- Complete for state lands, need to acquire for other lands, convert, and process.
<u>Land use activities</u>	- Need to acquire, convert, and process from various sources.
<u>Bathymetry</u>	- Complete as of date.

Project Descriptions

Additional approved Restoration projects that have high GIS potential are as follows:

Restoration of Second Growth Habitat for Wildlife in PWS

Harlequin Duck Restoration and Monitoring Study

Natural Recovery of Oiled and Treated Shoreline

Mussels and Sediments

Develop Harvest to Aid Restoration of Injured Terrestrial Mammals and Sea ducks

ADNR GIS will work with the GIS Review Committee of the Restoration Team to identify, analyze, and schedule all data acquisition, conversion, processing, and GIS production work. Additionally, ADNR GIS will work with CACI Building staff to design and implement an interactive GIS workstation environment to support immediate query needs of the Restoration Team. Analysis and representation of generalized data themes, such as vegetation, land use, and habitat, will be coordinated with and reviewed by the contributing agencies. This type of information coordination, in addition to work with the PIs, is anticipated with the USFS, ADF&G, USF&WS, native corporations, and ADEC. Other coordination efforts may be necessary to integrate broad resource agency information into PI studies.

ENVIRONMENTAL COMPLIANCE

ADNR GIS is a technical service project, and is subordinate to the environmental compliance of the restoration projects supported.

WHEN

ADNR GIS staff will continue to advise the Restoration Team on ongoing data acquisition and processing efforts that are projected to continue, or be initiated, in this seven month period. To the extent feasible, data acquisition that can be initiated before this period, for receipt and processing during this period, will be facilitated by ADNR GIS.

BUDGET (\$K)

	ADNR
Personnel	\$ 97.7
Travel	1.0
Contractual	12.0
Commodities	7.0
Equipment	6.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 123.7
General Administration	<u>14.7</u>
Project Total	\$ 138.4

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93063

Project Title: Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Fish

Project Category: Restoration Manipulation and Enhancement

Lead Agency: Alaska Department of Fish and Game (ADFG)

Cooperating Agencies: U.S. Forest Service (USFS)

Project Term: March 1, 1993 to October 31, 1993

INTRODUCTION

This project will develop project designs for appropriate and cost-effective salmon spawning habitat restoration and enhancement projects. The *Exxon Valdez* oil spill injured wild pink and chum salmon eggs and fry. Various amounts of oil were deposited in intertidal spawning habitats in Prince William Sound (PWS) where up to 75% of the spawning occurs. Salmon eggs deposited in 1989 and all subsequent years have shown increasing egg mortality. Recently detected genetic damages resulting from oil contamination in spawning beds may further reduce the productivity and fitness of wild salmon populations for many years to come. This project will be undertaken in PWS where portions of the spawning habitat was injured. The benefits of the project will be realized in the communities of Whittier, Valdez, and Cordova which support the commercial fishing industry in the region.

WHAT

The goal of this project is to develop proposals and designs for appropriate and cost-effective instream habitat and stock restoration projects. The following objectives will be achieved:

1. Review existing literature and databases, determine preliminary restoration techniques for specific sites, and identify sites where field studies are needed,
2. Conduct field studies at specific sites to collect data needed to evaluate restoration techniques,
3. Compile available data and select the most appropriate fish restoration projects,
4. Collect additional field data if necessary to develop project design and cost estimates, and write proposals for specific projects, and
5. Estimate the total area of anadromous fish spawning habitat that was oiled in PWS.

WHY

This is an ongoing project currently evaluating various sites in PWS for application of established spawning habitat restoration and enhancement techniques. The project is essential to responsibly develop project proposals and designs to restore and replace damaged salmon spawning habitat. The project was initially funded in September, 1991 near the end of the field season in PWS.

Field activities in 1991 focused on evaluation of 41 sites for construction of fish passes and fry weirs. Field activities in 1992 are focused on evaluation of 15 sites for construction of spawning channels. The ADFG is currently installing standpipes and water temperature/level recorders at these sites to obtain data on groundwater stability and water temperatures. The equipment must be in place throughout the winter to determine minimum temperatures and water levels at each site. Additional funds in FY93 are essential to retrieve the equipment being placed in the field now, analyze data, and prepare project designs.

HOW

Fifteen potential spawning channel sites have been identified in PWS (Willette and Carpenter 1991). Standpipes and electronic water temperature/level recorders are currently being installed at these sites to evaluate groundwater stability and temperature. This equipment must be retrieved from the field in FY93. Data obtained from electronic water temperature/level recorders will be analyzed to evaluate groundwater stability and the probable rate of intragravel flow at potential spawning channel sites. The rate of intragravel flow is an important variable affecting egg-to-fry survival in salmon spawning beds (McNeil 1966).

Data collected from field surveys conducted in FY92 (Willette and Carpenter 1991) will be evaluated in FY93 along with data describing groundwater characteristics. Criteria outlined by Bonnell (1991) will be used to evaluate the suitability of specific sites for the construction of spawning channels. In addition, the estimated increase in fish production and the benefit/cost ratio of the proposed project will be considered. Additional field work may be required to collect engineering data needed to develop detailed project designs. All restoration survey efforts will be coordinated with local landowners and governments.

Literature Cited

- Bonnell, R.G. 1991. Construction, operation, and evaluation of groundwater-fed side channels for chum salmon in British Columbia. In: Proceedings of the Fisheries Bioengineering Symposium, American Fisheries Society Symposium no. 10, pp. 109-124.
- McNeil, W.J. 1966. Distribution of spawning pink salmon in Sashin Creek, Southeastern Alaska, and survival of their progeny. USFWS, Spec. Sci. Rpt.-Fisheries NO. 538.
- Willette, T.M. and G. Carpenter. 1991. Survey and evaluation of instream habitat and stock restoration techniques for anadromous fish. Draft Status Report to the *Exxon Valdez* Oil Spill Trustees Council, 34p.
- Willette, T.M. and G. Carpenter. 1991. Survey and evaluation of instream habitat and stock restoration techniques for anadromous fish. Detailed Study Plan (Oil Year 4). Submitted to *Exxon Valdez* Oil Spill Trustees Council, 12p.

ENVIRONMENTAL COMPLIANCE

The project qualifies for a categorical exclusion under the National Environmental Policy Act, because it does not involve any significant manipulation of biological resources or their habitats.

Project Descriptions

WHEN

This project will continue for five months in FY93. This will allow project staff sufficient time to retrieve equipment placed in the field in FY92, analyze data, collect additional engineering design data if necessary, and prepare detailed project proposals (Table 1).

Table 1: Summary of project activities in FY93.

Date	Activity
June	Retrieve standpipes and electronic water temperature/level recorders from 15 sites.
July	Compile and evaluate data, select sites for development of detailed project proposals.
August	Collect additional engineering data if necessary for project design.
Sept-Oct	Prepare detailed project proposals including engineering designs.

BUDGET (\$K)

	ADF&G
Personnel	\$ 29.3
Travel	0.3
Contractual	20.5
Commodities	3.5
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 53.6
General Administration	<u>5.8</u>
Project Total	\$ 59.4

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93064

Project Title: Habitat Protection Fund

Project Category: Habitat/Land Protection

Project Type: Habitat Protection

Lead Agency: Alaska Department of Natural Resources (Federal agency to be determined)

Cooperating Agencies: Alaska Department of Fish and Game; National Oceanic and Atmospheric Administration; Department of Interior; Alaska Department of Environmental Conservation; U.S. Forest Service

Project Term: January 10, 1992 until completed

INTRODUCTION

Public comment, to date, has overwhelmingly supported use of the Habitat Protection and Acquisition option as a method of preventing further harm to, and assisting the recovery of, natural resources and services injured by the *Exxon Valdez* oil spill. Numerous proposals or nominations of lands believed to be deserving of protection or acquisition were received from the public as FY 93 work plan proposals.

In response, this project demonstrates a strong commitment on the part of the Trustees to accelerate important elements of the Habitat Protection process. The project would be conducted within the context of maintaining the integrity of the overall Restoration Planning process and accompanying compliance with NEPA and other legal and regulatory requirements.

WHAT

The goal of this project is to capitalize on available opportunities to provide protection for those parcels of non-public lands within the oil spill affected area which contain critical habitats linked to those natural resources and services injured by the oil spill. The initial focus of the effort will be on those parcels facing imminent threat, where the lack of protection could foreclose restoration opportunities.

WHY

The Habitat Protection and Acquisition option is but one of a number of restoration tools being considered in the draft Restoration Plan scheduled for release for public review and comment in February 1993. A final Restoration plan is expected in May 1993. In the interim, protection of key parcels of non-public lands which contain critical habitats is needed to ensure that the Habitat Protection and Acquisition option is not foreclosed by events preceding Trustee Council adoption and implementation of a final Restoration Plan. This will also allow the application of the full-spectrum of habitat protection actions ranging from moratorium to fee title. This fund: provides

the wherewithal to bring negotiations to closure when appropriate; exhibits good faith intent on the part of the Trustees; and allows access to monies without long delays.

HOW

1. BY NOVEMBER 15, 1992 - The Habitat Protection and Acquisition work group, in cooperation with The Nature Conservancy, will conduct and document a series of workshops to be attended by scientists and other resource specialists for the purpose of (1) assessing the rate and degree of recovery of resources and services injured by the oil spill, and (2) identifying and characterizing the habitats associated with the recovery of injured resources or services. This task is part of Project 93059.

2. ONGOING - The Habitat Protection and Acquisition work group will identify those parcels of non-public land within the oil spill affected area which face an imminent threat.

If the threat analysis indicates that there is no imminent threat, further analysis of the nomination may be deferred to the more detailed evaluation process emanating from the Restoration Planning process.

3. BY DECEMBER 1, 1992 - The Habitat Protection and Acquisition work group, through the Restoration Team, will request authority from the Trustee Council to negotiate protection on specific parcels.

4. FOLLOWING DECEMBER 1992 - The Trustee Council approves the results of the negotiations on specific parcels.

5. SUBSEQUENT TO #4 ABOVE - Additional evaluations (i.e. appraisals, biological surveys, title searches) of specific parcels will occur subsequent to Trustee Council approval of the negotiated terms.

WHEN

The project will commence October 1, 1992. There is no set completion date for the project because protection measures will vary depending upon the specifics of each parcel and negotiations may occur over multiple years.

ENVIRONMENTAL COMPLIANCE

Each habitat protection action will be evaluated to determine the level of environmental analysis and documentation necessary to comply with the National Environmental Policy Act (NEPA). It is expected that NEPA compliance for most contemplated protection measures would not exceed an Environmental Analysis level of documentation.

Project Descriptions

BUDGET (\$K)

	ADNR	FEDERAL AGENCY (TBD)	TOTAL
Personnel	\$ 0.0	\$ 0.0	\$ 0.0
Travel	0.0	0.0	0.0
Contractual *	10,000.0	10,000.0	20,000.0
Commodities	0.0	0.0	0.0
Equipment	0.0	0.0	0.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 10,000.0	\$ 10,000.0	\$ 20,000.0
General Administration	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Project Total	\$ 10,000.0	\$ 10,000.0	\$ 20,000.0

* The actual amount for interim habitat protection will be determined by the Trustee Council following imminent threat analysis.

**APPENDIX A:
SUMMARY OF INJURY**

The *Exxon Valdez* oil spill occurred just prior to the most biologically active season of the year in southcentral Alaska. During the four-month period after the spill, seaward migrations of salmon fry, major migrations of birds, and the primary reproductive period for most species of birds, mammals, fish, and marine invertebrate species took place. The organisms involved in these critical periods of their life cycles encountered the most concentrated, volatile, and potentially damaging forms of spilled oil. Oil affected different species differently. Resources continue to be exposed to oil remaining in the intertidal zone, as well as to oil transported to the subtidal zone. The following general account summarizes the main results from the Natural Resource Damage Assessment studies carried out after the spill.

Oil spill injuries can be estimated in several ways: Dead animals, such as birds and sea otters, can be counted and used to estimate the total number of each species lost. Where carcasses are not found and counted, injuries to populations can be based either on comparisons before and after a spill, or between oiled and unoiled environments. Measurements of physiological and biochemical changes due to oil exposure provide further evidence that may support changes observed in populations. Because populations fluctuate from year to year and there are natural differences from place to place, the most accurate estimates of injury are those in which the exact population is known just before the spill and then after the injury occurred. Although scientists studying the effects of oil spills may carry out excellent studies under difficult conditions, there are always uncertainties, especially where good pre-spill population data are lacking.

The injuries summarized here may change as the results of additional sampling and data analysis become available. It is also possible that injuries to populations of long-lived species may not be manifested for some time.

Introduction

Following the spill, humpback whales, Steller sea lions, sea otters, harbor seals, and killer whales were studied. Field work on Steller sea lions and humpback whales was completed in 1990. Humpback whale studies included photo-identification of individual whales, estimations of reproductive success, and documentation of possible displacement of whales from their preferred habitat within Prince William Sound. Exposure of this species to oil was not observed, nor were tissues sampled and analyzed for hydrocarbons. The data do not indicate an effect of the spill on mortality or reproduction of humpback whales in Prince William Sound. However, in 1989 humpback whales were not seen in Lower Knight Island Passage, a preferred habitat.

Results from the sea lion study were inconclusive. Several sea lions were observed with oiled pelts, and petroleum hydrocarbons were found in some tissues. Determining if there was an effect of the spill on the sea lion population was complicated by seasonal movements of sea lions in and out of the spill area, an ongoing population decline and a pre-existing problem with premature pupping.

Based on several photo-identification censuses a significant number of killer whales are missing from at least one and possibly two pods in Prince William Sound. Changes also have been observed in killer whale distribution and social structure. Some male whales have drooping dorsal fins. The cause of the mortalities and fin problems is uncertain.

Injuries to harbor seals and sea otters, described below, have been more evident. Studies of these species are continuing.

Sea Otters

The population of sea otters in Prince William Sound before the spill was estimated to have been as high as 10,000. The total sea otter population of the Gulf of Alaska was estimated to have been at least 20,000. Statewide, the sea otter population is estimated at 150,000. As the oil moved through Prince William Sound and the Gulf of Alaska, it covered large areas inhabited by otters. Sea otters were particularly vulnerable to the spill. When sea otters become contaminated by oil, their fur loses its insulating capabilities, leading to death from hypothermia. Sea otters also may have died as a result of oil ingestion and perhaps inhalation of toxic aromatic compounds that evaporated from the slick shortly after the spill. The effects of oil were documented by repeated surveys of populations in the spill area, recovery of beach-cast carcasses, analysis of tissues for petroleum hydrocarbons and indicators of reduced health, tracking sea otters outfitted with radio transmitters (including those released from rehabilitation centers), and estimating total mortality from the number of sea otter carcasses recovered following the oil spill. These studies concentrated on developing an estimate of sea otter mortality in Prince William Sound and along the Kenai Peninsula, the populations believed to have been most affected by the spill. During 1989, 1,011 sea otter carcasses were recovered in the spill area, cataloged and stored in freezers. Of these, 876 otters were recovered dead from the field and 135 died in rehabilitation centers or other facilities. It is estimated that 3,500 to 5,500 sea otters died from acute exposure to the oil in the entire affected area.

Heavy initial and continuing long-term exposure to petroleum hydrocarbons may be resulting in a chronic effect on sea otters. Significantly elevated concentrations of petroleum hydrocarbons have been detected in intertidal and subtidal sediment samples within the spill zone in western Prince William Sound and in intertidal mussels and benthic marine invertebrates and staples of the sea otter diet. Analyses of blood from sea otters in 1990 and 1991 indicated slight but significant differences in several blood measures in exposed animals. For example, higher eosinophil counts, total hemocrits and hemoglobin concentrations occurred in males in western Prince William Sound, the area that was oiled, compared to males in the eastern Prince William Sound, the unoiled area, suggesting systemic hypersensitivity reactions. These changes are not sufficient to indicate that the individuals that were sampled had health problems likely to result in death.

Abnormal patterns of mortality are continuing in sea otters. Based on pre-spill data from Prince William Sound, very few prime-age sea otters (animals between 2 and 8 years old) die each year and most mortality occurs among otters less than two years old. In 1990 and 1991 a high proportion of carcasses of prime-age sea otters were found on beaches, suggesting a chronic effect of the spill on sea otters.

Results of boat surveys indicate continued declines in sea otter abundance within oiled areas in Prince William Sound. Pre-spill estimates of sea otter abundance in Prince William Sound were carried out in 1984 and 1985 using similar survey techniques. Comparisons of pre- and post-spill estimates of sea otter abundance show that sea otter populations in unoiled areas experienced a 13.5 percent increase in abundance, while sea otter populations in oiled areas underwent a 34.6 percent decrease. In addition, the post-spill population in the oiled area is significantly lower than the pre-spill estimate, indicating a real decline of 1,600 sea otters in Prince William Sound in the first year after the spill, and up to 2,200 in the first three years after the spill.

Pupping rates and survival of pups through weaning in 1990 and 1991 were similar in eastern and western Prince William Sound sea otter populations. Weaned sea otter pups with radiotags died at a faster rate in western than in eastern Prince William Sound (Figure 2). In contrast, survival of tagged adult female sea otters was significantly higher in western Prince William Sound than in eastern Prince William Sound.

Sea otters released from rehabilitation centers had higher mortality and significantly lower pupping rates than those measured in the wild population before the spill. Of the 193 sea otters released from rehabilitation centers, 45 were fitted with radio transmitters. As of July 31, 1991, 14 of these animals were still alive, 14 were known to be dead, and 16 were missing. One radio transmitter is known to have failed.

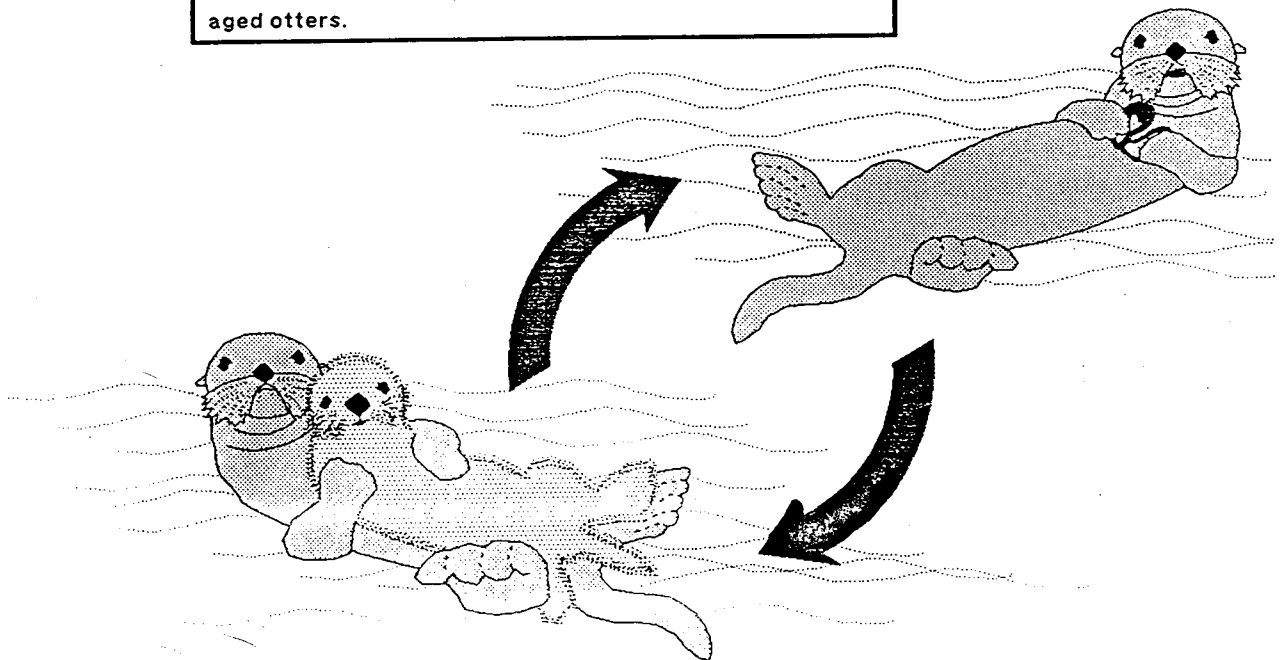
The observed changes in the age distributions of dying sea otters, continued declines in abundance, higher juvenile mortality, and higher mortality and lower

Sea Otters

Adults

Sea otters prefer shallow coastal waters with abundant molluscs and crustaceans for prey. Intertidal rocks and exposed beaches are used for haulout sites. Otters become sexually mature in 4 - 7 years. Most otters in Prince William Sound mate from September through October, but they are capable of breeding throughout the year.

INJURY: Heavy direct mortality of all age classes during the Exxon Valdez oil spill; continuing high mortality of prime aged otters.



Pups

Within Prince William Sound, most sea otter pups are born May through June. The single pup is dependent on its mother for 5 - 7 months. High quality, shallow habitats are used by female-pup pairs.

INJURY: High post-weaning mortality within the Exxon Valdez oil spill area.

Figure 2. Summary of the major injuries in relation to the life history of sea otters.

pupping rates suggest a prolonged, spill-related effect on the western Prince William Sound sea otter population.

Harbor Seals

Two hundred harbor seals are estimated to have been killed by the spill in Prince William Sound. Only 19 seal carcasses were recovered following the spill, since seals sink when they die. Population changes were documented by summer and fall aerial surveys of known haul-out areas. Toxicological and histopathological analyses were conducted to assess petroleum hydrocarbon accumulation and persistence and to determine toxic injuries to tissues. Severe and potentially debilitating lesions were found in the thalamus of the brain of a heavily oiled seal collected in Herring Bay, Prince William Sound, 36 days after the spill. Similar but milder lesions were found in five other seals collected three or more months after the spill. During 1989, oiled harbor seals were abnormally lethargic and unwary. Petroleum hydrocarbon concentrations in bile were 5 to 6 times higher in seals from oiled areas than in seals from unoiled areas one year after the spill. This indicates that seals were still encountering oil in the environment, were mobilizing fat reserves containing petroleum hydrocarbons, or both.

A complete census of harbor seals in Prince William Sound had not been conducted before the spill. However, trend index locations have been intermittently surveyed since the 1970s. Counts at the trend index sites declined by 40 percent between 1984 and 1988, with similar declines in what were subsequently oiled and unoiled areas. From 1988 to 1990, however, the decline at oiled sites, 35 percent, was significantly greater than at unoiled sites (13 percent). Trend surveys conducted in 1991 continue to indicate similar differences between oiled and unoiled areas, although mean numbers of seals in trend counts have increased since the spill. The increases in seals at unoiled sites have been significant, while those at oiled sites have risen only slightly. The first complete survey of Prince William Sound was completed during August 1991, resulting in a count of 2,875 harbor seals.

Killer Whales

Approximately 182 killer whales, forming nine distinct family units or "pods", used Prince William Sound before the spill. These whales were studied intensively before the spill, and their social structure and population dynamics are well known. Damage assessment studies of killer whales involved extensive boat-based surveys in Prince William Sound and adjacent waters. Whales were photographed, and the photographs were compared to the Alaskan killer whale photographic database for the years 1977 to 1989 to determine changes in whale abundance, seasonal distribution, pod integrity and mortality and natality rates.

The AB pod had 36 whales when last sighted before the spill in September 1988. When sighted on March 31, 1989, seven days after the spill, seven individuals were missing. Six additional whales were missing from the AB pod in 1990. Assuming that whales missing for two consecutive years are dead, the mortality rates for the AB pod were 19.4 percent in 1988-1989 and 20.7 percent in 1990-1991. The average annual mortality in AB pod from 1984 to 1988 was 6.1 percent. An additional whale was missing in 1991, but a calf also was born into the pod. The approximate calving interval of killer whales is four years. Accordingly, some long-term effects may not be obvious for many years.

Several of the missing whales from AB pod were females that left behind calves; such abandonment of calves is unprecedented in killer whales. As a consequence the social structure of AB pod has changed. Calves normally spend time with their mothers, but AB pod calves have been observed swimming with adult bulls. The occurrence of collapsed dorsal fins on two adult bulls after the spill is an indication of possible physiological injury. Very little is understood about the likely mechanisms of death from the spill. Various explanations, including oil exposure and other causes, continue to be explored. During the mid-1980s photographic evidence was obtained of bullet wounds in individuals in the AB pod, though there is no recent evidence of such shootings.

Another Prince William Sound pod, AT pod, is missing 11 whales. A subgroup of four AT pod members was photographed behind the *Exxon Valdez* three days after the grounding on Bligh Reef and three of these animals are among the missing AT pod whales. This is a transient pod and it is possible that the missing whales left the pod.

Terrestrial Mammals

Terrestrial mammals that may have been exposed to oil through foraging in intertidal habitats were studied. These species included brown bear, mink, black bear, Sitka black-tailed deer and river otters.

Brown bears forage seasonally in the intertidal and supratidal areas of the Alaska Peninsula and the Kodiak Archipelago. Preliminary analysis of fecal samples from brown bears in the spill area showed that some bears were exposed to petroleum hydrocarbons. High concentrations of petroleum hydrocarbon metabolites were found in bile from a yearling brown bear found dead in 1989. The normal rate of mortality in yearling cubs is close to 50 percent for the first two years, so it is uncertain if this death was due to oil or other causes.

Black bears also forage in the intertidal zone in the spill area and therefore could have been affected by the spill. No field studies were carried out, however, due to the difficulty of finding, collaring or otherwise investigating these animals in the dense underbrush that is their habitat.

Mink and other small mammals living in coastal areas may feed in and spend part or all of their time in the intertidal zone. When mink are sick or injured, they are known to crawl into inaccessible burrows or the brush. For this reason the effect of the spill on mink populations could not be determined. Also, information on pre-spill populations of mink and other small mammals is minimal. To determine if mink reproduction may have been affected by oil in their diet, a laboratory exposure study of ranch-bred mink was conducted. The mink were fed food mixed with small, non-lethal amounts of weathered oil. No changes in reproductive rates or success resulted from this exposure. It was found, however, that oil-contaminated food moved through the intestines of the animals at a more rapid rate than did clean food, possibly providing less nutrition to the animals.

Intensive searches of beaches revealed no Sitka black-tailed deer whose deaths could be attributed to the spill. However, deer taken for purposes of testing for human consumption (not part of the damage assessment) were found to have had slightly elevated concentrations of petroleum hydrocarbons in tissues of some individuals that fed on kelp in intertidal areas. It was determined that the deer were safe to eat.

River Otters

A few river otter carcasses were found by clean-up workers. River otters forage in streams and shallow coastal habitats that were contaminated by the spill. Analysis of river otter bile and blood samples indicated that petroleum hydrocarbons were being accumulated by this species. Moderately elevated concentrations of haptoglobin and activities of amino transferase enzymes in the blood of river otters from oiled areas in 1991 indicate a lingering toxic effect of oil on this species. Studies of radio-tagged animals in Prince William Sound showed that home ranges in oiled areas were twice that of unoiled areas, suggesting that in oiled areas otters must forage over a larger area to obtain sufficient food. In 1991, body lengths, body weights and dietary diversity were lower in oiled areas. River otters often feed on mussels, which continue to be contaminated with oil in many areas of Prince William Sound.

Birds

Introduction

Birds were among the most conspicuous victims of the oil spill. Seabirds are particularly vulnerable to oil, as they spend much of their time on the sea surface while foraging. Oiled plumage insulates poorly and loses its buoyancy, and oiled birds often die from hypothermia or drowning. Birds surviving initial acute exposure to oil may ingest oil by preening. About 36,000 dead birds were recovered after the spill; at least 31,000 of these deaths were attributable to oil. In addition to the large number of murres, sea ducks and bald eagles recovered after the spill, carcasses of loons, cormorants, pigeon guillemots, grebes, murrelets and other species were also recovered. The recovered birds represent only a small proportion of the total number of birds killed by the spill. Many oiled birds undoubtedly floated out to sea and sank. Many oiled birds that were washed onto beaches may have been scavenged, hidden in masses of oil buried under sand and gravel by wave actions, decomposed or simply washed onto a beach that was not searched. In a number of cases carcasses found shortly after the spill were not turned in to receiving stations. The results of analyses using computer models that account for some of these variables suggest that the total number of birds killed by the spill ranged from 300,000 to 645,000, with the best approximation that between 375,000 and 435,000 birds. These estimates reflect only direct mortality occurring in the months immediately following the spill, and do not address chronic effects or loss of reproductive output.

Common and thick-billed Murres

Approximately 1,400,000 murres reside in the Gulf of Alaska region, which stretches from Unimak Pass at the tip of the Alaskan Peninsula to the Canadian border in southeastern Alaska. The total population of murres in Alaska is approximately 12,000,000. The murre colonies on the Chiswell Islands are the colonies most visited by tourists in Alaska. Most of the pre-spill data on murre abundance in the Gulf of Alaska colonies affected by the spill were gathered in the mid-1970s to the early 1980s. In 1989 and 1990 murres were the most heavily affected bird species. As oil moved out of Prince William Sound and along the Kenai Peninsula and the Alaska Peninsula, it encountered major seabird nesting areas, such as the Chiswell and Barren islands, as well as numerous smaller colonies. The oil contaminated these areas in the Gulf of Alaska at the same time that adult murres were congregating on the water near their colonies in anticipation of the nesting season. Approximately 22,000 murre carcasses were recovered following the spill.

At the major colonies in the spill area surveys indicated that an estimated minimum of 120,000 to 140,000 breeding adult murres were killed by the spill. Extrapolating this information to other known murre colonies affected by the spill, but not specifically studied, the mortality of breeding adult murres is estimated to have been 172,000 to 198,000 birds. The spill also affected wintering and non-breeding birds and the total area-wide mortality of murres is estimated to be about 300,000. Numbers of breeding murres declined in 1989 from pre-spill counts or estimates at Alaska Peninsula sites (50-60 percent), the Barren Islands (60-70 percent) and the Triplet Islands (35 percent). These decreases persisted in 1990 and 1991. No significant changes in murre numbers were noted for the Semidi Islands and Middleton Island, colonies which are in the Gulf of Alaska, but outside the spill zone. Murres exhibit strong fidelity to traditional breeding sites and infrequently immigrate to new colonies.

Normally, murres breed on cliff faces in densely packed colonies. Each murre colony initiates egg laying almost simultaneously. Synchronized breeding helps repel predators such as gulls and ravens. In oiled areas, murre colonies have fewer breeding individuals than before the spill, breeding is later than normal and breeding synchrony has been disrupted.

These changes in numbers of birds and their behavior have caused complete reproductive failure in several of the large colonies during 1989, 1990 and 1991, and thus lost production of at least 300,000 chicks. There are some indications that normal breeding occurred in isolated areas of the Barren Island colonies in 1991, but it is uncertain when the whole colony will start to produce significant numbers of viable chicks. Murre colonies in unoiled areas displayed none of these injuries and had normal productivity in the years since the spill.

Bald Eagles

Of the estimated Alaskan bald eagle population of 39,000 birds (27,000 adults and 12,000 fledglings), an estimated 4,000 reside in Prince William Sound, and an estimated 8,000 to 10,000 reside along the northern Gulf of Alaska coast. One hundred fifty-one (151) dead bald eagles were found following the spill. Although there is considerable uncertainty regarding the total mortality of bald eagles, several times this number may have been killed initially by the spill. Seventy-four percent of radio-tagged bald eagles that died of natural causes during subsequent studies ended up in the forest or in other places away from the beaches where they would likely not have been found had they not been tagged. If this pattern of carcass deposition is representative of what happened following the oil spill, then as many as 580 bald eagles may have been killed directly by the spill. However, since eagles dying of acute exposure to oil probably behave differently than those dying naturally and the population trend counts did not indicate a significant decline following the spill, the number of eagles killed is certainly less than this number.

To assess injuries to bald eagles, helicopter and fixed-wing surveys were flown to estimate populations and productivity. Radio transmitters were attached to bald eagles to estimate survival, distribution and exposure to oiled areas. Bald eagles in Prince William Sound were most intensively studied. Productivity surveys in 1989 indicate a failure rate of approximately 85 percent for nests adjacent to moderately or heavily oiled beaches compared to 55 percent on unoiled or lightly oiled beaches. This resulted in a lost production of at least 133 chicks in Prince William Sound in 1989. Nest success and productivity on the Alaska Peninsula were also lower in 1989 than in 1990, but differences between these years for eagles residing in other coastal

areas affected by the spill were less apparent. Nest occupancy was lower in oiled areas than in unoiled areas in both 1989 and 1990. Reproduction returned to normal in 1990 and population indices from surveys in 1982, 1989, 1990 and 1991 suggest that the spill has not measurably affected the bald eagle population in Prince William Sound.

Sea Ducks

More than 2,000 sea duck carcasses were recovered after the spill, including more than 200 harlequin ducks. Studies concentrated on harlequins, goldeneyes, and scoters--species that use the intertidal and shallow subtidal habitats most heavily affected by the spill. All of these species feed on invertebrates, such as mussels, which in 1991 continued to show evidence of petroleum hydrocarbon contamination. Harlequin ducks, which feed in the shallowest water of all these species, were most affected. In 1989 and 1990 about 40 percent of the harlequin ducks sampled had tissues contaminated with petroleum hydrocarbons, and about 33 percent of the harlequins collected in the spill area had poor body condition and reduced body fat. The 1991 survey indicates harlequin population declines and a near total reproductive failure in oiled areas of Prince William Sound (Figure 3). Oil-contaminated mussel beds may be the source of this apparent continuing problem.

Other Birds

Changes in populations of waterbirds in the spill area were assessed with boat surveys, the same technique used in surveys carried out in 1972 and 1973, and then, again in 1984. Changes were assessed on the basis of both the earlier and later pre-spill data. Declines occurred in 16 of the 39 species or groups examined for the entire Prince William Sound area between 1972-1973 and post-spill. Declining species or groups of species include: grebes, cormorants, northern pintail, harlequin duck, old squaw, scoters, goldeneyes, bufflehead, black oystercatcher, Bonaparte's gull, black-legged kittiwake, Arctic tern, pigeon guillemot, *Brachyramphus* (marbled and Kittlitz's) murrelets, and northwestern crow. The following species or group of species declined more in oiled areas than in unoiled areas since the early 1970s: harlequin duck, black oystercatcher, pigeon guillemot, northwest crow, and cormorants. Comparisons of post-spill survey data with 1984 pre-spill data indicate that harlequin duck, black oystercatcher, murres, pigeon guillemot, cormorants, Arctic tern, and tufted puffin populations declined more in oiled areas than in unoiled areas.

Marbled and Kittlitz's murrelet populations declined greatly in Prince William Sound since 1972 and 1973. In 1973, the estimated murrelet population in the Sound was 304,000 birds, while murrelet populations were estimated to be 107,000 in 1989, 81,000 in 1990, and 106,000 in 1991. The length of time between pre-spill and post-spill surveys makes it difficult to determine the relative contribution of the spill to this decline. However, a high proportion of murrelets present in Prince William Sound were killed by the spill. Also, internal contamination of apparently healthy murrelets by petroleum hydrocarbons in the spill area opens the possibility that there were significant effects on murrelets beyond the initial mortality. Disturbance associated with clean-up activities may have influenced the number of murrelets observed in the spill area in 1989.

Nine black oystercatcher carcasses were found after the spill. This species feeds intertidally and breeds on rocky shores throughout the spill zone. In addition to mortality caused directly by the spill, oiling affected their reproductive success. Egg volume and weight gained by chicks raised on oiled sites were substantially lower than chicks raised on unoiled sites. The difference in weight gain by chicks may have resulted from differences in food supply, as the amount of food delivered to chicks raised on oiled sites was significantly less than that delivered to chicks at unoiled sites. Hatching success, fledging success, and productivity of young birds were not significantly different between oiled and unoiled sites. Direct disturbance by clean-up activities significantly reduced oystercatcher productivity on Green Island during 1990.

Pigeon guillemots are nearshore diving seabirds that gather daily on intertidal rocks near their colonies during the breeding season and forage by probing into intertidal and subtidal recesses and kelp. Five hundred sixteen (516) guillemot carcasses were recovered following the spill. Between 1,500 and 3,000 guillemots were estimated to have been killed by the spill, representing as much as 10 percent of the known pigeon guillemot population in the Gulf of Alaska. Boat surveys indicate that in 1973 the Prince William Sound guillemot population was approximately 14,600; while in 1989, 1990 and 1991, the estimated populations were, respectively, 4,000, 3,000 and 6,600. These data indicate that the Prince William Sound guillemot population was declining prior to the spill. The declines were significantly greater, however, in oiled areas. For the four islands of the Naked Island group, post-spill surveys showed a 40 percent decline in guillemots present during peak colony attendance hours compared to pre-spill surveys. Declines corresponded to the degree of shoreline oiling.

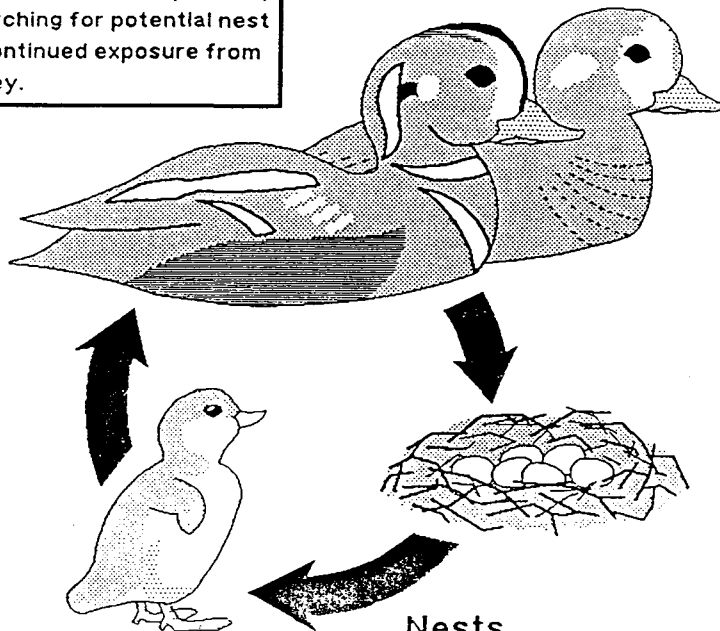
The extent of injury to certain species, including loons, cormorants and gulls, will never be known because pre-spill population estimates for these species in the spill area are not available. Although Peale's peregrine falcons did not appear to be directly affected by the oil spill, disturbance from nearshore activities appears to have affected rates of nest occupancy and reduced clutch and brood sizes in 1989. Studies of song birds did not document an injury from the spill.

Harlequin Ducks

Adults

In early May, paired harlequins congregate at the mouths of anadromous fish streams. The pairs fly upstream to search for suitable nest sites. Wintering harlequins feed on mussels and crustaceans in intertidal waters.

INJURY: Pairs are not congregating at streams in the Exxon Valdez oil spill area, nor are they searching for potential nest sites. Possible continued exposure from contaminated prey.



Broods

Broods hatch in July. They remain on freshwater with the female until August when they return to coastal waters.

INJURY: No broods observed within the Exxon Valdez oil spill area in 1990, and only one brood found in 1991, indicating reproductive failure at nesting and/or poor brood survival.

Nests

Located along shallow and swift rivers and streams. 3 to 7 eggs are laid in May and incubated for 28 - 30 days.

INJURY: No nests discovered in the Exxon Valdez oil spill area.

Figure 3. Summary of the major injuries in relation to the life history of harlequin ducks.

Fish and Shellfish

Introduction

No massive kills of adult open-water fish were observed following the spill. Adult salmon, for example, were able to migrate as expected to spawning areas after the spill. The early life stages of some fish species and adults of others depend on the intertidal and shallow subtidal areas and the upper layers of the sea where the greatest concentrations of oil occurred. In addition the eggs and larvae of fishes are more sensitive to oil contamination than are adults.

It is not surprising, therefore, that the available evidence from this spill indicates that the greatest damage was to the eggs and larvae of some species of fish, especially those that inhabit and spawn in the intertidal zone (salmon) and shallow subtidal zone (herring) or that forage in shallow water (Dolly Varden and cutthroat trout). Many species of fish produce large numbers of eggs and only a relatively small number reach adulthood. Since natural factors affecting such survival change from year to year it is difficult to estimate or measure the effects of oil on adult fish populations whose early stages were injured. Nevertheless, during 1991, data were gathered that would potentially help clarify the effects on adult fish exposed to oil as eggs or larvae. These data are still being analyzed.

The deaths of some rockfish, a deepwater species, also were attributed to oil. Several species of coastal and offshore fish, including pollock, halibut, sablefish, cod, yellowfin and flathead sole and rockfish, showed evidence of continuing exposure to petroleum hydrocarbons over a large geographic area, but significant injury has not been documented. Because salmon and other fish species can metabolize petroleum hydrocarbons, these contaminants are unlikely to concentrate in fish tissues. Indicators of exposure in fish include increased concentrations of hydrocarbon metabolites in bile and activities of mono-oxygenases in liver tissue.

Pink Salmon

The full extent of short-term injury to pink salmon cannot be assessed until after the 1991 run returns have been analyzed. As predicted before the spill, the catch of pink salmon in Prince William Sound during 1990 was an all-time record high and the 1991 run was also quite high. These catches were primarily due to strong runs of hatchery-produced salmon. Survival to adulthood of salmon fry released from the Armin F. Koernig hatchery, located in the middle of a heavily oiled area of the spill zone, was half that of Esther Hatchery, located outside the spill area. Wild production of pink salmon did not mirror the record production of hatchery fish.

Seventy-five percent of wild pink salmon in Prince William Sound spawn in the intertidal portion of streams. Wild salmon did not shift spawning habitat following the spill and many salmon deposited their eggs in intertidal areas of oiled streams. In the autumn of 1989 egg mortality in oiled streams averaged about 15 percent, compared to about 9 percent in unoled streams. Subsequently, egg mortality has generally increased. In 1991 there was a 40 to 50 percent egg mortality in oiled streams, and about an 18 percent mortality in unoled streams. The relative roles of the spill and other factors, including natural variability, in causing the increased 1991 egg mortality are being analyzed. In general the number of spawning fish in streams of Prince

William Sound indicates that the more viable spawn that is produced, the more adults will return to spawn from that year class. If this is true, then it is likely that mortality at the egg stage is additive with other sources of mortality in later stages and that the increased egg mortality observed since the spill is a threat to wild pink salmon in Prince William Sound. Eggs and larvae of wild populations continue to be exposed to oil in intertidal gravel in some areas.

Pink salmon juveniles were exposed to petroleum hydrocarbons from the spill in nearshore marine habitats in oiled portions of Prince William Sound in 1989. The survival of pink salmon to adulthood is directly related to growth rates during the initial marine residency. Growth rates of juvenile pink salmon were lower in oiled locations in 1989, but there was no evidence of continued reduced growth of juvenile salmon in nearshore waters in 1990. Laboratory experiments in 1991 confirmed that ingestion of food contaminated with oil can cause reduced growth and increased mortality of juvenile pink salmon.

Fry growth was decreased in oiled streams as compared to unoled streams over the winter of 1989-1990 and larvae from some heavily oiled streams showed gross morphological abnormalities, including club fins and curved vertebral columns. The pink salmon that returned to Prince William Sound in the summer of 1990 were hatched prior to the spill and were exposed to oil as larvae. Although there is great uncertainty, some analyses suggest that the 1990 return of both wild and hatchery pink salmon was 20 to 25 percent lower than expected without the spill, resulting in a return of 15 to 25 million fewer fish. Fish that returned in 1991 were the first that were exposed to oil as eggs. The returns of wild salmon to oiled and unoled streams in 1991 are still being analyzed.

Sockeye Salmon

Commercial harvest of sockeye salmon was curtailed in portions of Cook Inlet, Chignik, and Kodiak in 1989 because of the spill, resulting in an unusually high number of adults returning to spawn in certain lake systems--for example, Kenai and Skilak lakes, Red and Akalura lakes. The number of adults returning to the spawning areas is referred to as the "escapement." Commercial salmon fisheries are actively managed to maintain high production, and large overescapements resulting in low smolt production are a threat to the maintenance of sustained good production. In this case overescapement has resulted in poor survival to the smolt stage in the Kenai and Skilak lakes system. This overescapement is expected to result in a return of adults in 1993 and 1994 that is less than needed for adequate production. Total closure or severe reduction of the commercial and sport sockeye fisheries may be necessary in those years to enable recovery of this species in the Kenai and Red lakes systems. These fisheries account for up to half the commercial sockeye harvest in the Kodiak and Cook Inlet areas.

Dolly Varden and Cutthroat Trout

Prince William Sound is the northern extent of the range of cutthroat trout (Figure 4). Both cutthroat trout and Dolly Varden use nearshore and estuarine habitat for feeding throughout their lives, although they overwinter and spawn in freshwater. The highest concentrations of petroleum hydrocarbon metabolites in bile of all fish sampled in 1989 were found in Dolly Varden. Tagging studies demonstrated that the annual mortality of adult Dolly Varden in oiled areas was 32 percent greater than in unoled areas. The larger cutthroat trout also showed higher levels of mortality in oiled than in unoled areas. In 1989-1990, there was 57 percent greater mortality, and in 1990-1991, a 65 percent greater mortality, in oiled streams versus unoled streams.

Additionally, cutthroat trout growth rates in oiled areas were 68 percent in 1989-1990 and 71 percent in 1990-1991 of those in unoiled areas. Although concentrations of bile hydrocarbons were greatly reduced in 1990 and 1991, indicating less exposure to oil, it is unclear why differences persist in survival rates between oiled and unoiled streams.

Pacific Herring

Populations of Pacific herring were spawning in shallow eelgrass and algal beds at the time of the spill. The effects of oil on egg survival, hatching success, larval development and recruitment to the spawning population were studied. A large percentage of abnormal embryos and larvae were found in samples from oiled areas of Prince William Sound collected during the 1989 reproductive season. Larvae in oiled areas also had a greater incidence of eye tumors. Analysis of histopathological abnormalities in tissues of adult herring reveal the occurrence of some lesions whose presence would be consistent with exposure to oil. Whether the adult population has been affected by these larval injuries and lesions will not be determined until the 1989 and 1990 cohorts return to spawn in 1992 and 1993. It will be difficult, however, to measure a change in the adult population, beyond the bounds of the natural variability.

Evidence of oil contamination in adult herring was found in 1989 and 1990. In 1989, hydrocarbon metabolites occurred in the bile of adult fish. There were significant changes in the incidence of histopathological lesions and in the parasite burden of adults found in oiled as compared to unoiled sites. The parasite burden of adult herring returned to pre-spill incidences in 1991.

Rockfish and Other Fish

A small number of dead rockfish were found after the spill; this was the only type of fish observed dying after the spill. Five rockfish were recovered soon enough after death to establish oil exposure as the probable cause of death. Analyses of rockfish bile indicated exposure to oil in a significant portion of the samples collected from oiled areas in 1989, only one individual in 1990 and none in 1991. Histopathological liver lesions were evaluated in 1990 and two types of lesions (liver lipidosis and liver sinusoidal fibrosis) were found to be significantly elevated in oiled areas. Other species that had measurable amounts of petroleum hydrocarbon metabolites in the bile in 1989 included halibut, pollock, rock sole, yellowfin sole, flathead sole and Pacific cod, and in 1990, Dover sole and sablefish.

Cutthroat Trout

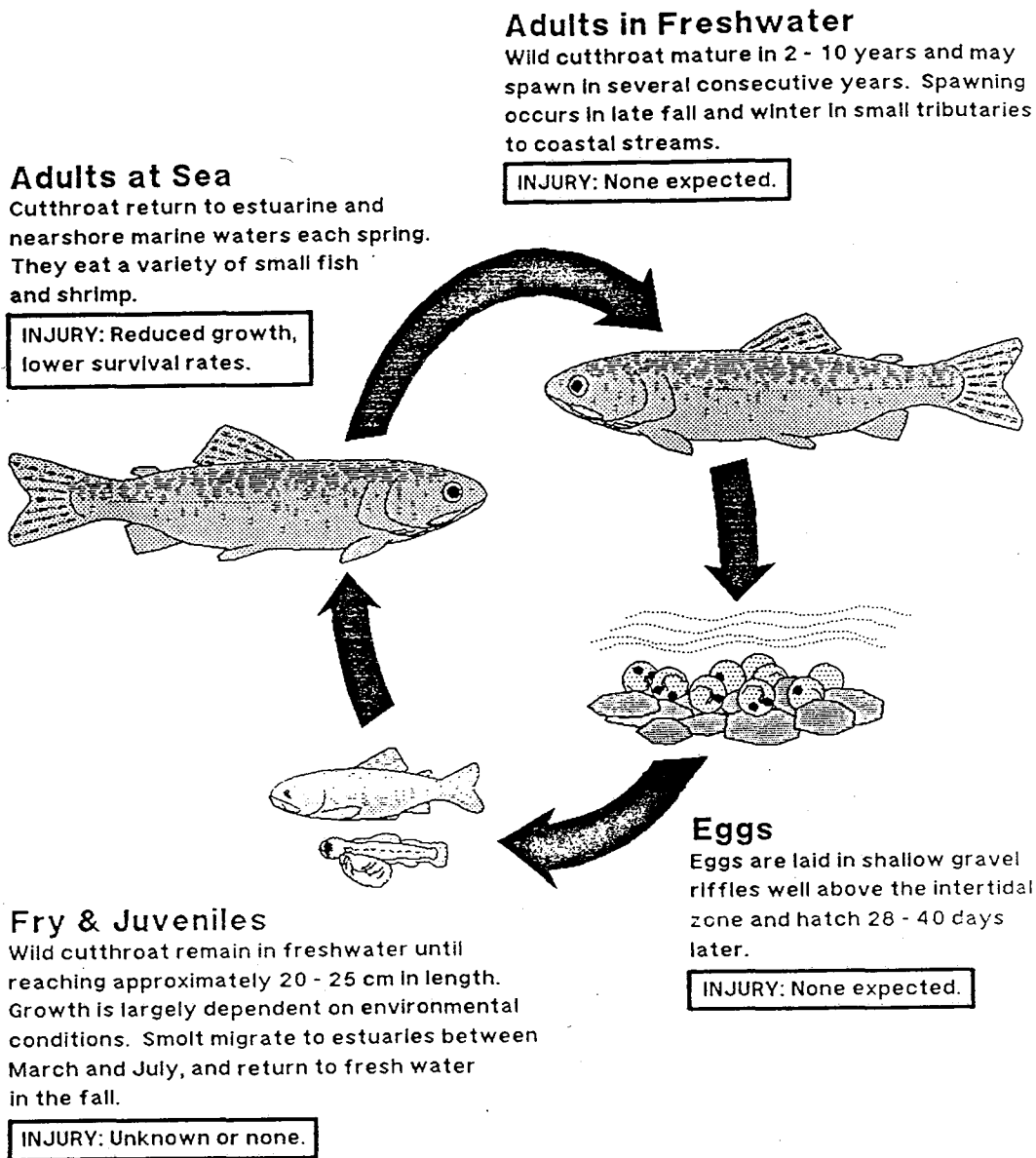


Figure 4. Summary of the major injuries in relation to the life history of cutthroat trout.

Introduction

The coastal tidal zone, commonly known as the "intertidal zone," was the most severely contaminated habitat. Intertidal habitats are highly productive and biologically rich. The intertidal zone is particularly vulnerable to the grounding of oil, its persistence and effects of associated clean-up activities.

Supratidal

The supratidal zone is above the high tide but still within the influence of the ocean from storm surges and wave spray. Results of studies from the Kodiak Island and Alaska Peninsula areas suggest that oil in the supratidal habitat and beach clean-up disturbance decreased the productivity of grasses and other vegetation, including beach rye, a grass that helps stabilize beach berms. In one instance, clean-up activities completely removed the supratidal vegetation. Increased production of supratidal vegetation was found in Prince William Sound in 1989. Increased production as a result of decreased browsing by terrestrial mammals or a fertilizing effect of the oil are possible causes.

Intertidal

Populations of intertidal organisms were significantly reduced along oiled shorelines in Prince William Sound, on Kodiak Island and Cook Inlet, and along the Alaskan Peninsula. Densities of intertidal algae (*Fucus*), barnacles, limpets, amphipods, isopods, and marine worms were decreased. Although there were increased densities of mussels in oiled areas, they were significantly smaller than mussels in the unoiled areas, and the total biomass of mussels was significantly lower. Sediment traps collected significant concentrations of petroleum hydrocarbons during the winter of 1990-1991, indicating that oil is continuing to be removed from the beaches by cleaning and natural processes and is being transported subtidally. Intertidal organisms continue to be exposed to petroleum hydrocarbons from subsurface oil in beaches.

In 1991 relatively high concentrations of oil were found in mussels and in the dense underlying mat (byssal substrate) of certain oiled mussel beds. These beds were not cleaned or removed after the spill and are potential sources of fresh oil for harlequin ducks, black oystercatchers, river otters and juvenile sea otters--all of which feed on mussels and show signs of continuing biological injury. The extent and magnitude of oiled mussel beds are unknown and continue to be investigated.

Intertidal fishes were less abundant in oiled areas than in unoiled areas in 1990. No such differences were documented in 1991.

Fucus, the dominant intertidal plant, was severely affected by the oil and subsequent clean-up activities. The percentage of intertidal areas covered by *Fucus* was reduced following the spill, but the coverage of opportunistic plant species that characteristically flourish in disturbed areas was increased. The average size of *Fucus* plants was reduced, the number of reproductive-sized plants greatly decreased, and the remaining plants of reproductive size decreased in reproductive potential due to fewer fertile receptacles per plant. Recruitment of *Fucus* at oiled sites was also reduced.

Subtidal Habitat

Between 1989 and 1991, oil concentrations declined in intertidal sediments sampled at most oiled locations, while the concentration in shallow subtidal sediments at depths of 3-20 meters remained about the same or in some cases, rose slightly. Petroleum hydrocarbon accumulation in filter-feeding mussels experimentally placed in the water column in various oiled areas was significant during the summer of 1989, but decreased in 1990. Patterns of sediment toxicity to marine amphipods and larval bivalve molluscs, used as test organisms, reflected similar patterns. In 1990 significant toxicity to these organisms was associated only with intertidal sediment samples from heavily oiled sites, but in 1991 toxicity was associated primarily with sediment samples from the shallow subtidal zone. The current evidence from analyses of petroleum hydrocarbons in the bile of bottom-dwelling fishes suggests that animals living on or near the sea floor continue to be exposed to petroleum hydrocarbons. In this connection the analysis of samples of bottom-dwelling organisms at the 100-m depth is continuing to see if there was a detectable effect of oil deep communities.

Clams exposed to oil actively take up hydrocarbons, but metabolize them very slowly. Hydrocarbons are consequently accumulated in high concentrations in clams. Studies of clam growth rates were initiated after the spill and analyses are still being conducted. Contaminated clams and other invertebrates are a potential continuing source of petroleum hydrocarbons for harlequin ducks, river otters, sea otters and other species that forage in the shallow subtidal zone. Samples from pollock, which feed in the water column, taken 500 miles from the T/V *Exxon Valdez* grounding site on Bligh Reef, showed elevated petroleum hydrocarbon metabolite concentrations in their bile. These data indicate that surface oil affected the water column or food supply at great distances from the spill.

No pre-spill data were available to directly determine if the oil spill had altered shallow subtidal communities, so the effects of hydrocarbons were investigated by comparison of oiled and unoiled areas. Data are available for 1990. The greatest differences between oiled and unoiled areas have been observed in the shallow-water eelgrass beds and their associated habitat. Within the oiled eelgrass beds there were lower densities of eelgrass, fewer *Telmessus* crabs and fewer amphipods, but more small mussels and juvenile cod. Even greater differences were observed, however, in the abundance of fauna at depths from 6-20 meters below the oiled eelgrass beds, where there were far fewer individuals in oiled areas. In the shallow subtidal rocky areas (less than 20m) *Laminaria* communities were studied, both in bays and around points on the open coast. In the *Laminaria* habitat fewer differences were noted between oiled and unoiled areas. The most noticeable difference was the greater abundance of young *Laminaria* plants, but fewer large older plants in oiled areas. In shallow-water sandy areas, eelgrass beds and areas around them were studied.

Post-spill populations of spot shrimp were studied in oiled and unoiled areas of Prince William Sound. Some differences were found between populations in these areas. The results of these studies are still being evaluated.

The spill directly impacted archaeological resources, subsistence, recreation, wilderness qualities and aesthetic and other indirect uses. Clean-up activities and the associated significant increases in human activity throughout the spill zone resulted in additional injuries to these resources and services.

Archaeological Resources

Archaeological resources along the shoreline were injured by the spill. Review of spill response data revealed injuries occurred at a minimum of 35 archaeological sites, including burial and home sites. These injured sites are distributed on both Federal and State lands. While injury to these 35 sites was documented during cleanup, a spill-wide assessment of injuries to archaeological resources has yet to be completed. In addition to oil contamination, increased knowledge of the location of archaeological sites puts them at greater risk from looting. Additional injury due to erosion caused by oil-spill response activities was documented.

A study was conducted to determine impacts caused by oil contamination on radiocarbon dating of archaeological resources and to investigate the potential for cleaning artifacts and materials to allow such dating. Results indicate significant injury to the ability to date artifacts and materials by Carbon ¹⁴ analysis.

Subsistence

Surveys undertaken by State researchers before the spill and in 1990 indicated that subsistence users in the oil-spill area significantly reduced their use of subsistence resources after the spill, primarily because of concern about contamination of these resources. The oil spill disrupted the subsistence lifestyle of some communities that have historically relied upon these resources for a significant portion of their diet. Some communities virtually or entirely ceased subsistence harvests in 1989 and have only gradually begun to resume harvests, while other communities continued some reduced level of subsistence harvest in 1989 and thereafter. Warnings were issued by the State in 1989 for people to avoid consumption of intertidal invertebrates (such as mussels and clams, which accumulate petroleum hydrocarbons) found along shorelines contaminated by oil. After the spill, an oil-spill health task force was formed, including representatives of the State and Federal governments, subsistence users, and Exxon. This group helped oversee studies conducted by the State and others in conjunction with the Food and Drug Administration and National Oceanic Atmospheric Administration in 1989, 1990 and 1991, on subsistence foods, such as seals, deer, salmon, ducks, clams and bottomfish. Based upon the test results these resources, with the exception of clams and mussels in certain oiled areas, such as Windy Bay, were determined to be safe for human consumption.

Recreation

Following the oil spill, recreational use of public lands and waters declined. Recreationists (e.g., sport fishermen, hunters, campers and sea kayakers) avoided oiled areas and many adjacent areas that were affected by clean-up activity. Many users canceled their plans or pursued their activities in other areas within the state. For example, visitor use in the coastal area of the Kenai Fjords National Park dropped by about 50 percent in 1989, compared to 1988. This disruption

continued in 1990, because oil remained present in many areas and some clean-up activity continued. In 1991 oil remained in many areas used by recreationists.

Wilderness and Intrinsic Values

There are designated "wilderness areas" in Kachemak Bay State Wilderness Park, Katmai National Park, and Becharof National Wildlife Refuge. In addition Federal "wilderness study" areas are located in Kenai Fjords National Park and the Chugach National Forest. Portions of these areas were oiled by the *Exxon Valdez* spill. The Wilderness Act of 1964 requires that Federal wilderness areas be "administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired..." Thus, the presence of oil, which was most recently documented by the 1991 May Shoreline Assessment, may be perceived as an injury to these areas. In addition to the injury from the oil, hundreds of workers, motorized machinery and support equipment were used in the wilderness areas during the cleanup. These clean-up activities disrupted uses of the wilderness, such as camping and fishing. These lands and resources may have intrinsic or nonuse values, as well as uses, which also were affected by the oil spill.

APPENDIX B:
EVALUATION OF THE PROPOSED PROJECTS BY THE CHIEF SCIENTIST

September 22, 1992

To: Trustee Council for the *Exxon Valdez* Oil Spill

From: Dr. Robert B. Spies, Chief Scientist

Subject: Recommendations on the 1993 Workplan (revision of 9/20/92 memo)

In carrying out the independent review of the 1993 workplan that you requested at the September 14th meeting of the Trustee Council, I have assumed that restoration funds should be used for one of the following purposes:

1. Further define the nature of damage from the oil spill and differentiate it from other sources of variability in populations and communities of organisms in the oil spill area.
2. Document the rate of recovery of populations and communities where measurable damage has been found.
3. Supplement natural recovery processes or prevent further degradation of habitat that could negatively influence recovery of injured resources.
4. Help in the regulation of the harvest of natural resources to contribute to recovery of injured resources.

An ideal restoration program would directly aid the replenishment of populations of seabirds, sea otters, some anadromous fish and intertidal communities injured by the spill. The adaptations for survival in organisms are the ultimate technological fix for replenishment and mother nature is doing most of the restoration for the Trustees (in a very cost effective manner). We can influence resource recovery most directly where an active harvest of resources (mainly fish or trees, in this case) can be regulated, provided we have enough information to implement effective regulations.

The other lines of action are (1) study to clarify injury and document recovery and (2) habitat protection. The Trustees may wish to examine the possibility that establishment of an endowment in the near future would assure continuing study of natural resources beyond the date that funds would be depleted at the present rate of spending. I would endorse, in concept, such a proposal as providing the most efficient and lasting source for funding for study leading to better resource



management, just as habitat protection and acquisition has been advocated as a lasting solution to resource protection.

The 1993 workplan was developed by obtaining ideas from agencies and the public, and then combining and culling these ideas using various criteria to produce the final package before you. The votes in the package are the recommendations of the Restoration Team. My review and those of the peer reviewers were based on our knowledge of the injuries and the three-page descriptions provided for each project. This provided enough conceptual information to judge the proposals on the basis of the criteria listed above. Some relative differences between the Restoration Team's vote and the scores in this memo may be resolved after the review of the detailed study plans.

The recommendations in this memo represent an assessment of each project without much analysis of the accompanying budgets, as detailed budgets were not available in time for the kind of review carried out for the 1992 workplan. In addition, the overall cost of the projects put out for competitive bid could differ significantly from the estimates currently available from the agencies. I recommend that detailed analysis of each proposed project be carried out later in conjunction with the finance committee.

I have used a simple scoring system for evaluating the 52 projects in the package:

- "1" Contributes directly to the restoration of injured species with a high probability of success.
- "2" May help in restoration of the injured species through management actions, provides a better understanding of the nature of the injury, is a restoration feasibility study or documents the course of recovery.
- "3" Project has a low probability of contributing to recovery.
- "4" Project is inappropriate for a restoration program as it will not contribute to recovery of injured resources.
- "E" The project may enhance natural resources, but is unrelated to recovery of injured resources.
- "S" Special consideration. In several cases, I thought it inappropriate for me to score projects that did not deal with damage to natural resources (e.g., damage to recreation, s of the proposals received a score of "1".

Project Number	Score	Comments
93002	2	This project is an attempt to pin down mechanisms responsible for a continuing problem of poor smolt survival in the Kenai River system.
93003	2	This project investigates the continuing damage to pink salmon eggs, particularly with regard to whether this may be due to oil or other factors.
93004	E	No data exist that demonstrate a measurable effect of the oil spill on adult pink salmon.
93005	S	The peer reviewer for archeology was generally supportive of the educational goals of this project.
93006	2	There was also a favorable review of this project. Some actual restoration of resources and services will occur through this project.
93007	S	This was endorsed by the archaeological reviewer. This has no score as it is an enforcement action.
93008	S	The Trustees may wish to consider whether the additional funds for training and education beyond normal agency activities are justified by the spill injury.
93009	S	The Trustees will have to determine the need for a public information project. I have no opinion to offer on this project.
93010	2	This may help a number of greatly affected murre colonies subject to periodic disturbance from firearm discharge on halibut charter boats. If an educational program does not help this problem some enforcement action may eventually be necessary.

Project Number	Score	Comments
93011	3	Develops data on the levels of harvest of river otters, which may or may not have suffered a population-level effect from the spill and harlequin ducks, which did suffer an apparent reproductive effect from the spill, but for which there is little apparent hunting pressure.
93012	2	Aids in the management of the upper Cook Inlet mixed stock fishery and thereby contributes directly to the management of the Kenai River sockeye fishery. This fishery is likely to sustain a low return in 1994 and beyond due to the overescapement problem in the Kenai River system. The Trustees may wish to consider how much additional management costs were caused by the spill-related problem.
93014	E	This will aid in the general management of pink, chum and sockeye salmon. The pink salmon and chum salmon fisheries did not suffer a demonstrated injury as a result of the spill. However, the sockeye salmon fishery may show an effect on adult stocks in the next several years in some systems.
93015	2	This project will contribute to the management of the mixed stock fishery. I can make no recommendation on the appropriate amount of additional funding necessary to properly supplement the ADF&G budget for the extra management of the Kenai River sockeye salmon fishery necessary since the spill.
93016	S	No opinion on the appropriateness of this project.
93017	S	If past reports on safety of subsistence foods have not been accepted in the native community the Trustees may want to consider the chances for a similar approach to work again.
93018	3	This is a management action for stocks not directly affected by the spill, but for stocks outside the spill area for which it is assumed are being impacted by closure of some streams in the oil impacted zones.

Project Number	Score	Comments
93019	4	Oysters (which are not an indigenous species) in particular, and shellfish in general, have not been shown to be depleted because of the spill.
93020	4	Shellfish have not been shown to be depleted because of the spill. The contamination of the shellfish by petroleum hydrocarbons over much of the spill area is likely to be very low or non-existent by the time a hatchery is built. It is not certain whether hatchery output will significantly enhance natural populations of shellfish. There was a large set of mussels in 1992 in PWS.
93022	2	This feasibility study may indicate if there is anything that can be done to help asynchronously breeding murre recover more quickly.
93024	E	The project supposes an injury to sockeye salmon smolt in the spill area that is not documented.
93025	E	There is not data to support an injury to adult chum salmon in the spill area. Montague Island shoreline was not heavily oiled.
93026	S	This is to compensate for a lost service--an expected shortfall of salmon for fisherman on the Kenai within the next several years. There appears to be insufficient independent review of the risks to natural runs of salmon and other fishes from hatchery rearing of several species with subsequent release in upper Cook Inlet.
93028	E	No strong link to injured resources. May help some migratory birds.
93029	E	No strong link to injured resources. May eventually help some species, but probably long after spill recovery is completed.

Project Number	Score	Comments
93030	2	This is a management action (hatchery incubation of eggs of natural run fish) to compensate for likely injury to adult run from overescapement in 1989. This project will be activated only if escapement falls below 150,000 by August 1, 1993. Natural recovery of this system will take longer than if action were to be taken.
93031	S	This aquaculture project will raise sockeye smolts in net pens to be released into Kitoi Bay. It is not designed to rebuild the natural run at Red Lake, but is compensation for loss of services--commercial fishing around Kodiak Island.
93032	E	No data exist that demonstrate a measurable effect of the oil spill on adult pink salmon.
93033	2	A worthwhile project on an injured species.
93034	3	This project will identify areas that could be protected to prevent further habitat degradation during natural recovery of pigeon guillemots. There were at least 600 and perhaps as many as 3000 pigeon guillemots killed by the spill. Tracking natural recovery of this species is problematical since pre-spill population estimates occurred only in 1973 and 1984/1985 and the boat survey data have low precision. It is uncertain to what extent there are impediments to recovery for this species. Their habitats are not greatly threatened by development and existing laws are probably sufficient to provide such protection.
93035	3	There has been no population-level injury established for oyster catchers, only a continued indication of a slight effect on egg size during development. With the lack of pre-spill data in the study areas the injury is somewhat uncertain.
93036	2	This study will attempt to determine to what extent oil remains in intertidal mussel beds and whether it is a source of continuing contamination of higher trophic level organisms.

Project Number	Score	Comments
93038	2	Needed to monitor natural recovery of oiled intertidal habitat in PWS.
93039	2	This study will document the recovery of intertidal communities affected by the oil spill and cleanup.
93041	2	This will form the basis of formulating a long-term plan of study and monitoring within the spill zone. The effort needs focus.
93042	E	In my opinion killer whales were not affected by the spill, although something abnormal happened around the time of the spill to AB pod.
93043	3	This project will (1) survey otter populations by fixed-winged aircraft, (2) construct a population model to help predict recovery, (3) identify patterns of habitat use, and (4) classify sea otter habitat within PWS. Goals 1 and 2 are worthwhile supplements to the boat surveys (93045) in studying and in prediction of recovery. Some collation of past data is justified under goals 3 and 4, but there is concern about the size of the overall budget and the number of USFWS employees proposed.
93045	2	This is the only continuous set of data on bird and sea otter populations since the spill and should be continued.
93046	3	The surveys of harbor seal haulouts are very valuable in tracking recovery. The habitat use studies will yield valuable information but have little probability of assisting in the recovery of this species. With a reduced scope of work and budget, this would move to a score of 2.
93047	2	This is a worthwhile study of the recovery of the subtidal habitat.

Project Number	Score	Comments
93048	5	The existing communications have been useful for field work in the spill area, but the replacement costs proposed here are very high.
93050	2	This will provide a catalog of existing data on resource inventories, resource damages, management plans, land ownership, etc. that will be very useful in the restoration process.
93051	3	This project has three components: (1) to identify marbled murrelet nesting habitat (\$480K), (2) to complete a foot survey of anadromous streams on all private lands in the oil spill area (\$335K), and (3) to develop channel typing procedures for evaluation from aerial photography of anadromous stream habitat (\$745K). Goal 3 will be useful only if the Trustees feel the need to gather further information on public lands. New rules for the Chugash National Forest have reduced the threat of logging on public lands in the spill area. Adequate information for the purposes of proposed habitat protection on private lands will be provided by component 2. As components 1 and 2 are more germane to achieving restoration through management or acquisition, removal of component 3 would improve the score to a 2. Data is needed on land adjacent to streams to evaluate its suitability for supporting injured species
93052	4	Bald eagles were injured by the spill, but this could not be detected in the population surveys. Since we have no way of measuring recovery of this species restoration action seems inappropriate.
93053	2	This project is technical support for other ongoing studies.
93057	2	This project is technical support for other ongoing studies. Funding for this and other GIS projects (93062) should be contingent on peer review.
93058	2	Habitat protection will prevent degradation that could have a negative effect on natural recovery of injured species.

Project Number	Score	Comments
93059	2	Information needed to develop a restoration option for early habitat protection.
93060	2	Information needed to develop a restoration option for habitat protection.
93061	2	Information needed to develop a restoration option for habitat protection.
93062	2	GIS: restoration. A needed tool for data analysis and mapping.
93063	E	There was not an injury to pink and chum salmon and this project is mainly to benefit these species.
93064	2	Habitat protection will prevent degradation that could have a negative effect on natural recovery of injured species.

CC: Barton
Cole
McVee
Pennoyer
Rozier
Sandor
Restoration Team

RECEIVED
AUG 6 1993

EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL
ADMINISTRATIVE RECORD

Exxon Valdez Oil Spill Restoration

1993 FINAL WORK PLAN

Prepared by:
Exxon Valdez Oil Spill Trustees
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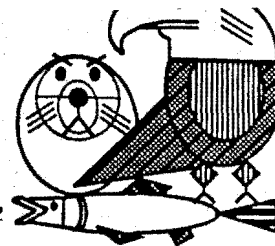
July 1993

Exxon Valdez Oil Spill Trustee Council

Restoration Office

645 G Street, Suite 402, Anchorage, Alaska 99501

Phone: (907) 278-8012 Fax: (907) 276-7178



July 22, 1993

Dear Concerned Citizen:

The following is the 1993 Final Work Plan as approved by the *Exxon Valdez* Oil Spill Trustee Council.

The 1993 Work Plan Summary Recommendation Matrix reveals the decisions and the amounts approved by the Trustee Council for each project. Also included are the 3-page project descriptions for the approved projects.

If you have any comments or questions regarding the 1993 Final Work Plan, please contact:

Exxon Valdez Restoration Office
645 G Street Suite 402
Anchorage AK 99501
(907) 278-8012

Sincerely,

A handwritten signature in dark ink, appearing to read "Dave R. Gibbons". The signature is fluid and cursive.

Dave R. Gibbons, Ph.D.
Interim Administrative Director

Trustee Agencies

State of Alaska: Departments of Fish & Game, Law, and Environmental Conservation

United States: National Oceanic and Atmospheric Administration, Departments of Agriculture and Interior

TABLE OF CONTENTS

1993 Work Plan Summary Recommendation Matrix including Trustee Council Actions	1
Project Number: 93002	14
Sockeye Overescapement	14
Project Number: 93003	18
Pink Salmon Egg to Pre-emergent Fry Survival in Prince William Sound	18
Project Number: 93006	24
Site-Specific Archeological Restoration (Interagency)	24
Project Number: 93012	28
Genetic Stock Identification of Kenai River Sockeye Salmon	28
Project Number: 93015	32
Kenai River Sockeye Salmon Restoration	32
Project Number: 93016	38
Chenega Chinook and Coho Salmon Release Program	38
Project Number: 93017	42
Subsistence Restoration Project	42
Project Number: 93022	46
Monitoring the Recovery of Murres in the Barren Islands	46
Project Number: 93024	50
Restoration of the Coghill Lake Sockeye Salmon Stock	50
Project Number: 93030	54
Red Lake Restoration	54
Project Number: 93033	58
Restoration Monitoring of Harlequin Ducks (<i>Histrionicus histrionicus</i>) in Prince William Sound and Afognak Island Areas	58
Project Number: 93034	62
Pigeon Guillemot Colony Survey	62
Project Number: 93035	66
Potential Impacts of Oiled Mussel Beds on Higher Organisms: Contamination of Black Oystercatchers Breeding on Persistently Oiled Sites in Prince William Sound	66
Project Number: 93036	70
Recovery Monitoring and Restoration of Intertidal Oiled Mussel Beds in Prince William Sound and the Gulf of Alaska Impacted by the <i>Exxon Valdez</i> Oil Spill	70
Project Number: 93038	74
Shoreline Assessment	74
Project Number: 93039	78
Herring Bay Experimental and Monitoring Studies	78
Project Number: 93041	82
Comprehensive Restoration Monitoring Program Phase 2: Monitoring Plan Development	82
Project Number: 93042	88
Recovery Monitoring of Prince William Sound Killer Whales Injured by the <i>Exxon Valdez</i> Oil Spill Using Photo-Identification Techniques	88

Project Number: 93043	92
Sea Otter Population Demographics and Habitat Use in Areas Affected by the <i>Exxon Valdez</i> Oil Spill	92
Project Number: 93045	96
Surveys to Monitor Marine Bird and Sea Otter Populations in Prince William Sound during Summer and Winter	96
Project Number: 93046	100
Habitat Use, Behavior, and Monitoring of Harbor Seals in Prince William Sound, Alaska	100
Project Number: 93047	104
Subtidal Monitoring: Recovery of Sediments, Hydrocarbon-degrading Microorganisms, and Eelgrass Communities in the Shallow Subtidal Environment	104
Project Number: 93051	110
Habitat Protection Information for Anadromous Streams and Marbled Murrelets	110
Project Number: 93053	114
Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the <i>Exxon Valdez</i> Oil Spill	114
Project Number: 93057	118
Damage Assessment GIS	118
Project Number: 93059	120
Habitat Identification Workshop	120
Project Number: 93060	122
Accelerated Data Acquisition	122
Project Number: 93062	126
Restoration GIS	126
Project Number: 93063	130
Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Fish	130
Project Number: 93064	134
Habitat Protection Fund	134
Project Number: 93065	138
Prince William Sound Recreation	138
Project Number: 93067	142
Prince William Sound Pink Salmon Stock Identification and Monitoring Studies	142
Project Number: 93068	148
Prince William Sound Chinook, Sockeye, Chum and Coho Salmon Stock Identification and Monitoring Studies	148

1993 WORK PLAN

SUMMARY RECOMMENDATION MATRIX INCLUDING TRUSTEE COUNCIL ACTIONS

PROJECT Number and Brief Description	RESTORATION TEAM Recommended/ Not Recommended	CHIEF SCIENTIST Recommended/ Not Recommended	PUBLIC ADVISORY GROUP Recommended/ Not Recommended	TRUSTEE COUNCIL ACTION Approved/ Not Approved/ Withdrawn	APPROVED '93 BUDGET INFORMATION
93002 - Sockeye Overescapement	Recommended Y-5 N-1	Recommended	Recommended Y-9 N-5	Approved ¹	\$ 714,600
93003 - Pink Salmon Egg to Pre-emergent Fry Survival in PWS	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 686,000
93004 - Documentation, Enumeration and Preservation of Genetically Discrete Wild Populations of Pink Salmon Impacted by EVOS in PWS	Recommended Y-5 N-1	Enhancement Project	Recommended Y-8 N-3 A-2	Not Approved	-----

¹ Approved contingent upon review of potential modifications resulting from sockeye synthesis (peer review) meeting in March and a detailed review of the overall budget by ADF&G and discussion at the next Trustee Council meeting. Only essential commitments should be expended until that time.

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93005 - Cultural Resources, Information, Education and Interpretation	Unanimously Recommended	No Opinion	Recommended with Qualifications	Not Approved	-----
93006 - Site-Specific Archeological Restoration	Unanimously Recommended	Recommended	Recommended with Qualifications	Approved	\$ 260,100
93007 - Archeological Site Stewardship Program	Unanimously Recommended	No Opinion	Recommended with Qualifications	Not Approved	-----
93008 - Archeological Site Patrol and Monitoring	Unanimously Recommended	No Opinion	Recommended with Qualifications	Not Approved	-----
93009 - Public Information, Education and Interpretation	Recommended Y-5 N-1	No Opinion	Recommended with Qualifications	Not Approved	-----
93010 - Reduce Disturbance Near Murre Colonies Showing Indications of Injury From the EVOS	Not Recommended Tie Vote Y-3 N-3	Recommended	Unanimously Not Recommended	Not Approved	-----
93011 - Develop Harvest Guidelines to Aid Restoration of River Otters and Harlequin Ducks	Recommended Y-5 N-1	Recommended	Recommended Y-9 N-3 A-1	Not Approved	-----

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93012 - Genetic Stock Identification of Kenai River Sockeye Salmon	Recommended Y-5 N-1	Recommended	Unanimously Recommended Look at reducing budget combine with 93015	Approved ¹	\$ 300,600
93014 - Quality Assurance for Coded-Wire Tag Application in Fish Restoration Projects	Not Recommended Tie Vote Y-3 N-3	Enhancement Project	Unanimously Not Recommended	Withdrawn	—
93015 - Kenai River Sockeye Salmon Restoration	Recommended Y-5 N-1	Recommended	Unanimously Recommended Look at reducing budget	Approved ¹	\$ 732,600

¹ Approved contingent upon review of potential modifications resulting from sockeye synthesis (peer review) meeting in March and a detailed review of the overall budget by ADF&g and discussion at the next Trustee Council meeting. Only essential commitments should be expended until that time.

PROJECT Number and Brief Description	RESTORATION TEAM Recommended/ Not Recommended	CHIEF SCIENTIST Recommended/ Not Recommended	PUBLIC ADVISORY GROUP Recommended/ Not Recommended	TRUSTEE COUNCIL ACTION Approved/ Not Approved/ Withdrawn	APPROVED '93 BUDGET INFORMATION
93016 - Chenega Chinook and Coho Salmon Release Program	Recommended Y-5 N-1	No Opinion	Unanimously Recommended Increase budget to \$50.9K to cover Hatchery costs	Funded \$10,000 for NEPA Compliance 3/10/93	Include in Draft 1994 Work Plan
93017 - Subsistence Food Safety Survey and Testing Restoration Project	Unanimously Recommended	No Opinion	Unanimously Recommended More local community involvement	Approved with Modifications Remove \$53.5 for Transportation Costs	\$ 307,100
93018 - Enhanced Management for Wild Stocks in PWS, Special Emphasis on Cutthroat Trout and Dolly Varden	Recommended Y-5 N-1	Not Recommended	Unanimously Recommended	Not Approved	-----
93019 - Chugach Region Village Mariculture Project	Unanimously Not Recommended	Not Recommended	Recommended Y-8 N-4 Contingent upon legal approval	Not Approved	-----

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93020 - Bivalve Shellfish Hatchery and Research Center	Not Recommended Tie Vote Y-3 N-3	Recommended Closer Study for Feasibility	Unanimously Recommended Contingent upon legal review	Not Approved	-----
93022 - Evaluating the Feasibility of Enhancing Productivity of Murres by Using Decoys, Dummy Eggs and Recordings of Murre Calls to Simulate Normal Densities at Breeding Colonies Affected by EVOS and Monitoring the Recovery of Murres in the Barren Islands	Unanimously Recommended	Recommended	Unanimously Not Recommended	Approved Monitoring Component only	\$ 177,200
93024 - Restoration of the Coghill Lake Sockeye Salmon Stock	Recommended Y-5 N-1	Enhancement Project	Unanimously Recommended	Approved	\$191,900
93025 - Montague Island Chum Salmon Restoration	Recommended Y-5 N-1	Enhancement Project	Unanimously Recommended	Not Approved	-----
93026 - Fort Richardson Hatchery Water Pipeline	Not Recommended Tie Vote Y-3 N-3	No Opinion	Recommended Y-9 N-4	Not Approved	-----

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93028 - Restoration and Mitigation of Wetland Habitats for Injured PWS Fish and Wildlife Species	Recommended Y-5 N-1	Enhancement Project	Not Recommended Y-3 N-8	Not Approved	----
93029 - PWS Second Growth Management	Recommended Y-5 N-1	Enhancement Project	Tie Vote Y-5 N-5 A-1	Withdrawn	----
93030 - Red Lake Restoration	Recommended Y-5 N-1	Recommended	Unanimously Recommended	Deferred until 3/29/93 meeting	Approved pending NEPA Compliance
93031 - Red Lake Mitigation for Red Salmon Fishery	Recommended Y-5 N-1	No Opinion	Recommended Y-10 N-1 A-2	Not Approved	----
93032 - Pink and Cold Creek Pink Salmon Restoration	Recommended Y-5 N-1	Enhancement Project	Recommended Y-12 N-1 Consult w/ Landowner	Not Approved	----
93033 - Harlequin Duck Restoration Monitoring Study in PWS, Kenai and Afognak Oil Spill Areas	Unanimously Recommended	Recommended	Unanimously Recommended	Approved at Reduced Level	\$ 300,000
93034 - Pigeon Guillemot Colony Survey	Recommended Y-5 N-1	Recommended	Unanimously Recommended	Approved	\$ 165,800

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93035 - Potential Impacts of Oiled Mussel Beds on Higher Organisms: Contamination of Black Oystercatchers Breeding on Persistently Oiled Sites in PWS	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 107,900
93036 - Recovery Monitoring and Restoration of Intertidal Oiled Mussel Beds in PWS and the GOA Impacted by EVOS	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 404,800
93038 - Shoreline Assessment	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 539,200 ²
93039 - Herring Bay Experimental and Monitoring Studies	Unanimously Recommended	Recommended	Recommended Y-12 N-0 A-1 Look at reducing budget	Approved	\$ 507,500
93041 - Comprehensive Restoration Monitoring Program Phase 2: Monitoring Plan Development	Unanimously Recommended	Recommended	Recommended Y-8 N-4 A-1	Approved	\$ 237,900

² This includes \$15,000 for U.S. Coast Guard travel.

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93042 - Recovery Monitoring of PWS Killer Whales Injured by EVOS Using Photo Identification Techniques	Recommended Y-4 N-2 At the request of the Trustee Council	Enhancement Project	Unanimously Recommended	Approved	\$ 127,100
93043 - Sea Otter Population Demographics and Habitat Use in Areas Affected by EVOS	Recommended Y-5 N-1	Recommended with reduced budget	Recommended Look at contracting Y-8 N-5	Approved	\$ 291,900
93045 - Surveys to Monitor Marine Bird and Sea Otter Populations in PWS During Summer and Winter	Unanimously Recommended	Recommended	Previously Approved by Trustee Council	Previously Approved 12/11/92	\$ 262,400
93046 - Habitat Use, Behavior and Monitoring of Harbor Seals in PWS, Alaska	Unanimously Recommended	Recommended	Unanimously Recommended Look at more local involvement	Approved	\$ 230,500
93047 - Subtidal Monitoring: Recovery of Sediments, Hydrocarbon-degrading Microorganisms, Eelgrass Communities and Fish in the Shallow Subtidal Environment	Unanimously Recommended	Recommended	Recommended Y-12 N-0 A-1 Look at reducing costs	Approved	\$ 1,000,800

PROJECT Number and Brief Description	RESTORATION TEAM Recommended/ Not Recommended	CHIEF SCIENTIST Recommended/ Not Recommended	PUBLIC ADVISORY GROUP Recommended/ Not Recommended	TRUSTEE COUNCIL ACTION Approved/ Not Approved/ Withdrawn	APPROVED '93 BUDGET INFORMATION
93050 - Update: Restoration Feasibility Study #5 (Identification and Recordation of Information Sources Relevant to Land and Resources Affected by EVOS)	Not Recommended Tie vote Y-3 N-3	Recommended	Agency will do work with existing in-house funding	Withdrawn	-----
93051 - Habitat Protection Information for Anadromous Streams and Marbled Murrelets	Unanimously Recommended	Recommended with removal of channel typing	Recommended with removal of channel typing portion Y-9 N-4	Approved	\$ 1,222,300
93052 - Identification and Protection of Important Bald Eagle Habitats	Unanimously Not Recommended	Not Recommended	Not Recommended Y-3 N-8	Withdrawn	-----
93053 - Hydrocarbon Data Analysis, Interpretation and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the EVOS	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 105,500
93057 - Damage Assessment GIS	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 67,500
93059 - Habitat Identification Workshop	Unanimously Recommended	Recommended	Previously approved by the Trustee Council	Previously Approved 12/11/92	\$ 42,300

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93060 - Accelerated Data Acquisition	Unanimously Recommended	Recommended	Previously approved by the Trustee Council	Previously Approved 12/11/92	\$ 43,900
93061 - New Data Acquisition	Unanimously Recommended	Recommended	Recommended Y-11 N-2	Rolled into 93064	—
93062 - Restoration GIS	Unanimously Recommended	Recommended	Unanimously Recommended	Approved	\$ 123,300
93063 - Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Fish	Unanimously Recommended	Enhancement Project	Unanimously Recommended	Approved	\$ 59,400
93064 - Habitat Protection Fund	Unanimously Recommended	Recommended	Recommended PAG request review before acquiring parcels Y-10 N-1 A-2	Approved ^{3,4}	\$20,000,000

³ Now includes 93061.

⁴ Funds for Kachemak Purchase included in the Project.

PROJECT Number and Brief Description	RESTORATION TEAM	CHIEF SCIENTIST	PUBLIC ADVISORY GROUP	TRUSTEE COUNCIL ACTION	APPROVED '93 BUDGET INFORMATION
	Recommended/ Not Recommended	Recommended/ Not Recommended	Recommended/ Not Recommended	Approved/ Not Approved/ Withdrawn	
93065 - Prince William Sound Recreation Plan			None	Approved 3/10/93	\$ 71,000
93066 - Kodiak Archeological Artifact Repository	Not Recommended		Unanimously Recommended	Approved 3/10/93	\$ 1,500,000
93067 - Pink Salmon Coded-Wire Tag				Approved 5/13/93	\$ 150,000 ⁵ plus 70,000 ⁶ total \$220,000
93068 - Coded-Wire Tag Recoveries in Chinook, Sockeye, Chum, and Coho Salmon				Approved 6/2/93	\$ 126,400

⁵ Funds to be transferred from project 93015.

⁶ Approved additional \$70,000 on June 2, 1993. Funds to be also transferred from project 93015.

PROJECT Number and Brief Description	RESTORATION TEAM Recommended/ Not Recommended	CHIEF SCIENTIST Recommended/ Not Recommended	PUBLIC ADVISORY GROUP Recommended/ Not Recommended	TRUSTEE COUNCIL ACTION Approved/ Not Approved/ Withdrawn	APPROVED '93 BUDGET INFORMATION
93 AD - Administrative Director's Office	Unanimously Recommended	-----	Increase Public Advisory Group Budget to \$225,000	Approved Long-Term contracts and 3 months funding for the rest pending further Trustee Council Review	\$ 1,702,200
93 FC - Finance Committee	Unanimously Recommended	-----	-----		\$ 105,200
93 RT - Restoration Team Support	Unanimously Recommended	-----	-----		\$ 2,328,400

1993 Additional Projects
Recommended by the
Public Advisory Group
on 1/7/93

<u>Project</u>	<u>Cost</u>	
1. Planning for expansion of the Kodiak Industrial Technology Center Public Idea #310 VOTE: Y-7 N-4 A-1	\$ 100,000	Not approved
2. First phase construction of a Kodiak Archeological Museum Public Idea #298-17 VOTE: Unanimously Recommended	1,500,000	Approved 3/10/93 ¹
3. Prince William Sound Herring Damage Assessment Vote: Unanimously Recommended	237,889	Not approved
4. Prince William Sound Pink Salmon Coded Wire Tag Project Vote: Y-7 N-4	773,600	Not approved
5. Prince William Sound Chum, Sockeye, Coho and Chinook Salmon Coded Wire Tag Project VOTE: Y-9 N-2	<u>249,590</u>	Not approved
TOTAL	\$ 2,861,079	

¹ See project 93066 in previous table.

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93002

Project Title: Sockeye Overescapement

Project Category: Damage Assessment

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: U.S. Fish and Wildlife Service

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

A. Background

The sockeye salmon resources of Kodiak Island lakes affected by overescapement comprise approximately 20% of the Kodiak Island long-term commercial sockeye salmon harvest. The Kenai River sockeye salmon lakes affected by the *Exxon Valdez* oil spill (EVOS) are the major income producers for commercial fishermen in Cook Inlet. Sockeye salmon spawn in lakes associated with river systems. Adult salmon serve an important role in the ecosystem, providing food for marine mammals, terrestrial mammals, and birds. Additionally, carcass decomposition serves to charge freshwater lake systems with important nutrients. Juvenile salmon, which rear in lakes for one or two years, serve as a food source for a variety of fish and mammals. Sockeye salmon are also an important subsistence, sport, and commercial species. The ex-vessel value of the commercial catch of sockeye from these lake systems has averaged about \$42 million per year since 1979, with the 1988 catch worth \$115 million. Sockeye salmon returns to the Kenai River system support some of the largest recreational fisheries in the State.

B. Summary of Injury

Commercial fishing for sockeye salmon in 1989, was curtailed in upper Cook Inlet, the outer Chignik districts, and the Kodiak areas due to presence of oil in the fishing areas from the EVOS. As a result, the number of sockeye salmon entering four important sockeye-producing systems (Kenai/Skilak, Chignik/Black, Red, and Frazer Lakes) and two less important lake systems (Akalura and Afognak or Litnik lakes) greatly exceeded levels that are thought to be most productive.

Overly large spawning escapements may result in poor returns by producing more rearing juvenile sockeye than can be supported by the nursery lake's productivity (Kyle et al. 1988). In general, when rearing fish abundance greatly exceeds the lake's carrying capacity, prey (zooplankton) are altered by changes in species and size composition (Mills and Schiavone 1982, Koenings and Burkett 1987, Kyle et al. 1988) and concomitant effects on all trophic levels can occur (Carpenter et al. 1985). Because of such changes, juvenile sockeye growth is reduced, mortality increases, larger percentages holdover for another year of rearing; and the poor quality of smolts increases

marine mortality. Where escapements are two to three times normal levels, the resulting high juvenile densities crop the prey resources to the extent that more than one year is required to return to normal productivity. Rearing juveniles from subsequent brood years suffer from both the poor quality of forage and from the increased competition for food by holdover juveniles (Townsend 1989; Koenings and Kyle 1991). This is the brood year interaction underlying cyclic variation in the year class strength of anadromous fish. Smolt production from the Kenai River in 1991 was extremely low as was production of smolt from Red Lake. In the spring of 1992, the Kenai River smolt estimates dropped by another order of magnitude, suggesting severe declines in sockeye salmon returns in future years. Counts of smolt migration in Red River (on Kodiak Island) were relatively higher in 1992, but still insufficient to provide an average return for this system. The effects of overescapement can cause continued adversity because of multiple-year impacts on the zooplankton community or other critical juvenile life-history habitat components. Consequently, damage assessment studies require continuation until the juvenile sockeye salmon habitat is restored or naturally recovers.

C. Location

The studies to be conducted on the Kenai Peninsula include the Tustumena and Kenai River lake systems. In addition, studies will continue on Kodiak Island to assess the damage to the Red Lake system with Upper Station Lake acting as a control.

WHAT

A. Goals

The goal of these studies is to determine the impacts of the overescapement of 1989 that was associated with fishery closures due to the EVOS. The studies have specifically focused on Red Lake and the major rearing lakes of the Kenai River system. Study activities include the enumeration of smolt production and sampling of smolt population characteristics, and monitoring of subsequent adult returns from these systems as well as measuring the changes in the rearing habitat of the effected lakes and nearby unaffected lake systems. A secondary benefit of these studies may be to provide insight as to what, if anything, can facilitate rapid recovery of these systems.

B. Objectives

1. Estimate the number, age, and size of sockeye salmon juveniles rearing in selected freshwater systems.
2. Estimate the number, age, and size of sockeye salmon smolts migrating from selected freshwater systems.
3. Determine effects of large escapements resulting from fishery closures caused by the EVOS on the rearing capacity of selected nursery lakes through:
 - a. Analysis of age and growth of juveniles and smolts
 - b. Examination of nutrient budgets and plankton populations.
4. In addition, evaluation of diel vertical migration induced by sockeye salmon

Project Descriptions

predation on subsequent growth and survival of juvenile sockeye will be made. Also, assessment of the role of egg-bearing copepods as an essential diet component of sockeye salmon juveniles in glacial lakes will be conducted.

WHY

Before any mitigation and restoration of sockeye salmon in the effected lakes can be undertaken, the extent and cause of damage needs to be established. The resource in question has major implications for the commercial fishing industry on Kodiak Island and in Cook Inlet, where sockeye salmon provide the major source of income. In addition, heavy use of the Kenai River by subsistence, personal use, and sport fishermen has much importance to the Alaskan economy.

To restore lost resources it is essential that a clear understanding of damages be assessed. In the case of overescapement, a lake may require many years to recover, as the extent of damage may persist. Thus, to prevent recurrence and compounding damage, and to expedite natural restoration of the system, an understanding of the mechanism is essential.

HOW

From early May to early July, two inclined plane traps will be operated daily in the outlet stream of Red Lake about one mile below the lake's outlet. The catch will be counted by species, and sockeye smolts will be sampled daily for age, length, weight, and condition factor. Each week, 500 sockeye smolts will be marked (biologically inert dye), and released about 0.5 mile above the traps to determine trap efficiency. A similar operation will occur at Upper Station Lake which is the study control. This project will also provide support for the assessment conducted by FRED Division (fall fry tow netting) of pre-smolt sockeye rearing conditions (biomass and growth data) in Red and Upper Station Lakes.

On the Kenai River, expanded smolt enumeration is proposed for the lower river through increased marking and recovery effort. In addition, coded-wire tagging of smolts is proposed on the Moose River and a smolt project is planned for the Russian River system.

Limnology studies will continue on Upper Station and Red lakes on Kodiak, the major lakes of the Kenai River (Skilak and Kenai lakes), and on Tustumena Lake which is the control for the Kenai system. In addition, an optical plankton counter will be used to assist in determining the effects of predator-induced diel vertical migration in Skilak Lake. These studies will be coupled with expanded tow netting on Skilak and Kenai Lake to obtain juvenile sockeye salmon specimens throughout their rearing cycle in freshwater. Water quality and physical measurements from all of the lakes will continue to be monitored. Disease screening of fish specimens is also planned.

ENVIRONMENTAL COMPLIANCE

None of the proposed projects are intrusive. They involve collection of data and do not affect fish and wildlife populations or their habitat.

WHEN

The studies are continuous and will most likely continue beyond the end of the upcoming fiscal year (September 30, 1993). The studies will terminate when the sockeye salmon populations or their habitat recover to pre-spill conditions. Progress reports and interim findings will be released annually in a progress report issued in late November. Major discoveries are issued through news releases or through scientific publication.

BUDGET (\$K)

	ADF&G
Personnel	\$ 465.1
Travel	7.5
Contractual	63.9
Commodities	54.7
Equipment	20.5
Capital Outlay	<u>0.0</u>
Sub-total	611.7
General Administration	<u>74.1</u>
Project Total	\$ 685.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93003

Project Title: Pink Salmon Egg to Pre-emergent Fry Survival in Prince William Sound

Project Category: Damage Assessment/Restoration Monitoring

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Marine Fisheries Service (NOAA)

Project Term: March 1, 1992 to July 30, 1995

INTRODUCTION

Each year approximately one-half billion wild pink salmon fry emerge from the streams of Prince William Sound (PWS) and migrate seaward. Adult returns of wild pink salmon to PWS average from 10-15 million fish annually. These huge outmigrations of wild pink salmon and subsequent adult returns play a major role in the PWS ecosystem. Both juveniles and adults are important sources of food for many fish, birds, and mammals. Adults returning from the high seas also convey needed nutrients and minerals from the marine ecosystem to estuaries, freshwater streams, and terrestrial ecosystems. Wild pink salmon also play a major role in the economy of PWS because of their contribution to commercial, sport, and subsistence fisheries in the area.

Up to 75% of pink salmon spawning in PWS occurs in intertidal areas. In the spring of 1989, oil from the *Exxon Valdez* oil spill (EVOS) was deposited in layers of varying thickness in intertidal portions of many western PWS streams utilized by spawning salmon. Pink salmon eggs and fry rearing in these intertidal areas appear to have been adversely affected by the oil. Salmon egg mortalities were 70%, 65%, and 115% higher in oiled streams than in comparable and nearby unoiled streams in 1989, 1990, and 1991. Differences between oiled and unoiled streams in 1989 and 1990 were confined to intertidal spawning areas and may be attributed to direct lethal effects of oil. Large differences observed across all tide zones in 1991 may be the consequence of damage to germ cells of the adults which originated from the 1989 brood year when egg and larval exposures to intertidal oil were greatest. A consequence of this genetic damage may be persistent functional sterility and reduced returns per spawner for populations from oiled streams.

The proposed damage assessment and resource monitoring study will consist of field and laboratory studies conducted in western PWS and additional laboratory studies at the National Marine Fisheries Service (NMFS) Research facility at Little Port Walter in southeastern Alaska. The majority of project funds will be spent to support the portion of the project located in PWS and will contribute to the local economy of Cordova. Results of the project will direct future restoration efforts for pink salmon and may impact future harvest management strategies in PWS fisheries.

WHAT

A. Goal

The project will continue to monitor egg mortalities in the oiled and unoled wild pink salmon streams previously studied, examine stream characteristics unrelated to oiling which may partially or completely explain observed mortality differences, and provide laboratory verification that field results observed for eggs in 1989, 1990 are consistent with lethal effects of oil contamination of intertidal pink salmon spawning habitat. The laboratory verification experiment will also test the hypothesis that oil contamination during incubation can result in functional sterilization of exposed animals at sexual maturity and may explain the persistence of higher egg mortalities observed in all tide zones of oiled streams in 1991.

B. Objectives

The specific objectives of the project are as follows:

1. Estimate the density, by tide zone, of eggs and pre-emergent fry in 31 streams using numbers of live and dead eggs and fry.
2. Estimate egg mortality and overwinter survival of pink salmon eggs in the oiled and unoled streams among the 31 sampled.
3. Determine whether the increased pink salmon egg mortalities observed in oiled streams in 1989, 1990, and 1991 can be attributed to the physical characteristics of the study streams.
4. Determine survival, genetic damage, hydrocarbon uptake, mixed function oxidase activity, and sublethal teratogenic effects from long-term exposures to oil in each of two exposure groups:
 - a. Green eggs to eyeing, and
 - b. Green eggs to swim-up.
5. Determine survival, genetic damage, hydrocarbon uptake, and mixed function oxidase activity from long-term exposures of juvenile pink salmon fed oil-contaminated food.
6. Determine growth characteristics from each exposure group from juvenile stage to maturity.
7. Assess whether differences exist among exposure groups with respect to fecundity, fertilization rate, genetic damage, and sublethal teratogenic effects in the second generation progeny through swim-up.
8. Compare lab study with field observations:
 - a. Determine if the elevated egg mortalities in 1989 and 1990 were potentially caused by oiling in the environment.

Project Descriptions

- b. Determine if the elevated egg mortalities in oiled streams in 1991 were potentially caused by genetic damage to 1989 eggs.

WHY

Information from this study will provide resource managers insight to the magnitude and persistence of damages sustained by wild pink salmon due to EVOS. Efforts to restore damaged pink salmon populations depend upon the ability to identify sources of reduced survival and to monitor their persistence. Information on the potential of oil exposures causing genetic damage is needed so spawning escapement goals can be reevaluated and adjusted if necessary. Verification of the genetic hypothesis would also provide the first evidence that reproductive capacity of fish exposed to chronic or acute sources of oil pollution would be compromised.

HOW

A. Field Studies

A systematic sampling program stratified by stream and tide zone will be used to collect egg and fry density and survival data from 11 oiled and 14 unoled sites sampled previously in *NRDA Fish/Shellfish Study 2, Injury to Salmon Eggs and Fry in PWS*. Sampling will consist of egg-digs conducted in late September and early October, and fry-digs conducted in mid-March. Egg and pre-emergent fry data will be summarized by date, stream, level of hydrocarbon impact, stream zone, and number of live and dead eggs and fry. Density estimates will be used to assess adult spawning success. Relative numbers of live and dead eggs and fry will be used to test for continued reductions in survival in oiled streams.

B. Laboratory Study 1

Intra-stream crosses will be made using within stream pools of randomly combined gametes from six oiled and six unoled streams from southwestern PWS. Eggs from the crosses will be incubated through hatching in a controlled laboratory environment. Egg mortalities will be compared for all crosses. Crossing results will be compared to results from field studies to determine the effect of stream characteristics on egg mortality differences previously observed between oiled and unoled sites.

C. Laboratory Study 2

This study consists of three experiments. The first will examine the effects of six levels of intertidal gravel oil contamination and two durations of exposure on responses to various life history stages of cultured eggs and fry. Responses measured in the first generation will include survival to eyeing, survival to emergence, hydrocarbon uptake, survival to maturity, growth to maturity, and fecundity. Responses measured in the second generation will include fertilization rate and number of defective progeny. Samples for use in genetic analyses will be collected from first generation eyed eggs, emergent fry, juveniles, and mature adults. Genetic analyses will include flow cytometry methods and examination of metaphase germ cells. Second generation eyed eggs and emergent fry will be similarly sampled. The second experiment will determine if cultured fish fed oiled food for 6 weeks experience genetic damage and reduced gamete viability.

Treatments will consist of 6 concentrations of oil in the feed (1 control and 5 different oil levels). Biological responses to be measured between emergence and the first 6 weeks of feeding will include growth, survival, hydrocarbon concentration, chromosome damage, and MFO incidence. Subsequent response measurements will include growth to maturity, fecundity, fertilization rate and number of defective progeny. Flow cytometry samples and samples for examination of metaphase cells will be taken after the first 6 weeks and will mirror those taken in the first experiment. The third experiment will determine if there is evidence of differential gamete survival to emergence between ten randomly paired families of cultured fish for five different treatment regimes. The treatments will be a combination of oiling concentrations from study 1 (Ci) and duration of exposure as follows:

1. Control,
2. C₂ through eyeing,
3. C₂ through emergence,
4. C₄ through eyeing, and
5. C₄ through emergence.

The fertilized gametes from ten randomly selected pairs of pink salmon (family) will be divided into aliquots, each aliquot will be randomly assigned one of the five treatments (3 aliquots per treatment). Ten family groups will be created and assigned in this manner. Individual aliquots will be incubated in pipe incubators and all fish culture practices will be randomized between families. Families will be incubated until emergence when they will be inspected, counted, and terminated.

ENVIRONMENTAL COMPLIANCE

Egg and pre-emergent fry sampling will require an ADF&G Title 16 Permit and an ADF&G Biological Collections Permit. Transport of wild gametes to the PWSAC hatchery will require an ADF&G Fish Transport Permit for each stock and a Permit Alteration may be required to rear and incubate the wild eggs at the AFK Hatchery. This project received a categorical exclusion under the National Environmental Policies Act.

WHEN

August 1993	Interim Report 1 including: instream egg density and survival results, intra-stream crossing results, first generation doses response results for eggs and fry.
August 1994	Interim Report 2 including: update of Interim Report 1, first generation doses response results through year 1.
July 1995	Final Report

Project Descriptions

BUDGET (\$K)

	ADF&G	NOAA	TOTAL
Personnel	\$ 201.0	\$ 117.9	\$ 310.6
Travel	9.6	10.0	21.4
Contractual	65.4	116.0	199.0
Commodities	30.5	54.0	75.5
Equipment	2.1	19.0	19.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 308.6	\$ 316.9	\$ 625.5
General Administration	<u>34.7</u>	<u>25.8</u>	<u>60.5</u>
Project Total	\$ 343.3	\$ 342.7	\$ 686.0

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93006

Project Title: Site-Specific Archeological Restoration (Interagency)

Project Category: Restoration Management Actions

Project Type: Archeology

Lead Agency: National Park Service

Cooperating Agencies: Alaska Department of Natural Resources; Department of Interior, Fish and Wildlife Service; Department of Agriculture, U.S. Forest Service

Project Term: Five years for restoration action component; ten years for monitoring component January 1, 1993 to December 30, 2002

INTRODUCTION

A two-phase archeological restoration assessment of all existing and accessible oil spill response documentation has revealed that there is solid evidence for substantive injury to 24 known archeological sites that can be directly linked to the *Exxon Valdez* oil spill event. The sources of injury include oiling, oil spill beach clean-up actions, and vandalism. Of these three identified sources, clean-up activities and vandalism appear to have resulted in the most clear-cut cases of injury to archeological sites (e.g. loss or destruction of diagnostic artifacts, illegal excavation, disturbance of human remains). The effects of oiling are more problematical, but the available evidence indicates that oil penetration impairs the ability of radiocarbon samples to yield accurate dates and may alter archaeologically-relevant soil chemistry.

In June 1992 the Trustees convened a multi-agency panel of experts in the archeology of the oil spill region chaired by Martin McAllister, the nation's foremost expert in archeological restoration. This panel gave thorough review to all available oil spill injury data and arrived at the following conclusions:

1. Nineteen known archeological sites had been injured by clean-up activities or vandalism related to the oil spill event.
2. A total of 10 known sites had been affected by moderate to heavy oiling (5 of which are also among the 19 sites injured by cleanup and vandalism).
3. Based on the total known sites and projected archeological sites in the oil spill pathway supplied by the Exxon Company contractors and a special Trustee-sponsored GIS/statistical study by the State University of New York, it is estimated that:
 - a. A total of 112 archeological sites suffered substantive injury from oil spill cleanup or vandalism tied to the oil spill event.

- b. A total of 59 archeological sites were subjected to moderate to heavy oiling during the oil spill event (at least half of these sites also number among the 112 sites affected by other sources of injury).

Note: These numbers represent the most conservative, statistically-derived estimate of injury endorsed by the "McAllister Panel." The next-lowest estimates put forward by Dr. Al Dekin's injury study are 338 and 155, respectively; statistically valid estimates, but based on what appear to be less valid assumptions about the nature and distribution of injury.

The purpose of this project is to conduct site-specific restorative actions at injured archeological sites on Federal or State lands within the oil spill pathway. Guidance for the proposed work is drawn from Section 14 of the Archeological Resources Protection Act (ARPA). None of the planned work duplicates previous studies; it is based on a careful review of the results of earlier injury investigations.

WHAT

The goal of this project is to ameliorate injury to archeological sites that were impacted by oiling, oil spill cleanup, or vandalism as a direct result of the *Exxon Valdez* oil spill event. The measures include the following:

1. Full damage examination and analysis of the injured sites.
2. Recovery analysis and curation (and where appropriate, repatriation) of any remaining archeological resources that were exposed or disturbed by oil spill related injury.
3. Data recovery to compensate for the loss of important archeological information at injured sites and/or the stabilization and physical repair of disturbed areas within injured sites.

WHY

Archeological sites constitute a category of finite, non-renewable resources managed by the State and Federal governments for the public benefit. These resources represent a major part of the cultural heritage of the United States and injury to resources of this type results not only in the loss of important scientific data about the human past but in an irrevocable diminution of our nation's historic patrimony. The restorative measures proposed herein are designed to either repair physical injury or reduce the loss of important archeological information caused by injury. Physical repair includes such actions as restoring trampled protective vegetation at a site or filling in a looter's hole. Data recovery is used to recover what bits of information can be salvaged from the area of an illegal excavation--in a sense, restoring to the public what information has been potentially lost by means of scientific investigations. If restorative measures are not taken, current signs of vandalism may provoke further vandalism, disturbed archeological soils will most likely result in accelerated erosion of archeological fabric; and altered artifact patterns and contaminated radiocarbon samples will probably play subtle havoc with future archeological

Project Descriptions

interpretations in the region--one of Alaska's richest but least known archeological zones. In recognition of the archeological importance of the area, the National Park Service has already committed a majority of its funds under a five-year National Archeological Survey project to conduct a sample survey and evaluation of coastal sites in Kenai Fjords and Katmai. Other participating agencies lack a similar funding source, but they are committed to do what they can to increase survey coverage of the area.

HOW

The first step in this project will be to conduct site-specific restoration assessments at sites with documented injury, but where there is insufficient detail upon which to determine appropriate treatment (19 sites). The second step will be to carry out the indicated restorative action--either physical repair and/or data recovery. In many cases, the anticipated restoration treatments will be limited in scope and difficulty and the necessary restorative actions will be taken immediately upon completion of the assessment. A few may require carefully planned return visits. This portion of the work will be carried out in a two-year split (1993 and 1994) to permit sufficient time for planning larger and more complex restorative measures and to take advantage of corrective feedback from the first year of the project.

A concurrent restoration assessment, coordinated with the first, will address long-term injury resulting from oiling. Ten known sites that have been exposed to moderate to heavy oiling will be monitored for a period of 10 years to determine the effect of oil on radiocarbon samples, archeological soil chemistry, and protective site vegetation. Research assessments of this type are specifically authorized by Section 14(c) of ARPA when the nature and level of injury to archeological sites remain uncertain or problematic. The results will alert future researchers to any skewing effect the oil may have on archeological soil or radiocarbon specimens and make land managers aware of any residual threats to archeological sites (e.g., alterations or reductions in protective vegetative cover). The 10 sites selected for monitoring include 5 from the list of 19 sites with evidence of injury attributable to cleanup or vandalism and 5 additional sites that have been oiled, but presently have no documentation of other injury. These 5 sites bring the total number of known injured sites to 24, the number mentioned at the beginning of this proposal.

After completion of the assessment and treatment of previously known injured sites in 1994 the work could be expanded in 1995 to discover additional injured sites, assess the nature and extent of the injury, and carry out appropriate treatment. The favored approach will be a "find and restore strategy." A problem-oriented research design will be developed to guide this inventory. The search will employ a stratified-random survey methodology to target the effort toward the most likely zones to contain injured archeological sites in need of treatment. Continuation of the oiling assessment and the start of this work will depend on an interim review of the results from the first two years of the project and the express approval from the Trustee Council to proceed.

The results of all project work will be published in both technical and popular formats. As they become available, pertinent findings will be fed into the stewardship, site protection monitoring, and public education projects. The research and restorative actions will follow the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation. The Division of Polar Research, National Science Foundation, is recommended as the most appropriate source and coordinator for peer review of the project.

ENVIRONMENTAL COMPLIANCE

The proposed project is a categorical exclusion from the National Environmental Policy Act but subject to the provisions of the Historic Preservation Act, the Archeological Resources Protection Act, and the Native American Graves and Repatriation Act. The project will be carried out in conformance with the consultative processes and standards demanded by these legislative mandates.

WHEN

March 1 - June 1, 1993	Consultation under the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act; preparation of work plans and research designs.
July 1, 1993	Start of field work for restoration assessment and oil monitoring projects.
December 30, 1994	Completion of restoration assessment for known injured sites.
June 1, 1995	Start of field work for discovery, assessment, and treatment of additional archeological sites.
December 30, 1997	Completion of restoration assessments and treatment actions for additional injured sites.
December 30, 2002	Completion of oil monitoring project.

BUDGET (\$K)

	USNPS	USFWS	USFS	ADNR	TOTAL
Personnel	\$ 9.1	\$ 14.9	\$ 10.6	\$ 49.2	\$ 83.8
Travel	7.7	10.4	7.2	8.5	33.8
Contractual	84.9	3.5	5.3	14.5	108.2
Commodities	1.1	1.2	1.0	3.9	7.2
Equipment	1.2	1.8	1.2	2.9	7.1
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 103.9	\$ 31.8	\$ 25.3	\$ 79.0	\$ 240.0
General Administration	<u>7.3</u>	<u>2.6</u>	<u>2.0</u>	<u>8.2</u>	<u>20.1</u>
Project Total	\$ 111.2	\$ 34.4	\$ 27.3	\$ 87.2	\$ 260.1 4

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93012

Project Title: Genetic Stock Identification of Kenai River Sockeye Salmon

Project Category: Restoration Management Actions

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Project Term: January 3, 1992 to September 30, 1995

INTRODUCTION

A. Background

Fishing time in the Upper Cook Inlet area was affected in 1989 due to the presence of oil from the *Exxon Valdez* oil spill (EVOS). As a direct result, sockeye salmon (*Oncorhynchus nerka*) spawning in the Kenai River system exceeded optimal escapement goals by three times. This overescapement resulted in overproduction of sockeye salmon fry. The overabundance of sockeye salmon juveniles depleted invertebrate prey populations to the point that widespread juvenile mortality occurred during the winter-spring rearing period. Consequently, sockeye smolt outmigrations in the Kenai River have been severely reduced, and the number of adult sockeye salmon returning from the overescapement in the Kenai River system is expected to be well below minimum escapement levels. Starting in 1993, a large reduction, or closure of Kenai River sockeye salmon harvests may be necessary in an attempt to reach adequate escapements.

Sockeye salmon harvested from the mixed-stock fishery of Cook Inlet include fish from the Kenai, Kasilof, and Susitna Rivers. In order to effectively manage the harvest of EVOS-damaged stocks, Restoration Science Study R59 - Assessment of Genetic Stock Structure of Salmonids - was implemented. This study uses Genetic Stock Identification (GSI) techniques to identify Kenai River stocks in mixed stock Cook Inlet fisheries. Area managers will use this information to modify fishing areas and openings in order to facilitate the harvest of surplus Kasilof and Susitna River stocks while protecting the EVOS-damaged Kenai River stocks.

Restoration of Kenai River sockeye stocks will benefit subsistence, sport, and commercial fishermen in coastal communities throughout Cook Inlet, from Homer north through Anchorage to Tyonek. In 1992 nearly 10,000 families obtained subsistence permits to harvest salmon in UCI, most targeting Kenai River sockeye salmon. The most recent statistics indicate that nearly 100,000 sport anglers fished the Kenai River for salmon in 1990, spending \$38 million in 1986 dollars. Forty percent of those anglers were from out of state. Of the 1,323 permits licensed to commercial fish in UCI, 80% are fished by State residents with the remaining predominantly from Pacific Coast states. Average ex-vessel value (1987-1991) of the UCI commercial salmon harvest was \$ 67.8 million.

WHAT

Contingent upon funding, the Alaska Department of Fish and Game (ADF&G) will continue to develop a comprehensive genetic database of sockeye salmon stocks in Cook Inlet. In 1992 ADF&G began collecting baseline genetic data from 28 subpopulations from the Kenai, Kasilof, and Susitna Rivers. Beginning in 1993, samples from the Cook Inlet commercial harvest will be analyzed to estimate the composition of the fisheries. This information will enable area managers to identify Kenai River fish occurring in the mixed-stock commercial fishery and thus harvest surplus stocks of sockeye salmon while providing protection to EVOS-damaged stocks destined for the Kenai River. The specific objectives are the following:

1. Refine and expand the allozyme database to include all significant spawning stocks contributing to mixed-stock harvests of sockeye salmon in Cook Inlet. Initiate the development of DNA marker detection in sockeye salmon to test for expanded resolving power.
2. Obtain genetic data each week from samplings of the various mixed-stock fisheries occurring in 1993 - 1995.
3. Use Genetic Stock Identification (GSI) algorithms to estimate the proportion of Kenai River stocks in mixed stock fisheries so that managers may modify area and time of harvest in order to protect these damaged stocks while targeting surplus Kasilof River and Susitna River stocks. Estimates will be provided within 48 hours post-fishery.

WHY

Attempts to use stock identification to manage harvests of Cook Inlet sockeye salmon in the past have relied on scale growth patterns. However, the accuracy of the scale technique alone has not been reliable, and it is insufficient to permit the in-season protection of the EVOS-damaged Kenai River stocks. GSI techniques rely on genetic variation to discriminate between populations of organisms. This method has recently been applied as an in-season fisheries management tool, and it has proven to be extremely effective for allocating and adjusting the harvest of fish stocks intercepted in mixed-stock fisheries such as those that occur in Cook Inlet. Once a database has been established, GSI techniques should provide a mechanism for in-season management on a stock-specific basis. This will allow managers to control the harvest of Kenai River sockeye salmon and facilitate their recovery.

HOW

A comprehensive baseline genetic database will be developed for all sockeye salmon stocks contributing to Cook Inlet fisheries. Additional sockeye salmon will be collected from approximately 20 baseline subpopulations each year (1993-1995). Sites will be chosen to supplement those being collected during the 1992 field season. Mixed stock fishery samples will be collected from every drift net fishery occurring during the July fisheries (1993-1995). Muscle, liver, heart, and eye tissue will be taken from individual fish and examined by protein electrophoresis (allozyme analysis) for discriminating gene markers. Genotypic and allelic frequency estimates will be calculated from allozyme electrophoretic data for each baseline and

Project Descriptions

mixed-stock sample at every gene locus examined and will be used to identify discrete spawning populations. Stock components of mixed fishery samples will be estimated using a conditional maximum likelihood algorithm. Fishery composition estimates will be available within 48 hours following the fishery so that management decisions can be based on the actual composition of the fisheries.

ADF&G will also screen representative individuals for DNA-level markers. Total genomic DNA will be extracted and amplified through PCR (polymerase chain reaction) techniques utilizing various mitochondrial and nuclear primers. Restriction analyses as well as sequencing studies will be performed. Maximum likelihood simulation studies will be performed to test the additional resolution that could be provided by the DNA-level data. DNA data will be collected from the fishery samples as scientifically and logistically feasible.

ENVIRONMENTAL COMPLIANCE

Collecting permits will be obtained as required. This project qualifies for a "Categorical Exclusion" under Federal lead requirements.

WHEN

June - Sept. 1992	Baseline & Mixture sample collections/coordination with project R53
July - Dec. 1992	Laboratory analyses of baseline and model mixtures
Jan. - April 1993	Laboratory analyses of baseline populations and annual report
July - Sept. 1993	Laboratory analyses of mixtures; numerical analyses of stock structure; modeling for 1993 mixture analyses
Oct. 1993 - Sept. 1994	Baseline analyses, in-season analyses, annual report
Oct. 1994 - Sept. 1995	Baseline analyses, in-season analyses, final report

BUDGET (\$K)

ADF&G

Personnel	\$ 179.5
Travel	12.0
Contractual	18.0
Commodities	34.7
Equipment	31.9
Capital Outlay	<u>0.0</u>

Sub-total	\$ 276.1

General Administration	<u>24.5</u>

Project Total	\$ 300.6

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93015

Project Title: Kenai River Sockeye Salmon Restoration

Project Category: Restoration Management Action

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 3, 1992 to September 30, 1996

INTRODUCTION

Sockeye salmon *Oncorhynchus nerka* which spawn in the Kenai River system were injured by the Exxon Valdez oil spill. Reduced fishing time in the Upper Cook Inlet area due to the oil spill caused sockeye spawning escapement levels in the Kenai River system to exceed the desired amount by three times. The biological impact of the oil spill on Kenai River sockeye salmon stocks is expected to be serious. Data collected by NRDA Fish/Shellfish Study 27, *Sockeye Salmon Overescapement*, showed greatly reduced survival estimates of juvenile sockeye salmon during the winter-spring rearing period. The large escapement appears to have produced more rearing juvenile sockeye salmon than could be supported by nursery lake productivity. In general, when rearing salmon abundance greatly exceeds lake carrying capacity, the species and size composition of prey resources are altered, which, in turn, affects all trophic levels. Because of such changes, juvenile sockeye growth is reduced and freshwater mortality is increased. Greater numbers of fry remain in the lake for another year of rearing. Competition for a limited food supply reduces condition of surviving fry. Marine mortality is increased because of poor condition of outmigrating smolts.

Limiting sockeye salmon fry production by closely regulating the number of spawning adults is the best way to restore the productivity of these rearing areas. However, the number of adult sockeye salmon returning from the 1989 overescapement may be so low that a reduction or closure of Kenai River sockeye may be necessary starting in 1993 in an attempt to reach adequate spawning escapements.

This project consists of increased monitoring and management of the sockeye salmon stocks in the Kenai River and Upper Cook Inlet (UCI) north of Anchor Point. The project will benefit subsistence, sport, and commercial fishermen in coastal communities throughout Cook Inlet, from Homer north through Anchorage to Tyonek. In 1992 nearly 10,000 families obtained subsistence permits to harvest salmon in UCI, most targeting Kenai River sockeye salmon. The most recent statistics indicate that nearly 100,000 sport anglers fished the Kenai River for salmon in 1990, spending \$38 million in 1986 dollars. Forty percent of those anglers were from out of state. Of the 1,323 permits licensed to commercial fish in UCI, 80% are fished by State residents with the remaining predominantly from Pacific Coast states. Average ex-vessel value (1987-1991) of the

UCI commercial salmon harvest was \$ 67.8 million.

WHAT

A. Goal

The goal of this project is to restore Kenai River sockeye salmon stocks injured by the oil spill. This will be accomplished through improved stock assessment capabilities, more accurate regulation of spawning levels, and modification of human use. Restoration of Kenai River sockeye salmon stocks will be achieved when average fry, smolt, and adult production can be maintained at pre-spill levels. Prey resources of rearing lakes must also be restored to normal levels (This will be monitored under another restoration study, which will be based on information obtained from NRDA Fish/Shellfish Study 27).

B. Objectives

Specific objectives of this proposal are as follows:

1. Improve stock identification capabilities by combining parasite and genetic stock identification information with available scale growth data to provide statistically reliable estimates of Kenai River stocks in the mixed stock fishery of Upper Cook Inlet (UCI),
2. Increase the accuracy and precision of escapement monitoring by supplementing hydroacoustic equipment used in the Kenai River, and
3. Provide more accurate estimates of abundance of Kenai River sockeye salmon within UCI through hydroacoustic assessment techniques.

WHY

More intensive management is necessary to restore affected stocks to pre-spill levels and maintain them at those levels until the populations stabilize. This project will help restore those stocks by providing the information needed to properly manage human uses. Intensive fisheries management will temporarily reduce human pressure on these injured stocks to speed their recovery. As a means of minimizing impacts on the fisheries, existing fisheries may need to be restricted or redirected to alternative sites. For Cook Inlet this will relieve pressure on what are anticipated to be small runs to the Kenai River in the next several years without shutting down other UCI fisheries.

HOW

A. Stock Identification

Stock identification studies used to regulate human use of UCI sockeye salmon have, in past years, relied on scale growth patterns. The accuracy and precision of this technique has varied considerably from year to year. Kenai stocks typically dominate the total return and their scale

Project Descriptions

patterns are generally distinct enough to provide some separation from other stocks. However, when runs to other systems are more abundant (as may occur in 1993-1995) separation of Kenai stocks will be much more difficult. Improvements in stock identification procedures will be necessary to identify the contribution of Kenai River sockeye salmon to the total run accurately in this situation. Recent work by ADF&G, in cooperation with National Marine Fisheries Service staff, has shown that parasite occurrence can be used to improve estimates of stock contribution during the fishing season. The combination of scale patterns, parasites and genetic stock identification techniques (Restoration Science Study Number 59) will greatly increase the accuracy of UCI stock assessment estimates.

Sockeye salmon escapements into major drainages of Upper Cook Inlet were sampled for genetic, parasite, scale and otolith characteristics in 1992. During 1993, 20 additional baseline populations will be sampled and mixed-stock samples will be collected from the commercial drift gillnet fishery. Stock composition of mixed stock fishery samples will be estimated using scale pattern analysis, parasite data, genetic data, or a combination of all three. Stock resolution will be enhanced by using several kinds of biological marker data simultaneously. Typically a maximum-likelihood estimation procedure for a mixture problem with learning samples has been used to combine these data. The principal components of this project are sample collection, transportation to genetic laboratory facilities (for preparation by Restoration Study Number 59), and real time stock composition modeling necessary for inseason resource management decisions.

B. Escapement Monitoring

Bendix Corporation side-scan hydroacoustic equipment has been used since 1976 to count adult sockeye salmon entering the Kenai River to spawn. Lack of Bendix replacement parts and the inability to purchase new Bendix counters will compromise our future ability to provide escapement estimates. Accuracy of estimates would be greatly enhanced through use of newer, more technically advanced equipment. Evaluation of new equipment in 1992 will result in selection of the most appropriate replacement system. Funding for purchase of replacement equipment was authorized in 1992. ADF&G will conduct continuous operations with both the old Bendix equipment and the new equipment on both banks of the Kenai River during a three week period in 1993 to encompass the peak of the sockeye salmon run. This will provide a measure of quality assurance that will allow comparison of data previously collected using only the Bendix device to that collected using new equipment. Use of the Bendix is expected to be unnecessary in subsequent years.

C. Offshore Assessment Program

Sockeye salmon returning to UCI are captured with a drift gill net at a series of stations between Anchor River and Red River delta. Estimates of the total sockeye salmon return are made several times during the season by estimating expected total test fishery catch per unit of effort for the season and catchability of sockeye salmon in the test fishery calibrated by the commercial drift gillnet fishery. Analysis of historical data indicates that existing sampling effort and catch has not been proportional to abundance. Calibration by the commercial fleet is not guaranteed for future reduced run sizes. In 1992 hydroacoustic equipment and techniques were evaluated by a contractor experienced in marine salmon investigations to supplement the existing program.

Anticipated results include: (1) operating parameters of the hydroacoustic system used, (2) real time estimates of fish density, (3) fish distribution across the transects, and (4) definition of run timing models and total return estimates. In 1993 a hydroacoustic survey will be conducted to provide a real-time estimate of adult sockeye salmon in UCI. Placement and duration of transects needed for the 1993 survey will be based on 1992 results to provide an appropriate level of precision and accuracy for an abundance estimate of sockeye salmon. This is to include appropriate species composition estimates of fish targets. Purchase of offshore hydroacoustic equipment will be necessary in order to meet these goals.

ENVIRONMENTAL COMPLIANCE

A Corps of Engineers Section 10 or 404 permit, State of Alaska Title 16 permit, and a finding that this project is consistent with the Alaska Coastal Zone Management Plan may be required. This project qualifies for a "Categorical Exclusion" under Federal lead agency requirements.

WHEN

Four additional years will be required to meet project objectives. Adult returns from the injured 1989 brood year will occur during 1993-1995, but information on the 1990, 1991, and 1992 brood years will also be needed to monitor recovery of the system. Adult returns from the 1992 brood year will not be observed until 1996.

Aug. 1992	Begin to evaluate results of escapement monitoring, purchase new equipment and design escapement monitoring for 1993.
Jan. 1993	Begin to evaluate results from the offshore hydroacoustic investigation and design a survey for 1993.
April 1993	Results of baseline genetic sampling due to evaluate accuracy and precision of stock composition modeling and set sample design and sample size goals for 1993.
May 1993	Award contract for the offshore hydroacoustic survey in UCI to begin in July.
June 1993	Begin field work: fishery sampling and escapement monitoring begin in July, and escapement sampling for stock identification baselines through September.
Sept. 1993	Interim Report to include (1) performance of stock composition modeling with scale, genetic, and parasite data, (2) estimates of adult sockeye escapement in the Kenai River, and (3) offshore hydroacoustic estimates of sockeye salmon.

Project Descriptions

BUDGET (\$K)

ADF&G

Personnel	\$ 203.1
Travel	10.6
Contractual	136.5
Commodities	41.2
Equipment	25.4
Capital Outlay	<u>0.0</u>

Sub-total \$ 416.8

General 40.0
Administration

Project Total \$ 456.8

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93016

Project Title: Chenega Chinook and Coho Salmon Release Program

Project Category: Manipulation and Enhancement

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Project Term: January 1, 1993 to December 31, 2003

INTRODUCTION

A. Background

Due to the oil spill, salmon stocks were impacted. Subsistence as well as sport and commercial fisheries were disrupted. Traditional usage of fish stocks and fishing grounds by the Chenega Village residents was lost. This project will help to restore lost subsistence fishing and establish alternate subsistence fishing opportunities. The Trustee Council requires full environmental compliance before funding this project. Therefore, only completion of the Environmental Assessment is planned for the 1993 fiscal year. Implementation of the field work will begin in May of 1994.

B. Injury

As a result of the *Exxon Valdez* oil spill, subsistence harvest of salmon and other resources was disrupted.

C. Location

Fish production at W. Noerenberg (WHN) Hatchery at Esther Island in PWS. (This is the preferred site if production can be accomplished without major modifications). Fish will be released and harvested in the vicinity of Chenega Village in southwestern Prince William Sound, at Deadend Bay.

WHAT

A. Goal

To replace subsistence resources by permitted releases of chinook and coho salmon at designated sites near Chenega Village from stocks of Prince William Sound Aquaculture Corporation (PWSAC) Wally Noerenberg Hatchery near Esther Island.

B. Objectives

- 1) Produce 50,000 chinook salmon smolts at the W. Noerenberg Hatchery for transport and release at site(s) near Chenega Village.
- 2) Hold and feed the smolts in net pens at the release site for 2 weeks before they are released.
- 3) Harvest approximately 1500 adult chinook salmon when they return (Assume 3% survival rate; 4 years before all year classes are represented).
- 4) Produce 50,000 coho salmon smolts for transport, holding, feeding and release near Chenega Village.
- 5) Harvest approximately 2500 adult coho salmon annually (Assume 5% survival rate; annual return beginning 1 year after first release).

WHY

A. Benefit to Injured Resource/Service

These projects will restore and improve subsistence salmon harvests that were lost because of the *Exxon Valdez* oil spill.

B. Relationship to Restoration Goals

Results from this project will help to restore lost subsistence fisheries. (Restoration Options: replace lost subsistence use (Management of Human Uses) 18 (Resource Manipulation), 30 (Other) related to hydrocarbon contamination of subsistence foods.

HOW

A. Method

1. Smolts will be utilized from existing production lots and raised to smolt stage at the WHN Hatchery.
2. Smolts will be transported by barge to the designated sites.
3. Smolts will be held and fed in net pens for 2 weeks before release to improve survival and imprinting.
4. Adults will be harvested when they return.
Chinook Salmon: broodstock - from hatchery stock.
Coho Salmon: broodstock - from donor stock near the release site.

All plans will be reviewed by the PWS Regional Planning Team (RPT) and by the Fish Transport

Project Descriptions

Permit (FTP) process and will comply with the ADF&G Fish Genetics Policy.

B. Other Efforts

This project will provide an alternate source of food for subsistence use and reduce the need for reliance on wild stocks that were injured by the oil spill.

ENVIRONMENTAL COMPLIANCE

This project will be reviewed for full compliance with the NEPA Process, the PWS RTP, and the ADF&G FTP review before it is implemented. The lead Federal agency has determined that this project requires an Environmental Assessment under the NEPA process.

WHEN

Jan. 1993	Plans are reviewed by the NEPA process, PWSAC, and the PWSAC RPT.
Aug. 1993	Completion of Environmental Assessment.
Oct. 1993	Review and approval of Environmental Assessment.
June 1994	First chinook smolts transported, penned, fed, and released.
Oct. 1993	Coho salmon broodstock screening and selection.
June 1994	First "adult" (jack) returns of chinook salmon.
Oct. 1994	First coho salmon eggs are taken from the designated location.
June 1995	First coho salmon smolts are released.
Aug. 1996	First coho salmon adults return.
June 1996	First complete complement of all chinook salmon age classes return.

Each year, smolts will be released in June (or late May).

BUDGET (\$K)

	ADF&G
Personnel	\$ 0.0
Travel	0.0
Contractual	10.0
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 10.0
General Administration	<u>0.7</u>
Project Total	\$ 10.7

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93017

Project Title: Subsistence Restoration Project

Project Category: Restoration Management Actions

Project Type: Subsistence

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Oceanic and Atmospheric Administration

Project Term: January 1, 1993 to September 30, 1995

INTRODUCTION

A. Background

Subsistence use of fish and wildlife constitute a vital natural resource service that was injured by the *Exxon Valdez* oil spill. Data collected by the Alaska Department of Fish and Game's Division of Subsistence has demonstrated this injury.

B. Summary of Injury

Annual per capita subsistence harvests declined dramatically (from 12 to 77 percent decline as compared with pre-spill averages) in ten of the communities in the path of the spill during the first year after the event. While some of these communities' harvests demonstrated a limited recovery in the second post-spill year, harvest levels in other affected communities showed no signs of recovery. Concern over the long-term health effects of using resources from the spill area, a loss of confidence on the part of subsistence hunters and fishermen in their own abilities to determine if their traditional foods are safe to eat, and a perceived reduction in available resources, all contribute to the reduced harvest levels.

C. Location

This subsistence restoration project will involve the following communities: Chenega Bay, Tatitlek, Cordova, Valdez, Nanwalek, Port Graham, Seldovia, Kenai, Seward, Larsen Bay, Karluk, Old Harbor, Akhiok, Port Lions, Ouzinkie, Kodiak City, Chignik Lake, Chignik, and Chignik Lagoon.

WHAT

A. Goal

The goal of the project is to restore the subsistence use of fish and wildlife damaged by the *Exxon Valdez* oil spill. Community meetings will be held in order to identify and map the specific areas and resources of continued concern to subsistence users. These meetings will provide a

comprehensive, final opportunity to identify these concerns. Data obtained in these meetings will provide prioritization and locations of sites to the Alaska Department of Environmental Conservation's 1993 spring shoreline survey, Restoration Project 93018, in order to focus treatment efforts if necessary. Samples of subsistence foods will be collected from harvest areas identified during the mapping.

C. Objectives

Community representatives will assist in site selection, as well as the collection of samples. The samples will be analyzed for the presence of hydrocarbon contamination. The results of the tests, along with findings from other damage assessment and restoration studies, will be interpreted by the Oil Spill Health Task Force, and reported to the communities in an informational newsletter and community visits. This information will assist the Trustee Council in making decisions concerning restoration, enhancement or replacement of lost subsistence resources and uses. In addition, funds will be made available to support subsistence food sharing programs between communities.

WHY

The Oil Spill Health Task Force has had some success in conveying the message that most subsistence foods are safe to eat. However, concerns about long-term effects remain. Also, limited public access to the damage assessment studies has created the impression in most communities that the task force did not base its conclusions on a complete assessment of all data. This project provides the opportunity to put information from the damage assessment into context. This will help to empower the people in the impacted communities to make informed decisions and encourage those who are so inclined to return to using more subsistence resources. It would also restore the communities' abilities to pass on skills and knowledge associated with using subsistence foods.

Making information from subsistence users part of the restoration process will facilitate the recovery of subsistence use areas, the importance of which might otherwise be missed. There is a need in these communities to actively participate in restoration of the environment. This project would provide for this involvement.

The project answers the need to continue to monitor the risks to human health from the oil spill. This is consistent with the goal of restoring human services of the natural resources damaged in the oil spill. It also addresses the need to restore the natural resources and the services these resources previously provided to subsistence users.

HOW

By involving subsistence users in decisions affecting mitigation, and the monitoring, enhancement and replacement of the natural resources, we can accelerate the recovery of the resources subsistence users rely upon. This involvement, combined with effective communication of information concerning the safety of the resources should cause subsistence harvests to begin to approach pre-spill levels, and reduce anxiety about their use.

Project Descriptions

The Division of Subsistence will use the results of a joint study currently being conducted with the U.S. Minerals Management Service in 15 communities impacted by the *Exxon Valdez* oil spill to determine the communities where concern continues to exist, as well as the nature of that concern. Similar activities were suggested by the Bureau of Indian Affairs.

The details of the subsistence research being undertaken by the Department of the Interior as part of the Chenega Bay settlement are not available due to the litigation sensitive nature of the work. Nevertheless, the Department of Fish and Game has been assured by Regina Sleater, an attorney of the U.S. Department of the Interior, that there is minimal overlap between the ADF&G study and the DOI study. In addition, the results of the Interior study will be available in December 1992 and 93017 will be able to build upon--rather than overlap with--the Interior project.

ENVIRONMENTAL COMPLIANCE

This project is categorically excluded under NEPA guidelines.

WHEN

Jan. 1-May 31, 1993	Community meetings to map areas and species of concern
June - July 1993	Coordinate with DEC shoreline assessment to verify oiling information
June 1993	Collect subsistence food samples for testing (two months for analysis)
August 1993	Informational newsletter issued
September 1993	Collect subsistence food samples for testing
November 1993	Informational newsletter issued
December 1993	Collect subsistence food samples for testing
February 1993	Informational newsletter issued
March 1994	Collect subsistence food samples for testing
May 1994	Informational newsletter issued
June - July 1994	Coordinate with DEC shoreline assessment to verify oiling information
June 1994	Develop plan for additional cleanup/mitigation of oil
September 1994	Develop plan for enhancement/replacement of resources
May 1995	Coordinate with DEC shoreline assessment to verify oiling information

Note: There will be ongoing communication with subject communities throughout the duration of the project, with visits to communities as needed.

BUDGET (\$K)

	ADF&G	NOAA	TOTAL
Personnel	\$ 78.5	\$ 65.2	\$ 143.7
Travel	30.0	0.0	30.0
Contractual	85.5	0.0	135.5
Commodities	0.8	17.3	35.4
Equipment	0.0	0.0	18.1
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 194.8	\$ 82.5	\$ 327.3
General Administration	<u>17.8</u>	<u>12.0</u>	<u>33.3</u>
Project Total	\$ 212.6	\$ 94.5	\$ 360.6

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93022

Project Title: Monitoring the Recovery of Murres in the Barren Islands

Project Category: Restoration Monitoring

Project Type: Birds

Lead Agency: Department of the Interior - Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to December 31, 1993

INTRODUCTION

A. Background

Murres were the species of higher vertebrates most heavily affected by the oil from the *Exxon Valdez* spill. These diving seabirds have continued to demonstrate abnormal breeding behavior and low reproductive output at several sites since the spill. Factors that normally result in increased breeding success of common murres are breeding in high-density concentrations and laying eggs in synchrony with neighbors. Being one of a crowd apparently reduces vulnerability to avian predators. Within a colony, birds in groups that breed early tend to be more productive than birds breeding later, and older birds tend to breed earlier and be more successful than young birds. Prior to laying, murres tend to be flighty. In cases where a small percentage of murres in a cluster have begun to incubate before others have laid, incubators tend to leave their eggs exposed to predators, joining the flock when panic flights occur. Nevertheless, as more birds lay there is a tendency for incubators, now apparently feeling safer with company, to remain with eggs when non-breeders flush.

For reasons not yet fully understood, murres at colonies affected by the oil have not yet resumed normal breeding schedules. Apparently a relatively small proportion of birds have laid their eggs earlier than others, and egg predation by gulls has been high. Perhaps a substantial proportion of experienced breeders were killed in the spill so that the population now is composed of mostly young, inexperienced breeders. It is not well understood how crucial the presence of older birds is to the social facilitation of normal breeding, and it is possible that a shortage of experienced breeders is causing the abnormal timing and poor reproductive success. Another contributing factor could be reduced breeding densities, since populations were reduced by mortality of adults.

B. Summary of Injury

Over 100,000 murres were killed by the oil, and counts of birds at colonies within the trajectory of the oil indicated reduced populations after the spill. In the 3 years following the spill, remaining murres at colonies affected by the oil have initiated laying up to 1 month late, if they laid at all, and reproductive output has remained much lower than would be expected. Three

consecutive years of poor reproductive success is very unusual based upon other studies.

C. Location

Experiments would be conducted at murre colonies in the Barren Islands, located between the Kenai Peninsula and the Kodiak Archipelago.

WHAT

A. Goal

The purpose of this project is to count murrees at breeding colonies and determine the timing of nesting events and reproductive success to evaluate recovery.

B. Objectives

1. Monitor the recovery of murrees in the Barren Islands.

WHY

A. Benefit to Injured Resources/Services

Monitoring is essential to assess the recovery of the colony as a whole following the oil spill. The underlying causes of the abnormal nesting behavior (e.g., delayed laying) are not yet understood, and monitoring data will provide the basis for testing various hypotheses. Understanding the impact of the oil spill may make it possible to minimize damage in future spills by directing clean-up efforts appropriately. Moreover, documentation of the response of murrees in the aftermath of the oil spill will provide a basis for predicting the extent of the injury from future spills.

B. Relationship to Restoration Goals

This project meets the Trustee Council goal of restoring the spill area to its pre-spill condition by providing information that could be used to develop a management action.

HOW

A. Methodology

Murrees will be counted on established plots. Counts will be made from boats following standard seabird census protocols. Information on timing of nesting events and reproductive success will be obtained through observation and use of the time-lapse photography.

B. Coordination with Other Efforts

Data from the monitoring program will be used to assess the effectiveness of this project.

Project Descriptions

ENVIRONMENTAL COMPLIANCE

This is a non-intrusive project which appears to qualify for categorical exemption under NEPA.

WHEN

Jan. - April 1993	Plan and arrange logistics (e.g., boat charters), recruit seasonal employees, develop detailed study protocols, assemble field gear, purchase equipment
May 1993	Train personnel; organize equipment
June - August 1993	Conduct field studies
Sept. - Oct. 1993	Analyze data; store equipment
Nov. - Dec. 1993	Write report; draft report submitted for internal review Nov. 15
Dec. 15, 1993	Draft report submitted for peer review
Dec. 30, 1993	Final report completed

BUDGET (\$K)

	USFWS
Personnel	\$ 80.0
Travel	13.6
Contractual	55.5
Commodities	8.2
Equipment	4.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 161.3
General Administration	<u>15.9</u>
Project Total	\$ 177.2

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93024

Project Title: Restoration of the Coghill Lake Sockeye Salmon Stock

Project Category: Restoration Manipulation and Enhancement

Lead Agency: Alaska Department of Fish and Game (ADF&G)

Cooperating Agencies: U.S. Forest Service (USFS)

Project Term: January 1, 1993 to December 31, 1997

INTRODUCTION

This project will attempt to restore the natural productivity of Coghill Lake through use of established lake fertilization techniques. Coghill Lake is located on the eastern side of Port Wells in the northwest region of Prince William Sound (PWS). The Coghill Lake sockeye salmon stock historically supported important sport and commercial fisheries. Returns have declined in recent years from a historical average of 250,000 to only 25,000 in 1991. Damage assessment studies on juvenile salmon suggest that the *Exxon Valdez* oil spill contributed to the decline of the Coghill sockeye stock. Salmon migration patterns indicate that juvenile sockeye smolt from Coghill Lake likely migrated through oil-contaminated areas in western PWS. Juvenile salmon similar in size to Coghill smolts utilized oiled nearshore nursery habitats. The growth and survival of juvenile salmon utilizing these habitats was reduced by oil contamination from the *Exxon Valdez* spill. The Coghill Lake stock is presently at extremely low levels. Action must be taken to restore the stock before any further decline occurs. The communities of Anchorage, Whittier, Valdez, and Cordova will benefit from this project. Coghill Lake sockeye have been heavily utilized by sport fishermen traveling from Whittier by boat and from Anchorage by air. Commercial fishermen from all of these communities have historically fished the Coghill Lake sockeye salmon stock. Restoration of Coghill Lake sockeye salmon will further improve management of important sockeye and chum salmon stocks returning to hatcheries in western PWS.

WHAT

The goal of this project is to restore the natural productivity of Coghill Lake and the resident sockeye salmon population through use of established lake fertilization techniques. The USFS will apply fertilizer to the lake each summer for five years (the USFS has already purchased the fertilizer from another funding source). The ADF&G will conduct limnological and fisheries studies needed to monitor and refine the fertilization program. These studies will focus on the effects of fertilization on primary and secondary production and the growth and survival of juvenile sockeye salmon in the lake. The ADF&G component of the project will achieve the following objectives each year:

1. Determine the response of lake nutrient levels, primary and secondary production, and plankton species composition to lake fertilization,

2. Monitor changes in water temperature, light penetration, and water level in the lake,
3. Determine the habitats utilized by sockeye salmon fry at various lifestages,
4. Determine if fry prey composition, growth, and overwinter survival changes in response to lake fertilization,
5. Estimate the effect of fertilization on lake carrying capacity and smolt-to-adult survival, and,
6. Develop recommendations for refinement of the lake restoration program.

WHY

This project will restore an important natural resource and resource service in the *Exxon Valdez* oil-spill area. Restoration of the Coghill sockeye stock will further provide natural resource services to replace those once provided by other injured stocks. Damage assessment studies on juvenile salmon suggest that the *Exxon Valdez* oil spill may have contributed to the decline of the Coghill sockeye stock. Lake fertilization techniques have been successfully applied in Alaska and elsewhere to restore the productivity of sockeye salmon rearing lakes. The production of sockeye salmon populations is closely linked to the productivity of lakes where the fish rear for one to three years. The availability of food in rearing lakes determines the growth and size of smolts that emigrate to sea. Smolt size in turn determines ocean survival and subsequent adult returns. The fry food resources in Coghill Lake are currently very low. As a result, the lake cannot support large numbers of fry, and the smolts are very small. Fertilization is needed to increase lake productivity and boost fry food abundance until natural nutrient input from salmon carcasses is restored.

HOW

Limnological sampling will be conducted twice each month at two stations. Dissolved oxygen concentrations will be measured from the surface to a depth of 40 M. Eight liter water samples will be collected from the 1m stratum, chemocline, and monimolimnion. Replicate vertical zooplankton tows will be taken using a 153- μ m mesh conical net. Water samples will be analyzed for the following parameters: conductivity, alkalinity, calcium, magnesium, turbidity, total iron, filterable reactive phosphorus, total phosphorus, nitrate and nitrite, total Kjeldahl nitrogen, total nitrogen, and reactive silicon. Yearly phosphorus loading will be estimated. Euphotic zone depth and algal standing crop will be estimated. Zooplankton abundance will be estimated from triplicate counts of organisms in 1 ml subsamples. Zooplankton dry weight and biomass will be estimated by regression analysis using body length measurements on 10 individuals from each taxa. Light penetration will be measured at 1 m increments from the surface to a depth equivalent to 1% of the subsurface light. Water temperature in the epilimnion and water level will be continuously monitored by electronic recorders moored at 5, 15, and 25m depth. The habitats used by sockeye salmon fry in the lake will be determined from visual surveys, beach seine and tow net catches, and hydroacoustic surveys conducted in June, August, and October. A 70-Khz echosounder will be used to determine the vertical distribution of fry in the lake during the day

Project Descriptions

and at night. Twenty samples ($n=10$) of 10 sockeye salmon fry will be collected from various habitats during each survey for later analysis of stomach contents and otolith growth.

Stomach analysis will be conducted on sockeye fry ($n=200$) collected during each survey. Prey items in the stomach will be identified to the lowest possible taxonomic level. Prey body weight will be estimated by regression analysis using body length measurements on 10 individuals from each taxa. Stomach contents' weight will be estimated by the product of abundance and mean body weight for each taxa. Chi-square analysis will be used to test for differences ($P=.05$) in the proportion of stomach contents weight in each taxonomic group between three time periods. Analysis of covariance will be used to test for differences ($P=.05$) in stomach contents weight between three time periods.

Otolith microstructure analysis will be conducted on sockeye fry ($n=200$) collected during each survey. Thin sections of the otoliths will be prepared using established methods. A computer image analysis system will be used to collect data from the otoliths. A modified Fraser-Lee back calculation procedure will be used to reconstruct fish growth histories during weekly time periods. Weekly growth estimates obtained from otoliths will be regressed against weekly mean water temperatures obtained from electronic temperature recorders. Analysis of covariance will be used to test for differences ($P=.05$) in temperature-specific growth between Coghill Lake sockeye and fish fed an excess ration. Comparison of regression slopes will be used to determine if fry growth in Coghill Lake is limited by food abundance. This information will be used to monitor the growth response of the fish to fertilization and determine the carrying capacity of the lake.

The overwinter survival of juvenile sockeye will be estimated from fall fry and spring smolt population estimates. Fall fry population size will be estimated with a 120-Khz echosounder towed along 10 randomly selected transects. A mid-water trawl will be used in conjunction with the hydroacoustic surveys to determine species composition, age, and size of fish targets. Sockeye salmon smolts emigrating from Coghill Lake will be enumerated using incline-plane traps. The traps will be operated continuously from early May through June. The catch efficiency of the traps will be determined by mark/recapture analysis. Age composition and size will be estimated from a sample of 40 smolts collected each day. Chi-square analysis and analysis of variance will be used to test for differences ($P=0.05$) in age composition and smolt size between years, respectively. A representative sample of smolts will be coded-wire tagged to enable later estimation of smolt-to-adult survival in the commercial fishery. The combined results from these investigations will be compiled in an annual report describing the success of the fertilization program and recommending refinements to the methodology.

ENVIRONMENTAL COMPLIANCE

An Environmental Assessment has been conducted to evaluate the various options for rehabilitating Coghill Lake and the resident sockeye salmon population. The assessment has concluded that a program of lake fertilization is the most appropriate method for rehabilitation in this case. Final approval of the Environmental Assessment is expected before the end of 1992.

WHEN

This project will be conducted over a five-year period which corresponds to the generation time for Coghill Lake sockeye salmon. Lake fertilization is expected to elevate lake productivity until carcasses from adult spawners can once again contribute significantly to the nutrient load in the lake. Project activities will take place throughout each year.

May - June 1993	Enumerate outmigrant smolts and estimate smolt age and size
June - October 1993	Apply fertilizer each week and conduct limnological sampling
June, Aug., Oct. 1993	Determine fish habitat use and sample for otolith and stomach analysis
October 1993	Estimate fall fry population size using hydroacoustic techniques
June - October 1993	Conduct laboratory analyses of limnological, otolith, and stomach samples
October - Dec. 1993	Analyze data and prepare annual report

BUDGET (\$K)

	ADF&G	USFS	TOTAL
Personnel	\$ 84.8	\$ 10.2	\$ 114.9
Travel	1.2	5.4	6.7
Contractual	17.1	7.0	15.8
Commodities	7.6	0.7	14.7
Equipment	39.6	0.0	21.5
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 150.3	\$ 23.3	\$ 173.6
General	<u>16.3</u>	<u>2.0</u>	<u>18.3</u>
Project Total	\$ 166.6	\$ 25.3	\$ 191.9

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93030

Project Title: Red Lake Restoration

Project Category: Restoration, Manipulation and/or Enhancement

Project Type: Fish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 7, 1993 to September 30, 1997

INTRODUCTION

Red Lake, located on the southwest side of Kodiak Island, has historically been one of the most consistent producers of sockeye salmon for Kodiak's commercial purse seine fishermen. The Department of Fish and Game's annual escapement goal for the system ranges from 200 to 300 thousand. Since 1980, the catch has ranged from 25,000 to 1.5 million with an average of 450,000. This fishery has had an average annual value to fishermen of about \$2.2 million.

Careful management of the number of spawning fish is required to maintain this fishery at a high level. Young sockeye salmon spend at least their first year of life (up to 3 years) living and growing in lakes where they rely on microscopic-sized animals (plankton) for food. These animals, in turn, graze on tiny plants. If too many adult salmon spawn in the lake system, an overabundance of the young sockeyes will deplete their limited food source before they migrate to sea. When this happens, large numbers of young salmon die, survivors grow more slowly and smaller numbers migrate to the ocean to mature. So, large numbers of spawners in one year may result in an unusually small run in the next cycle.

In 1989, as a result of the *Exxon Valdez* oil spill, commercial salmon fishing was closed over most of Kodiak Island waters. The closure resulted in an escapement of 768,000 sockeye salmon into Red Lake, a 2.5 fold increase over the maximum desired. Data gathered showed low survival for the 1989 escapement year. Surveys showed low numbers of juveniles in the lake in the fall of 1990; and, in the spring of 1991, reduced number of migrant smolts were observed. This means that very low numbers of sockeye will return as four-, five-, and six-year olds in 1993, 1994, and 1995. It is anticipated that adult salmon return may be depressed to the extent that the escapement may fall below 150,000. If this happens during one or more of these years, supplemental production would be implemented immediately to restore the population.

If immediate actions are taken, we will have the capability to restore Red Lake sockeye salmon production. As a result of the oil spill, sockeye salmon returns are expected to be so low in 1993 and 1994 that minimum spawning population goals will not be achieved. If this were to happen, the productivity of this lake would be underutilized, and the fisheries would be seriously impacted in future years.

Restoration will involve taking a total of six million early run sockeye salmon eggs at Red Lake by August 30th each year. The eggs will be transported and incubated in a module at the Pillar Creek Hatchery in Kodiak. Fry will be reared until emergence and then released into Red Lake in May of each year.

The commercial purse seine fleet will benefit from this project as well as all associated fishing communities on Kodiak Island. The Red Lake sockeye fishery has historically provided a stable, significant source of income for Kodiak fishermen; consequently, restoration of this system is extremely important.

WHAT

Contingent upon the finding of a sockeye salmon synthesis meeting, this project is intended to supplement natural sockeye fry production in Red Lake with fry plants if escapement levels fall below minimum levels. However, early observations indicate that 1993 escapement levels will be adequate for this year. Therefore, no field work is needed this season.

Since the Trustee Council requires full environmental compliance before funding further work on this project, only completion of the Environmental Assessment is planned for the remainder of the 1993 fiscal year.

Project objectives are as follows:

1. Increasing the incubation and rearing capacity of Pillar Creek Hatchery to support additional Red Lake eggs and fry.
2. Collecting six million early run Red Lake sockeye eggs, beginning in 1993 and continuing through 1995, contingent upon Red Lake escapement falling below the minimum escapement goal of 150,000 by August 1.
3. Incubation of six million Red Lake sockeye eggs at Pillar Creek Hatchery with 90% survival from green to eyed eggs.
4. Rearing of approximately 5.4 million Red Lake sockeye fry at Pillar Creek Hatchery to the size of .25 grams with 90% survival.
5. Evaluating freshwater survival and the success of hatchery fry plants, by thermally marking otoliths of fry prior to stocking into Red Lake.
6. Stocking of approximately 4.9 million fed fry (.25 gram) into Red Lake with timing parallel to the period of wild stock recruitment.
7. Producing approximately 146,000 adult red salmon from annual fry plants (3% fry to adult survival).

Project Descriptions

WHY

The project restoration activity will result in restoration by allowing wild and cultured fry to enter the lake at the same period. A forecasted survival rate of 3% from fry to adult could result in 146,000 adults returning each year to the Red Lake system.

This project should be funded because immediate actions are needed to restore Red Lake sockeye salmon production if expected damage from the oil spill is realized. This damage is expected to result in weak return in 1993 and 1994, when minimum escapement goals may not be achieved. If this happens, the productivity of the lake would be underutilized and the fishery and economy would be seriously impacted in future years.

HOW

Pillar Creek Hatchery will be modified by the addition of an incubation module and 24 Kitoi box incubators to allow receipt of Red Lake eggs. Additional raceways will be installed to short-term rear emergent fry. Net pens, frames, seines and other egg take gear will be purchased and staged in Kodiak in July each year, after the initial purchase in 1992. If escapement into Red Lake is below 150,000 by August 1st (beginning in 1993), an egg take will proceed. Eggs will be collected, with a goal of 6,000,000, in August and transported to Pillar Creek Hatchery for incubation. During incubation, between the eyed and hatched stages, eggs will be marked by thermally induce otolith banding. Fry will be reared in aluminum raceways until reaching a weight of .25 grams and then will be transported by float plane for release into Red Lake. Smolt samples will be collected via NRDA #27 smolt enumeration project and checked for marks to determine hatchery fry contribution and project success.

This project will be operated in close association with NRDA Study #27 which monitors the effects of the 1989 overescapement on the productivity of Red Lake. This monitoring will assist with forecasting returns and, in association with the ADF&G weir, will help coordinate this project's restoration activities. Also, Pillar Creek Hatchery enhancement and rehabilitation activities in other areas of Kodiak Island will provide technical assistance to this project.

Red Lake lies within the boundaries of the Kodiak National Wildlife Refuge. Other projects of this type on refuge lands have required an environmental analysis (EA) and a "finding of no significant impact." The EA will be completed prior to implementation of this project.

WHEN

July 1992-Jan. 1993	Purchasing incubators, raceways, pipeline, and plumbing
Jan. 1993-Feb. 1993	Purchasing egg take supplies
Nov. 1992-Dec.1992	Annual project status report
Mar. 1993-June 1993	Preparation of PCH for receiving of eggs; incubator, raceways, and pipeline installation, egg take camp set up, supply ordering
July 1993- Sep.1993	Completion of Environmental Assessment

BUDGET (\$K)

ADF&G

Personnel	\$ 7.5
Travel	0.0
Contractual	0.0
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>

Sub-total	\$ 7.5

General Administration	<u>0.0</u>

Project Total	\$ 7.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93033

Project Title: Restoration Monitoring of Harlequin Ducks (*Histrionicus histrionicus*) in Prince William Sound and Afognak Island Areas

Project Category: Restoration Monitoring

Project Type: Birds

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: Alaska Department of Natural Resources; National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Auke Bay Laboratory; U.S. Fish and Wildlife Service

Project Term: January 10, 1992 to September 30, 1995

INTRODUCTION

The *Exxon Valdez* oil spill (EVOS) significantly affected Harlequin ducks (*Histrionicus histrionicus*). Not only was there direct mortality of at least 200 Harlequins in Prince William Sound (PWS), but there has been a nearly complete reproductive failure of residents of the western PWS oil spill area from 1990 to 1992. (No study was conducted in 1989). This is a significant and unexpected long-term effect. Because some Harlequins spend their entire lives in the oil spill area, where they breed, feed, and overwinter, it is possible to detect and study this impact of EVOS. (Non-resident Harlequins and other seaducks that over-winter in oiled areas may be similarly affected, but because they breed in areas remote from the spill, it is impractical to study them.)

Harlequins are intertidal feeding diving ducks. The Harlequin duck population in the Prince William Sound and Afognak areas contains both resident and non-resident migrants. The residents breed along forested streams within a few kilometers of saltwater, molt in secluded bays and lagoons, and roost on offshore rocks. Broods are found with hens on saltwater in summer. Non-resident Harlequin ducks which winter on the south coast of Alaska breed elsewhere on mountain streams. They arrive in the south coastal area in October and depart in May. Harlequin ducks return to the same breeding and wintering areas year after year.

Breeding Harlequin ducks were formerly distributed throughout PWS, including the oil spill area, with broods commonly observed in shoreline habitats (Isleib and Kessel, 1973; Isleib, pers. comm.). Subsequent to the oil spill, Harlequin ducks have failed to breed in western Prince William Sound, and their population has declined in the oil spill area.

In contrast, these ducks reproduced normally in unoiled areas of Prince William Sound, and their population has remained stable. A few broods were found on the periphery of the EVOS area in 1991-92.

The reproductive failure of Harlequin ducks in the oil spill area is postulated to be a chronic effect of petroleum exposure through contaminated intertidal food. Blue mussels (*Mytilus*) appear to be the most likely source of contamination. They are well known to concentrate and hold pollutants in their tissues. Restoration Study #103 has documented high concentrations of polynuclear aromatic hydrocarbons (PAHs) in mussel flesh, byssal thread mats, and underlying substrates in western PWS in 1992. Because Harlequin ducks consume entire mussels, ingesting petroleum hydrocarbons in mussel tissue, on the shell surface, and in attached byssal threads and sediment, Harlequin ducks collected in 1989-90 in western PWS and SW Kodiak contained oiled food items in their gullets and petroleum residues in liver tissue and bile. Experimental studies have demonstrated that single small doses of petroleum can cause reproductive failure in some seabirds. A search of the files of U.S. Coast Guard Federal On-Scene Coordinator indicated that approximately 130 blue mussel beds may retain EVOS oil in western PWS. However, field evidence collected in 1992 has shown additional previously unreported oiled mussel beds in PWS and along the Kenai coast. EVOS oil also remains associated with dispersed blue mussels in a number of sheltered locations currently under investigation. Damage Assessment studies of Harlequin ducks through 1992 have been limited to Prince William Sound. Additional work is needed on Afognak Island.

WHAT

A. Goals

1. Test the hypothesis that continuing exposure to oil is responsible for the observed reproductive failure by examining Harlequin duck reproductive anatomy, histology, and blood parameters in oil spill and control areas;
2. Determine from chemical samples whether hydrocarbon residues are currently present in Harlequins;
3. Monitor Harlequin reproduction in western Prince William Sound;
4. Characterize Harlequin duck nesting habitat using existing information, remotely sensed data, and GIS modelling techniques;
5. Apply and evaluate Harlequin duck habitat models to provide a broad general perspective on Harlequin duck habitat within the EVOS area.

B. Objectives

1. Collect and analyze tissue and blood samples from Harlequin ducks in oiled and unoled areas of PWS for evidence of oil-induced pathology;
2. Investigate food habits and to examine food items from proventriculus samples for petroleum contamination;
3. Determine breeding condition of Harlequin ducks by examining reproductive tracts of both males and females for physiological changes;
4. Continue monitoring productivity of Harlequin ducks in oiled and unoled areas of PWS by means of shoreline boat surveys for young in August;
5. Describe and characterize potential Harlequin duck nesting habitat on Afognak Island.

Project Descriptions

WHY

The ultimate goal of this project is the restoration of breeding Harlequin ducks to the oil spill area. To achieve restoration requires the following:

1. Determine the nature and extent of the reproductive failure
2. Define habitat requirements to guide restorations, and
3. Determine whether hydrocarbon residues are currently present in Harlequins in order to clarify the link to persistent oil contamination. If the observed failure of reproduction is related to the contaminated food chain, remaining oil may need to be treated to make other restoration efforts more effective. In some cases these mussel beds remain grossly contaminated. Technical knowledge of habitat requirements of breeding Harlequin ducks may prove valuable for habitat acquisition and mitigation measures, protection of non-Federal lands in National Park Service areas, development of marine sanctuaries, or other restoration actions.

HOW

ADF&G will use methodology developed during previous Harlequin duck studies. The 1993 project will collect Harlequin ducks to test for anatomical, histological, and chemical differences between ducks from oiled and unoled areas of PWS. Two collection periods are planned; one in April, when the ducks would be responding physiologically to changes in photoperiod, and one in late May, when the birds are actually in breeding condition. Aspects of reproductive tract anatomy, including ovary, oviduct, and testis weight, follicle number and size, will be recorded and samples taken for histological examination. Blood and tissue samples will be taken from the 40 collected Harlequin ducks. Blood samples will be analyzed for normal blood parameters and for the presence of elevated levels of haptoglobins and interleukins. Tissues will be examined histologically, and samples from adipose tissue, liver, and bile will be analyzed for the presence of petroleum hydrocarbons. Proventriculus and other gut contents will be removed for hydrocarbon analysis and food habits documentation.

The status of Harlequin reproduction in PWS will be monitored by brood surveys in shoreline habitats during August. All major stream mouths in the western PWS oil spill area will be visited. Equivalent surveys will be conducted in eastern PWS.

The 1993 Harlequin duck project will assist the Habitat Protection Work Group (HPWG) in the mapping of potential Harlequin duck habitat on Afognak Island. Potential Harlequin duck nesting habitat, brood rearing habitat, and feeding areas will be characterized using habitat parameters documented in Restoration Study 71, new data from field work on Afognak, and databases from remote sensing and other sources. Field reconnaissance of potential Harlequin habitat on Afognak Island will be conducted in early June to determine the feasibility of remotely classifying Harlequin duck habitat. Site-specific information on Harlequins will also be obtained. This project will coordinate with Restoration Study #051 (Stream Habitat Assessment) to ground-truth aerial photographs and satellite imagery in the Afognak area. There is no financial or operational overlap with project #93051.

ENVIRONMENTAL COMPLIANCE

This project will comply with requirements of the National Environmental Policy Act. No environmental analysis is required to conduct this study, because it is a research project. State and Federal collecting permits will be obtained through regular procedures.

WHEN

This project will be conducted during 1993-1995. Field work will be completed each year by August 30. Report preparation will begin in September, and the annual progress report will be completed before January 30. Literature review and study plan revisions will be conducted during February. Preparation for field work will continue during March-April. Field work will begin in mid-April. Collection periods will occur in April and late May. Field reconnaissance of Afognak Island will be carried out during June. Brood counts will take place between August 15-September 1. Final report preparation will be between September 1, 1994-January 29, 1995.

BUDGET (\$K)

	ADF&G
Personnel	\$ 89.9
Travel	25.0
Contractual	133.3
Commodities	19.0
Equipment	10.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 277.2
General Administration	<u>22.8</u>
Project Total	\$ 300.0

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93034

Project Title: Pigeon Guillemot Colony Survey

Project Category: Habitat Protection and Acquisition

Project Type: Birds

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to December 31, 1993

INTRODUCTION

A. Background

The pigeon guillemot (*Cepphus columba*), a diving seabird, feeds in nearshore waters and nests in numerous small colonies on rocky shores throughout the eastern North Pacific. The U.S. Fish and Wildlife Service began studies of pigeon guillemots at Naked Island in the center of Prince William Sound (PWS) during the late 1970s when oil tanker traffic began through the Sound. These studies have provided baseline data for evaluating the effects of the spill on guillemots.

An estimated 2,000 to 3,000 guillemots were killed as a direct result of the *Exxon Valdez* oil spill. These birds may have represented as much as 10% of the cataloged pigeon guillemot population in the Gulf of Alaska, and 33% of the 1991 estimated PWS population. Pigeon guillemots are one of six seabird species that showed significantly greater declines in the oiled area of PWS. The PWS summer population has declined from over 15,000 in 1972 to 6,585 in 1991. At Naked Island, guillemot numbers declined more in oiled areas, and a complete colony census in 1992 showed continuing decline. Adults were contaminated internally, and unhatched eggs showed internal and external contamination in 1989 and 1990. On a daily basis throughout the summer, guillemots perch on intertidal and supratidal rocks at nesting colonies, and researchers have hypothesized that guillemots were, and continue to be, contaminated by shoreline oiling.

Knowledge of the distribution of guillemot colonies and of the number of birds breeding at these colonies is very limited. Because guillemots often represent only a small number of the birds nesting at large multispecies colonies, researchers typically only list guillemots as present, and good estimates of their numbers are not often made. In addition, guillemots nest at many locations where the other more abundant seabirds do not breed, thus the majority of guillemot colonies are missed completely.

Within the spill area, censuses specific for pigeon guillemots have been conducted only in very limited areas around Naked Island and Afognak Island (1992 only). Although Bird Study 2 provided a population estimate for PWS guillemots, these surveys were not designed to identify breeding colonies. Information on the location and degree of oiling at guillemot colonies would

identify areas where protection management actions might be appropriate or where additional cleanup could benefit guillemots.

B. Location

This project will be conducted in PWS with efforts focused primarily in the western sound.

WHAT

A. Goal

The goal of this project is to enhance recovery of pigeon guillemot populations injured by the *Exxon Valdez* oil spill. This goal will be accomplished by identifying important breeding areas for possible protection or additional cleanup.

B. Objectives

1. Locate all pigeon guillemot nesting colonies within the EVOS area of PWS, and estimate numbers of birds at each.
2. Survey Naked Island colonies during the first week in June.
3. Locate pigeon guillemot colonies within selected areas outside the spill area as non-oiled controls, and estimate numbers of birds.
4. Secondary objectives
 - a) Determine which colonies or areas are best suited for comparative monitoring of future population productivity.
 - b) Determine which colonies or areas may benefit from restoration efforts, and suggest possible restoration strategies.

WHY

A. Benefit to Injured Resources/Services

This project will benefit injured pigeon guillemot populations by identifying and censusing guillemot colonies throughout the spill area. Important breeding areas must be identified to enable protective measures or land acquisition which will benefit guillemot restoration. Guillemots nest in crevices among supratidal talus, on cliffs, or in the cavities formed by the roots of trees at the forest/cliff edge. Guillemot nest sites are sensitive to logging operations or other shoreline developments, since they utilize forest edges and beach talus. Because guillemots tend to feed near their nest sites, adjacent foraging areas could also be impacted by such activities as logging, tailings from mining operations, intensive commercial fishing, barge or dredging operations, and recreation activities. Thus, foraging areas near large guillemot colonies might be included in a marine sanctuary system or be protected by an extended buffer strip.

Project Descriptions

B. Relationship to Restoration Goals

This project meets the Trustee Council goal of restoring the environment to its pre-spill condition by identifying management actions that will help restore an injured marine bird species.

HOW

A. Methodology

Pigeon guillemot colonies will be located and censused by cruising the shoreline when birds are at their colonies. The optimum time for locating colonies is prior to incubation, in May and early June, at 0400-0800 h or at high-tide. In PWS, three teams of two observers operating from 25-foot boats will find colonies by cruising close to shore during the appropriate hours. About 60 km of shoreline can be covered per boat per day during appropriate hours, so that much of the west side of PWS can be covered in May and early June. Colony locations will be marked on topographic maps and lat/long recorded using the Global Positioning System. Colonies will also be censused. Habitat, nest accessibility and onshore oiling at each colony will be recorded.

B. Coordination with Other Efforts

This project will use existing distribution and abundance data collected by the PWS boat survey project (former Bird Study 2) to determine likely guillemot colony locations. This project will also share personnel and equipment with the proposed 1993 boat survey project (Project 93045), assuming both projects are approved. Data on colony locations will be added to the Catalog of Alaskan Seabird Colonies. The catalog, including updated information such as will be collected by this proposed project, will be used as a data layer for the oil spill area geographic information system being developed under proposed project 93060 (Accelerated Data Acquisition for Habitat Protection/Acquisition).

ENVIRONMENTAL COMPLIANCE

This project relies on non-intrusive methods and appears to qualify for a categorical exemption from the requirements of the National Environmental Policy Act.

WHEN

March - April 1993	Study design and logistical planning
May - June 1993	Colony census
Sept. - Dec. 1993	Data analysis, report

BUDGET (\$K)

	USFWS
Personnel	\$ 88.0
Travel	4.4
Contractual	49.5
Commodities	6.2
Equipment	1.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 149.1
General Administration	<u>16.7</u>
Project Total	\$ 165.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93035

Project Title: Potential Impacts of Oiled Mussel Beds on Higher Organisms: Contamination of Black Oystercatchers Breeding on Persistently Oiled Sites in Prince William Sound

Project Category: Restoration Monitoring/Restoration Manipulation

Project Type: Birds

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to March 15, 1994

INTRODUCTION

A. Background

The Shoreline Assessment Program which has monitored the recovery of beaches impacted by oil from the *Exxon Valdez* spill has documented the existence of persistent oil contamination in dense blue mussel (*Mytilus edulis*) beds at more than 100 sites throughout western Prince William Sound (PWS). The oil has been trapped under the mussels in the byssal mats that anchor the mussels to each other and to the substrate. In this anaerobic environment, the oil has not degraded. Sheening from these beds has been observed, and aromatic compounds are still present.

The black oystercatcher (*Haematopus bachmani*) is a large shorebird that lives on rocky intertidal shores throughout the North Pacific. They nest in the open on rocky points and islets and rely on cryptic egg coloration and distractive behaviors to avoid predation of eggs and chicks. After hatching, adults feed their chicks until the chicks are capable of feeding themselves; the total length of this rearing period is unknown, but may last two or more months. During the early rearing period, the adults and chicks occupy a feeding territory in the vicinity of the nesting site. Black oystercatchers feed on a variety of intertidal mollusks, including mussels which form a significant portion of the diet of both adults and chicks. In PWS, oystercatchers favor gravel shorelines, and mussel beds embedded in sand/gravel beaches are an important foraging habitat. The mussel beds used by oystercatchers in PWS occur in low energy environments where oil persists. Because oystercatcher chicks are fed food items from a restricted area near their natal site, oystercatcher chicks are excellent subjects for monitoring how oil from the *Exxon Valdez* spill is affecting the physiology and reproduction of a higher vertebrate species. Because of their complete dependence on rocky intertidal areas and the importance of mussels in their diet, black oystercatchers can serve as an indicator species for assessing the condition of rocky intertidal habitats and the continuing presence of oil in such habitats.

B. Summary of Injury

Oil from the *Exxon Valdez* contaminated rocky shorelines used by black oystercatchers for feeding and nesting. Based on initial studies in PWS at Green Island, the oiling affected black oystercatchers by reducing the number of breeding pairs and by reducing egg volume. Subsequent studies demonstrated that oystercatcher chicks raised on oiled beaches, despite being delivered a larger biomass of food, grew slower than chicks raised on unoiled beaches. Based on studies with captive birds, ingestion of oil can decrease growth because energy that would otherwise be used for growth is used to fuel the metabolic processes that detoxify oil. The reduced growth rates of chicks raised at sites with persistent oil contamination is still occurring, suggesting continuing injury due to the presence of *Exxon Valdez* oil in rocky intertidal habitats.

C. Location

This study will be conducted in Prince William Sound. Study sites will include Montague Island (unoiled), Green Island (oiled) and Knight Island (oiled).

WHAT

A. Goal

The goal of this study is to determine whether black oystercatchers breeding on shorelines with persistent oil contamination in Prince William Sound are affected by their use of these habitats. This study will determine if there is a link between use of oiled mussel beds by oystercatchers and their reproductive success, as evidenced by chick growth rates and recruitment.

B. Objectives

1. To determine if the continued persistence of hydrocarbons in mussel beds is being transferred to chicks via the food chain and is responsible for depressed growth rates.
2. To assess the recruitment of oystercatchers into the breeding population and the survival of sub-adult birds that were raised in oiled territories.

WHY

A. Benefit to Injured Resources

This study will be beneficial to the restoration of black oystercatchers because the study will determine whether continuing injury or recovery is occurring at oiled sites. If recovery is not occurring, the study is designed to reveal whether a cause of the continuing injury to oystercatchers is use of oiled mussel beds for feeding. This study will identify specific mussel beds and their characteristics which result in the continuing injury to oystercatchers. These data could be used to identify sites needing additional treatment. Treatment of such sites will eventually benefit oystercatchers by returning their foraging areas to a normal condition.

Project Descriptions

B. Relationship to Restoration Goals

This study meets two Trustee Council restoration goals: restoration monitoring and restoration manipulation. This study will determine whether black oystercatchers are continuing to be adversely affected by persistent oil contamination. This information is necessary to plan meaningful restoration actions. This study will also identify areas with persistent contamination and document the effects of that contamination on a higher trophic level organism. These data could be used by the Trustee Council to identify specific areas needing additional treatment so that the contamination can be eliminated.

HOW

A. Methodology

Study methodology will follow previous study plans. From June to late August, study personnel will operate from field camps at Herring Bay, Knight Island, Montague Island, and Green Island. Chicks raised on Montague Island will serve as unoiled controls.

Chicks will be banded with individually-recognizable color bands when ≥ 7 days old and will be reweighed twice before fledging. At ≥ 25 days, blood samples will be collected from chicks. Fecal samples from chicks will be collected and analyzed to determine the presence of hydrocarbons ($n = 50$).

Recruitment of young into the breeding population and overwinter survivorship will be determined by relocation of color-banded birds marked in previous years by this study ($n = 140 +$).

Samples of mussels from mussel beds used by black oystercatchers for feeding will be collected for hydrocarbon analysis by the NOAA oiled mussel bed project.

B. Coordination with Other Efforts

This study continues damage assessment and restoration projects on black oystercatchers in 1989, 1991 and 1992. As in 1992, the study will coordinate with the proposed NOAA oiled mussel bed study to ensure that oiled mussel beds used by oystercatchers are included in the NOAA sampling program. This study will also coordinate with the proposed harlequin duck study.

ENVIRONMENTAL COMPLIANCE

This study is a non-intrusive study primarily involving observations and infrequent handling of live birds. No birds will be collected. Samples of oystercatcher fecal material and food items will be collected for analysis of hydrocarbon content. This study appears to qualify for a categorical exemption from the requirements of the National Environmental Policy Act.

WHEN

March - May 1993	Logistical planning
May 20 - Aug. 10, 1993	Field data collection
Aug 11 - Oct. 31, 1993	Data entry, analysis; fecal sample analysis
Nov 1 - Dec. 31, 1993	Draft report written and internal review
January 1994	Draft report submitted for peer review
April 1, 1994	Final report

BUDGET (\$K)

	USFWS
Personnel	\$ 38.0
Travel	4.0
Contractual	48.0
Commodities	6.0
Equipment	3.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 99.0
General Administration	<u>8.9</u>
Project Total	\$ 107.9

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93036

Project Title: Recovery Monitoring and Restoration of Intertidal Oiled Mussel Beds in Prince William Sound and the Gulf of Alaska Impacted by the *Exxon Valdez* oil spill

Project Category: Restoration Monitoring and Restoration Manipulation

Project Type: Coastal Habitat

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: National Park Service; U. S. Fish & Wildlife Service; Alaska Department of Fish and Game; and Alaska Department of Environmental Conservation

Project Term: January 1, 1993 to December 31, 1997

INTRODUCTION

A. Background

The persistence of *Exxon Valdez* crude oil underlying some densely packed mussel (*Mytilus trossulus*) beds in Prince William Sound, Alaska, began to cause concern, 1991, among scientists from State and Federal agencies. With the encouragement of the Restoration Team and the Trustee Council, staff from several agencies conducted a field survey and sampled mussels and underlying sediments from several sites in June of 1991. Subsequent sampling trips were conducted by NOAA in August and September of that year and several times to date in 1992.

Preliminary analytical data indicate total aromatic hydrocarbon concentrations as high as 470 ppm dry weight in sediments and 5.5 ppm dry weight in mussels. Natural recovery of oiled mussel beds appears to be minimal.

B. Summary of Injury

High concentrations of oil in mussels from oiled mussel beds may provide a source of continued exposure to petroleum hydrocarbons through ingestion by higher consumers. There may be possible linkage to 2 species of birds - harlequin ducks and black oystercatchers; and possibly river and sea otters. The presence of these contaminated beds is also of concern for human subsistence.

C. Location

Identified and verified oiled, densely packed mussel beds are located throughout the western and southwestern part of Prince William Sound. The National Park Service has also surveyed and sampled mussels and sediments from oiled sites along the Kenai Peninsula and proposes to continue the monitoring in 1993. NPS expects to extend the geographic area of site survey to

the Kodiak area.

WHAT

A. Goal

The overall purpose of this project is to document continued bioavailability of petroleum hydrocarbons to consumers of contaminated mussels, and determine the rate of recovery of oiled mussel beds with and without manipulation. Restoration/recovery methodology will be tested to accelerate cleansing of oiled mussel beds.

B. Objectives

- 1.a. To measure recovery of petroleum hydrocarbon concentrations to background levels in mussel bed sites manipulated in 1992. This involves three sites treated by NOAA and two sites manipulated by ADEC in 1992; and additional sites if cleaning mussel beds is initiated by ADEC in 1993 under Project 93038. [NOAA]
- b. To test the feasibility of new, minimally intrusive manipulative techniques at 3 oiled mussel bed sites within Prince William Sound; and to conduct restorative manipulations at selected sites in the Gulf of Alaska. [NOAA, NPS]
2. To measure natural recovery in levels of petroleum hydrocarbons in mussels and underlying sediments and oiled mussel beds identified and sampled in 1991 and 1992 and to sample mussel beds in areas newly identified by other agency field investigators. [NOAA, NPS]
3. To measure the physiological and reproductive injury of mussels, with and without treatment. [NOAA]

WHY

A. Benefit to Injured Resources/Services

This project will provide data on the efficacy of natural recovery processes and the efficacy of on-site cleaning or manipulation to hasten return to background levels.

Documentation of the level of hydrocarbons in oiled mussel beds or recovery of oiled mussel beds is necessary to evaluate continued linkage to injury seen in consuming species - harlequin ducks, black oystercatchers, river and sea otters; and, will provide necessary information for human subsistence purposes.

B. Relationship to Restoration Goals

If petroleum hydrocarbon concentrations remain high in these beds in 1993; further action may be necessary to minimize or eliminate these mussels as a pathway of oil being incorporated into the food chain of consuming mammals and birds. Recovery monitoring is necessary to insure that

Project Descriptions

petroleum hydrocarbon levels in sediments and mussels have returned to background levels and are no longer a source of contaminated prey.

HOW

A. Methodology

Sampling of mussels and sediments for petroleum hydrocarbons will follow protocol established by NOAA and the NRDA process. NOAA's Auke Bay Lab has successfully established a fast screening method (UV Fluorescence) for sediment hydrocarbons. Using this technique, we have documented that hydrocarbon distribution within a heavily oiled mussel bed appears to be patchy and probably related to grain size of the sediment. Rapid turn around of hydrocarbon data allows targeting manipulative areas in a timely manner. Most sediment samples will be analyzed using this method and only selected sediment samples (mostly for method verification) and mussel samples (based on UV levels found at particular sites) will be analyzed by gas chromatography/mass spectroscopy.

Samples for histopathological analyses have been collected several times at manipulated and control sites in 1992 and we propose to process them and have them examined for anomalies, particularly precancerous conditions associated with long-term exposure to petroleum hydrocarbons. Data for condition and reproductive indices for mussels from selected sites will be calculated using accepted standard methods.

Byssal thread extrusion rates were measured in May 1992 and again in June 1992 in mussels from selected sites and data from these trials are currently being analyzed. Depending on results, we may again repeat this test in May 1993. Thread extrusion rates can be a sensitive indication of overall physiological health. These tests incorporate hydrocarbon depuration while mussels are exposed to clean seawater.

Maps will be produced showing within site variation of petroleum hydrocarbon concentrations at manipulated sites. These will show a time series to illustrate changes in concentrations at 30 days, 90 days and 1 year. Standard statistical analytical methods will be used on data and will be tested at the $P = .05$ level. Guidance here will come from that given by the NRDA peer reviewers.

B. Coordination with Other Efforts

Close coordination with principal investigators of species affected by ingestion of oiled mussels will be maintained to identify new areas of continued contamination.

ENVIRONMENTAL COMPLIANCE

This is a field research project in which routine data collection will take place which is limited in context and intensity. Consequently, this project is categorically excluded from being required to provide an Environmental Impact Statement or Environmental Assessment.

WHEN

Analytical Analyses: GC/MS analyses will be conducted at the completion of all NRDA samples still in the analytical queue. Selected mussel and sediment analysis are scheduled to begin in December 1992 and expected to continue on an as needed basis through 1993. UV fluorescence screening will be done on an as needed basis. This technique produces data within 10 days. We estimate processing around 500 samples by this method in 1993.

Biological and physiological measurements and data from 1992 will be analyzed during Jan-Mar 1993.

Field work on manipulated sites is scheduled to occur during May with follow up evaluation at 30 days and at the end of the field season. Resampling of oiled mussel sites already identified and any new sites proposed by other agency field personnel will be sampled at a suitable low tide series - probably in late June. Some of this site sampling may be coordinated with the other trips.

BUDGET (\$K)

	NOAA	USNPS	ADEC	TOTAL
Personnel	\$ 126.0	\$ 31.5	\$ 0.0	\$ 157.5
Travel	23.0	6.0	0.0	29.0
Contractual	70.0	45.0	0.0	115.0
Commodities	26.0	7.6	0.0	33.6
Equipment	34.0	4.0	0.0	38.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>4.0</u>
Sub-total	\$ 279.0	\$ 94.1	\$ 0.0	\$ 373.1
General Administration	<u>23.8</u>	<u>7.9</u>	<u>0.0</u>	<u>31.7</u>
Project Total	\$ 302.8	\$ 102.0	\$ 0.0	\$ 404.8

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93038

Project Title: Shoreline Assessment

Project Category: Restoration Monitoring

Project Type: Coastal Habitat

Lead Agency: Alaska Department of Environmental Conservation

Cooperating Agencies: Trustee Agencies

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

Shorelines treated during spill response activities need to be monitored to ensure recovery is proceeding at an acceptable rate and that winter storms have not brought subsurface oil to the surface. Shorelines treated in 1992 and other potentially oiled sites need to be evaluated to determine if the shorelines responded to treatment, or if additional treatment is required to restore resources and services. Technical experts with *Exxon Valdez* spill experience from the State and Federal agencies along with the local communities will evaluate impacted shorelines for the presence of *Exxon Valdez* hydrocarbons. The evaluation will document the amount of remaining hydrocarbons and determine if the remaining oil impacts shoreline activities.

This project is divided into two phases. Phase 1 is the physical survey of selected shorelines. This project will use the assessment procedures developed and refined during the *Exxon Valdez* spill clean up. Agency surveyors and upland landowners will evaluate shorelines and determine if additional activities would be of net benefit to restore resources and services. Phase 2 is the restoration of land and resource uses, if necessary. Light duty restoration activities would be performed during and after the survey by the surveyors where feasible. Larger scale treatment work, if necessary, would be identified on work orders and restoration crews from Chenega, Port Graham or other areas would be hired to perform the identified work.

This project will assess *Exxon Valdez* impacted shorelines in Prince William Sound and the Gulf of Alaska. The principal areas are Knight, Latouche, Evans, Elrington, Green, and Disk Islands in Prince William Sound and Tonsina Bay, Windy Bay, and Chugach Bay in the Gulf of Alaska. These areas are in proximity to Chenega Village, Whittier, Port Graham, Seward and Homer.

WHAT

The overall purpose of the project is to ensure that shorelines have recovered sufficiently to facilitate normal shoreline activities. The project objectives are to assess the shoreline hydrocarbon concentrations and, where appropriate, to carry out necessary treatment either during the survey or following the survey using local work crews to perform the identified work.

The shoreline assessment will utilize the process developed and refined since the 1989 spill:

1. Survey shorelines for the presence of *Exxon Valdez* hydrocarbons.
2. Determine if resource uses are affected by hydrocarbons.
3. Perform light duty manual treatment to restore resource use if necessary and feasible.
4. Write work orders for local crews to treat the shoreline if necessary.
5. Document field activities.

WHY

This project will assess shorelines and determine if resources and services are still impacted and the need for additional treatment, if any. The public, land owners, and resource managers need to have current and accurate field information for operation and management. If resources are impacted and need to be restored, technical experts need to survey the sites and determine the best course of action to correct the problem and not cause further damage. Impacts on resources will be corrected and resource use will be restored. Public complaints about the presence of hydrocarbons can be assessed and addressed through the framework of this project.

Information collected by this project will assist Trustee Council review of other projects submitted for funding. This project will provide current, accurate information about shoreline conditions that will help with funding decisions for other activities. Accurate field information will be used by Restoration Team members to identify areas with persistent hydrocarbon concentrations that may slow restoration activities.

HOW

The Alaska Department of Environmental Conservation, in conjunction with the other Trustee Agencies and in consultation with the U. S. Coast Guard, will review the 1992 shoreline survey information and produce a list of subdivisions to be surveyed in 1993. This list will then be circulated to subsistence users by Project 93017 (Subsistence) and to land owners and resource managers to identify additional sites to be included on the 1993 survey. Agency personnel will review the proposed survey list and ensure that oiling conditions at each segment warrant an assessment. The survey list will be prioritized based on resources affected and projected oil concentrations. For planning purposes, we have assumed that 80 sites or less will be recommended for survey. After a final list is developed, the survey list will be sent to land and resource agencies for their approval and clearance to assess the sites.

Phase 1 is the physical survey of the shorelines. Agency technical experts and the upland owners will assess the shoreline segments and document oiling conditions. The survey team will be berthed on a vessel and use skiffs to access the shoreline. Float planes will provide logistics support. Previous *Exxon Valdez* surveys have used these logistics as the most cost effective and time efficient support structure. Agency representatives will be chosen for their environmental and habitat experience. Each person will have extensive *Exxon Valdez* spill experience. Surveys

Project Descriptions

will be conducted daily during both low tide windows with appropriate weather and light conditions. Field information will be recorded on forms previously generated during *Exxon Valdez* surveys to facilitate comparison and familiarity of the existing databases.

Phase 2 is the restoration of resources and services, if necessary. Agency personnel with input from the landowner will determine if treatment is necessary based on established State and Federal standards. Such a determination would include consideration of the resources impacted by the oil, the area and concentration of remaining oil, the cost effectiveness and technical feasibility to treat the oil, the services such as subsistence provided by the shoreline segment, and a reasonable expectation that the treatment will not cause more damage than allowing the oil to remain in place. Such a determination would be made by the Agencies in consultation with the Chief Scientist. The State On-Scene Coordinator will resolve disagreements between Agencies. Any light duty restoration work that is determined to be necessary would be completed during and after the survey by the surveyors which have proven to be the most cost effective method of treatment. Additional restoration treatment would be identified with work orders and the treatment will be performed using local work crews. Necessary treatment would usually consist of hand labor using shovels, rakes, and bags. A determination of appropriate restoration activities, if any, to be done in oiled mussel beds would be based upon results from the 1992 mussel bed study (R-103), the 1993 spring survey of project 93036 (Monitoring of Oiled Mussel Beds), and other completed and ongoing damage assessment and restoration studies. Any treatment work done in oiled mussel beds will be conducted in conjunction with Project 93036 to ensure appropriate treatment methods are used and to monitor the effectiveness of treatment.

The need for shoreline treatment work, if any, in 1993 cannot be determined until the 1993 shoreline assessment is completed and the results of several damage assessment and restoration studies become available this winter and next spring. Because of the necessity of preplanning logistics support, we will assume limited treatment work will be necessary. If treatment is found not to be necessary, the logistics support will not be used, and the money will be returned to the Trustee Council for use in other restoration activities. If treatment is found to be necessary at a level greater than initially authorized, we will request additional funds from the Trustee Council to expand the effort.

Surveyors and work crews will be required to attend Hazwoper training.

Wastes generated during restoration activities will require treatment at approved facilities.

ENVIRONMENTAL COMPLIANCE

As in prior years, permits and notifications will be required by several permitting agencies. All permits will be obtained prior to commencement of field work.

WHEN

The duration of this project will be determined by yearly surveys of contaminated sites. The project will be recommended for termination as soon as conditions warrant. Funds expended in 1993 will be proportional to the amount of restoration work necessary. Unexpended funds will be returned for use on other projects in later years. If work is necessary in future years,

milestones would be similar for each year. Costs would vary in future years due to the size of the survey and type of restoration activities.

Dates	Project Activity
Jan. 15 - Feb. 15, 1993	Solicit input from landowners and resource agencies on sites to be surveyed.
March 1, 1993	Produce final list of survey sites for Trustees.
March 7, 1993	Submit request for bids for vessel and float plane.
March 30, 1993	Receive approvals from land and resource agencies to access shoreline for survey and restoration activities.
April 15, 1993	Secure contracts for vessel and float plane.
May 15, 1993	Surveyors, landowner representatives, and work crews receive Hazwoper training.
Jun. 1 - Jul. 15, 1993	Perform survey.
August 15, 1993	Complete restoration activities, if any.
September 30, 1993	Complete report and documentation.

BUDGET (\$K)

	ADEC	ADF&G	ADNR	USFS	USDOJ	NOAA	TOTAL
Personnel	\$ 147.1	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	\$ 197.1
Travel	6.0	0.0	0.0	0.0	0.0	15.0*	21.0
Contractual	252.1	0.0	0.0	0.0	0.0	0.0	252.1
Commodities	16.5	0.0	0.0	0.0	0.0	0.0	16.5
Equipment	5.0	0.0	0.0	0.0	0.0	0.0	5.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 426.7	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	25.0	\$ 491.7
General Administration	<u>36.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>44.0</u>
Project Total	\$ 463.2	\$ 11.5	\$ 11.5	\$ 11.5	\$ 11.5	\$ 26.5	\$ 535.7

* For U.S. Coast Guard participation.

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93039

Project Title: Herring Bay Experimental and Monitoring Studies

Project Category: Restoration Manipulation and Enhancement, and Restoration Monitoring

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 1996

INTRODUCTION

Marine intertidal communities were the largest single category of habitat affected by the *Exxon Valdez* oil spill. Experiments conducted at Herring Bay, Knight Island, and throughout the EVOS impact area since 1990 clearly indicate that one of the consequences of the oil spill and resultant clean-up activities was injury to intertidal algal and invertebrate populations, especially in the mid- to upper-intertidal zones. The dominant organism in this community is the seaweed *Fucus gardneri* which provides habitat and food for a variety of invertebrates. These invertebrates in turn serve as an important food source for marine mammals, birds, and fishes. This project is designed to examine the impact of oil on relationships between and among intertidal invertebrates and plants, to investigate means of restoring *Fucus* populations and to provide detailed monitoring of the recovery of intertidal communities over the long term.

A. Summary of Injury

Studies to date indicate that plants and animals living in the upper portion of the intertidal zone suffered extensive injury. In fact, data from 1991 show that some species were still declining in abundance. The upper intertidal is where oil was deposited on rocks and sediments during ebbing tides and where clean-up activities were focused. The dominant alga, *Fucus gardneri*, was greatly reduced in many of these areas, and experiments indicate that several years will be required for its recovery in the lower- and mid-intertidal zones. Recovery of this species in the upper intertidal will require an even longer period. Oil inhibits recruitment of *Fucus* and other algae, and *Fucus* does not recruit successfully onto the cleaned, bare rock surfaces. Grazers such as limpets were also reduced by the spill/cleanup and have been unable to recover, due to lack of food and shelter normally provided by the algae. Barnacles have recruited on oiled surfaces, even tar, but our studies show poor subsequent survival. Our data show some recovery in the mid- to lower-intertidal zone, but recruitment is not consistent between locations and years. Recruitment variability appears to have a greater impact on intertidal community structure in Alaska than at lower latitudes.

B. Location

The proposed restoration, monitoring, and experimental studies will be conducted in Herring Bay, Knight Island. Intertidal studies were initiated in Herring Bay in May 1990 and have continued through the 1992 season. Herring Bay was heavily oiled in 1989, and was a central area for clean-up efforts. The Bay was chosen for experimental studies because of its oiling history and proximity to non-oiled sites used as controls.

WHAT

A. Goals

1. To understand what factors limit and/or facilitate recolonization of the intertidal by algae, especially *Fucus*, and invertebrates such as barnacles, mussels, and limpets.
2. To provide controlled, long-term natural recovery monitoring of inter-tidal communities such that natural variability can be differentiated from oil/clean-up effects.

B. Objectives

1. Quantify recruitment rates, survivorship, and population dynamics of barnacles and other sessile invertebrate species on oiled, oiled and cleaned, and non-oiled substrates and at matched oiled and non-oiled sites.
2. Determine the recovery rate of important community members dependent upon other species reduced or eliminated by the spill, i.e., second-order impacts. And determine the recovery rates of species with poor dispersal capabilities, e.g., the predators *Nucella* and *Leptasterias*.
3. Quantify the population structure and population dynamics of *Fucus* in oiled, oiled-cleaned, and control sites to monitor and to project recovery rates, especially in the upper intertidal zone areas denuded by the oil spill/clean-up activities.
4. Develop techniques for restoring *Fucus* by reducing heat and desiccation stress with a biodegradable substratum.

WHY

A major goal of restoration is to ensure that "injured resources have been restored to their pre-spill baseline conditions." Many plant and animal species were damaged directly by the fresh crude oil of the EVOS and/or the subsequent clean-up activities. Previous work in Herring Bay has shown that some populations continued to decrease in 1991 (1992 data not in yet), suggesting continuing expression of the original impact or additional damage due to residual oil. Experimental studies on the impact of the oil spill on intertidal community structure and recovery dynamics have been conducted in Herring Bay since 1990 and should be continued. A long-term monitoring commitment within Prince William Sound will provide several benefits, including (a) an

Project Descriptions

understanding of the year-to-year variables that affect intertidal community structure, (b) an understanding of long-term consequences of an oil spill, and (c) establishing baseline data and an understanding of complex community structuring mechanisms at monitoring locations strategically located within Prince William Sound, should there be a future perturbation.

HOW

Population dynamics of *Fucus*, sessile invertebrates, and grazers (limpets) will continue to be quantified in established quadrats at oiled and unoled sites. Recruitment of algae and invertebrates on tarred, cleaned, and control substrata will be determined, with and without grazing. The impact of grazing on algal recruitment and the role of algae in providing food or shelter on survival or recruitment of other species will be examined in enclosures and exclosures.

Growth rates of tagged *Fucus* plants will be determined. Studies will be continued on *Fucus* egg dispersal, survival, and recruitment at oiled and unoled sites. Experiments will be conducted on the effects of substrata heterogeneity, herbivory, shading by *Fucus* canopy, and tide level on settlement and recruitment of *Fucus* embryos.

Data from the Damage Assessment studies in Herring Bay have shown that the recovery of damaged *Fucus* populations in rocky habitats on steep south-facing beaches has been very slow. The extent of this type of damage throughout PWS will be estimated using data contained in the Department of Natural Resources Oil Spill GIS database. New data on beach aspect and beach slope in PWS will be generated under a technical services contract to DNR. The GIS model to estimate the areal extent of damage will be developed by Coastal Resources Associates. Field verification of the model and data quality assurance will be conducted in Herring Bay and in nearby sheltered rocky intertidal habitats.

For the *Fucus* restoration study, we will use biodegradable erosion-control fabric that has been seeded with *Fucus* embryos. A series of tests will be conducted to determine the optimum fabric type, of the several varieties available, to maintain sufficient moisture for embryo survival, yet provide enough open space for light for the growth of juvenile plants. We will eliminate the potential problem of lack of natural settlement by seeding the fabric with *Fucus* embryos for adding fertile adult plants. Unseeded strips will be used to test whether embryo seeding is necessary. The cost effectiveness of this procedure for large-scale restoration will be assessed.

ENVIRONMENTAL COMPLIANCE

We anticipate that this project will be categorically excluded.

WHEN

Each year of the study, the field season will commence on a low-tide series in late April. Approximately two weeks will be required to record winter results and initialize experiments for the season. Three subsequent 10-day visits will be made to Herring Bay during the summer low tides. Our objectives will be to collect quantitative data from the experiments and to monitor our restoration efforts. Reports will be prepared by March 1 of each year.

BUDGET (\$K)

	ADF&G
Personnel	\$ 7.5
Travel	0.0
Contractual	441.7
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 449.2
General	<u>21.3</u>
Administration	
Project Total	\$ 470.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93041

Project Title: Comprehensive Restoration Monitoring Program Phase 2: Monitoring Plan Development

Project Category: Restoration Monitoring

Project Type: Monitoring

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: Alaska Department of Fish and Game; Alaska Department of Environmental Conservation; Alaska Department of Natural Resources; U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Fish and Wildlife Service; U.S. Department of Interior, National Park Service

Project Term: January 1, 1993 to September 30, 1993

INTRODUCTION

A. Background

Resources to be monitored include affected floral and faunal assemblages as well as impacted substrates upon which they depend. Services arising from injured natural resources will also be monitored inclusive of, but not limited to, recreation, subsistence, and wilderness and intrinsic values. Finally, injured archaeological resources will be monitored.

B. Summary of Injury

The *Exxon Valdez* oil spill occurred just prior to the most biologically active season of the year. During the four-month period following the spill, critical life stages of algae, invertebrates, fish, birds, and mammals encountered the most concentrated, volatile, and potentially toxic forms of the spilled oil. While different species demonstrated varying levels of injury, sea otters and marine birds (common and thick-billed murres, sea ducks) were particularly hard-hit. Portions of 1200 miles of coastline were oiled resulting in impacts to intertidal and shallow subtidal resources. Oil reached shorelines nearly 800 miles from Bligh Reef, the site of the spill. Of continuing concern, resources are exposed to oil remaining in the intertidal zone or transported to the subtidal zone. Following the spill, recreational use of public lands and waters declined and archaeological resources along the shoreline also were injured. For a more detailed account of injuries to individual species, habitats and services, see Chapter IV of the *Exxon Valdez Oil Spill Restoration Volume 1: Restoration Framework*.

C. Location

Monitoring will be conducted on and in surface waters, on tidelands, and on adjacent uplands

including their watersheds in Prince William Sound and the Gulf of Alaska.

WHAT

A. Goal

This project will establish the design of the monitoring component of the Restoration Plan. The goal is to develop a comprehensive and integrated restoration monitoring program that will follow the progress of natural recovery, evaluate the effectiveness of restoration activities, and establish an ecological baseline from which future disturbances can be evaluated.

Implementation of this multifaceted program requires central coordination and management. To successfully implement an ambitious and wide-ranging program as contemplated, a high degree of organization is needed to create the design, to analyze, interpret and disseminate the data generated, and to assure that all aspects of the program are carried out as designed.

B. Objectives

This program will assist the Trustees in various organizational and coordination activities in support of developing a comprehensive, interdisciplinary and integrated program of restoration monitoring aimed at:

1. assessing the rate of natural (unassisted) recovery of injured resources and services;
2. evaluating the effectiveness of restoration activities, identifying where additional restoration activities may be appropriate, and determining when injury is delayed, and;
3. following the dynamics of other ecological components (those important in the food webs of injured species) to document long-term trends in the environmental health of the affected ecosystem.

To fulfill these objectives, a three-phase program is planned. Phase 1 is being conducted in early FY93 and focuses on the development of a "conceptual" plan for monitoring¹. Phase 2, which is the focus of this proposal, will be conducted over essentially the second-half of FY93 and deals with developing the technical plans for monitoring. Phase 3 provides for management of the monitoring program following full implementation (FY94 thru FY2203).

WHY

Monitoring is necessary to assess the adequacy of natural recovery. Resources and associated services that are found to be recovering at an unacceptable rate may have to be reconsidered as candidates for restoration action. Likewise, resources and services that are found to be

¹ Environmental Protection Agency pass-through money in 1991.

Project Descriptions

recovering faster than anticipated may allow for an earlier completion of a restoration endpoint. Monitoring of important physical, chemical and biological properties will establish an environmental baseline for the affected ecosystem. This baseline then can be used to assess the anticipated effects of human activities and to improve our ability to manage affected resources and services over the long-term.

HOW

Phase 1:

In Phase 1, which is being conducted this year (1 September 1992 thru 31 January 1993), a consultant will be asked to assist the Trustees in developing a "conceptual" design for the required monitoring plan. This will provide for more technical planning in Phase 2, which is the focus of this proposal. The conceptual planning in Phase 1 will address but will not be limited to such issues as goals and objectives, what resources and services to monitor, what process is required for management, what relationships need be established with other monitoring programs in the spill zone, and how can monitoring be funded over the long-term. Phase 1 planning also addresses the need to identify which current cleanup, damage assessment and restoration science studies would best serve the purpose of the intended restoration monitoring program.

Phase 2:

In Phase 2 (1 January 93 thru 30 September 93), a consultant will again be asked to assist the Trustees. With an approved "conceptual" plan, the consultant will develop a "detailed" monitoring plan that will be presented as a "strawman" plan for review by technical experts at a workshop. This phase focuses on the technical requirements of an integrated monitoring plan and assumes a close working relationship with the Trustee agencies and contracted peer reviewers. It is further assumed that the Trustee agencies will implement monitoring once this phase of planning is completed and a Final Restoration Monitoring Plan is approved. Phase 2 will establish:

1. what the bounds (magnitude) of the monitoring effort will be;
2. the locations (fixed and rotating) where monitoring should be conducted;
3. a technical design for each monitoring component (e.g., sediments, invertebrates, fish, birds, mammals, and services [recreation, subsistence, aesthetics, etc.]) that specifies how and when data will be collected, analyzed, interpreted, and reported;
4. a data management system to support the needs of the Trustees and other decision makers, planners, researchers and the public. This assumes a system that facilitates a variety of retrieval and analysis functions and is flexible and expandable to meet new and changing needs;
5. a rigorous quality assurance program to ensure that monitoring data produces defensible answers to management questions and will be accepted by scientific researchers and the public;

6. cost estimates for each monitoring component;
7. coordination of this monitoring plan with other monitoring programs that may exist or be proposed; and
8. a strategy for review and update to ensure that the most appropriate and cost-effective monitoring methods are applied.

A workshop approach will be used to establish a model for specific technical requirements. The consultant will then work directly with representatives of the Trustee agencies and peer reviewers to produce definitive monitoring protocols. After completion of a Draft Restoration Monitoring Plan, a program of peer review will be organized and implemented. Subsequently, the draft plan will be issued for public review and comment.

It is proposed in Phase 2 that NOAA/NMFS will assist the Trustees in various organizational and coordination activities pursuant to developing the Draft Final Restoration Monitoring Plan. NOAA/NMFS will design and prepare the RFP to solicit services of a consultant to provide technical expertise. NOAA/NMFS also will design procedures for evaluating the resulting technical proposals and chair a proposal review committee to select a consultant. NOAA/NMFS with the assistance of the consultant also will design and implement a workshop to develop a framework for detailed monitoring protocols, a data management system, a QA/QC program, costs, and a review strategy, etc.

The Trustee agencies will be expected to attend the workshop and to work with NOAA/NMFS and the consultant to provide detailed input to the comprehensive monitoring plan.

Phase 3:

Following development of the Restoration Monitoring Plan, 1994 and beyond will be devoted to Phase 3 - monitoring and management, including audits, annual reviews, data management, and reports.

ENVIRONMENTAL COMPLIANCE

This activity should fall under a categorical exclusion within NEPA because this proposed project is essentially a planning exercise. This does not, however, obviate the responsibility for each Trustee agency to conduct additional NEPA reviews as various components of the comprehensive and integrated monitoring plan are implemented in Phase 3.

WHEN

Phase 1 planning begins 1 September 1992 and will essentially be complete 1 February 1993. Phase 2 planning which is the focus of this proposal will begin 1 February 1993 and essentially be complete 30 September 1993. Phase 3, a fully expanded and integrated monitoring program, will be implemented in the 1994 field season and will continue for the life of the Restoration Monitoring Program (FY95 thru FY2004).

Project Descriptions

BUDGET (\$K)

	NOAA	FY11
Personnel	\$ 79.0	
Travel	15.0	
Contractual	100.0	
Commodities	15.0	
Equipment	10.0	
Capital Outlay	<u>0.0</u>	
Sub-total	\$ 219.0	
General Administration	<u>18.9</u>	
Project Total	\$ 237.9	

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93042

Project Title: Recovery Monitoring of Prince William Sound Killer Whales Injured by the *Exxon Valdez* Oil Spill Using Photo-Identification Techniques

Project Category: Restoration Monitoring

Project Type: Marine Mammals

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: None

Project Term: July 1, 1993 to September 30, 2002

INTRODUCTION

A. Background

The killer whale, *Orcinus orca*, occurs in all oceans of the world. Population estimates, based on photo-identification studies, are available for 4 North Pacific regions (inland waterways of Washington, British Columbia, southeast Alaska, and Prince William Sound). Current killer whale population estimates for Prince William Sound are 11 resident pods (representing 245 whales) and eight transient pods (representing 52 whales). Of these killer whale pods, AB pod is the most often encountered pod in Prince William Sound. The resident killer whale pods of Prince William Sound are a valued wildlife resource contributing substantially to the wilderness, aesthetic, tourism, and recreational values of the region.

B. Summary of Injury

The whales of Prince William Sound were studied intensively before the spill, and their social structure and population dynamics are well known. Damage assessment studies of killer whales involved boat-based photo-identification surveys in Prince William Sound. Photographs of killer whales were compared to the Alaska killer whale photographic database for the years 1977 to 1989 to determine the changes in whale abundance, seasonal distribution, pod integrity, mortality and natality rates.

One of the Prince William Sound pods, AB pod, had 36 whales when last sighted before the spill in September 1988. When sighted on March 31, 1989, seven days after the spill, seven individuals were missing. Six additional whales were missing from AB pod in 1990. Assuming that whales missing for two consecutive years are dead, the mortality rates for the AB pod were 19.4 percent in 1988-1989 and 20.7 percent in 1990-1991. The average annual mortality in AB pod in 1984 to 1988 was 6.1 percent. An additional whale was missing in 1991, but a calf was also born into the pod. The approximate calving interval of killer whales is four years, so some long-term effects may not be obvious for many years.

Several of the missing whales from AB pod were females which left behind juveniles; such abandonment of juveniles is unprecedented in killer whales. As a consequence, the social structure of AB pod has changed and significant mixing of maternal subgroups has been documented.

Killer whales, which may have died as a result of the oil spill, probably would have sunk and not been found by researchers. So, it has not been possible to directly link the missing whales of AB pod with the *Exxon Valdez* oil spill.

WHAT

A. Goal

The purpose of this study is to obtain photographs of individual killer whales occurring in AB pod and to document natural recovery. Photographs collected will be compared to the National Marine Mammal Laboratory's photographic database for the years 1989 to 1991 to determine if changes continue to occur in whale abundance, pod integrity, mortality and natality rates.

B. Objectives

1. Count the number and individually identify killer whales within AB pod.
2. Test the hypothesis that pre- and post-spill killer whale pod structure and integrity within AB pod have remained constant.
3. Determine killer whale reproductive rates and trends in abundance for AB pod within Prince William Sound.

WHY

Researchers have documented a decline in Prince William Sound's AB pod in 1989 and again in 1990. The AB pod has been the predominant resident pod of killer whales in Prince William Sound. It is important to pursue studying AB pod despite the difficulty of proving the link of injury to the *Exxon Valdez* oil spill because of its high intrinsic value as a wildlife resource of the Sound. Continued monitoring of the status of AB pod in Prince William Sound through photo-identification studies is required to document natural recovery of the injured population. The information gained from this work may lead to initiating additional actions to protect killer whales by protecting sensitive habitats, minimizing fishery interactions, reducing or redirecting other human-use impacts, and promoting public education.

Because killer whale recovery rates are essentially unknown (it may take 25-30 years or more), there is a clear need to continue monitoring population trends for killer whales in the spill area. Since the historical database was found inadequate to reliably predict killer whale movements or habitat requirements to support decisions to implement restoration options (habitat protection), additional habitat-use investigations (beyond satellite tagging) may be necessary in the future.

Project Descriptions

HOW

1. Personnel from the National Marine Mammal Laboratory (NMML) will develop and coordinate all killer whale research activities with this monitoring study. NMML has had extensive involvement in all phases of this research since 1989 and will provide the needed scientific continuity required for this research. Field studies will be conducted by NOAA and contract personnel who have recognized expertise in the study areas of concern. A shore-based camp (equipped with a suitable small boat for whale identification work) will be used in Prince William Sound to conduct photo-identification studies on killer whales from July to September 1993. Study areas will be similar to those worked when assessing injury to killer whales from 1989 through 1991. The camp would be fully self-contained with necessary items for safety and staffed by at least two biologists. For consistency in data collection, key personnel remain in the field throughout the study period.

Weather permitting, field personnel will spend an average of 8 to 10 hours per day conducting boat surveys searching for AB pod. When encountered, other pods of killer whales should be photographed as well. Specific areas, known for whale concentrations, are investigated first. However, if reports of whales are received from other sources, those areas are examined. If AB pod is not located in "known" areas and opportunistic sighting reports are not available; a general search pattern is developed and implemented. Travel routes typically taken by AB pod will be surveyed. When whales are sighted, researchers stop further search efforts and approach the whales to collect photo-identification information. When whales are encountered, researchers select a vessel course and speed to approximate the animals' course and speed to facilitate optimal photographic positioning.

2. Association patterns of individual whales/maternal subgroups will be examined to evaluate the current social structure of AB pod. Whale association patterns will be compared to the three-year database available at NMML (1989-1991) to determine if changes have occurred in AB pod structure and integrity.
3. Mortality (number of missing whales) and natality (number of births) will be calculated from the 1993 season through photo-identification studies. The 1993 vital rates will be compared to NOAA's historical database on Prince William Sound killer whales to determine trends in abundance.

ENVIRONMENTAL COMPLIANCE

This is a field research project in which routine data collection will take place which is limited in context and intensity. Consequently, this project is categorically excluded from being required to provide an Environmental Impact Statement or Environmental Assessment.

Permits required by the Marine Mammal Protection Act will be obtained prior to the field season.

WHEN

Apr. 1, 1993	Contract negotiation
June 1, 1993	Select contractor
July 15, 1993 to Sep. 15, 1993	Field research
Dec. 30, 1993	Draft report
Feb. 15, 1994	Final report

BUDGET (\$K)

	NOAA
Personnel	\$ 18.8
Travel	4.2
Contractual	89.0
Commodities	6.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 118.0
General Administration	<u>9.1</u>
Project Total	\$ 127.1

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93043

Project Title: Sea Otter Population Demographics and Habitat Use in Areas Affected by the *Exxon Valdez* Oil Spill

Project Category: Restoration Monitoring/Restoration Habitat Protection

Project Type: Marine Mammals

Lead Agency: Department of the Interior - Fish and Wildlife Service

Cooperating Agencies: None

Project Term: April 1, 1993 to March 31, 1994

INTRODUCTION

A. Background

The sea otter (*Enhydra lutris*) is a well-known marine mammal species in Alaska. They historically occurred throughout coastal waters of the Pacific, but as a result of fur harvests in the 18th and 19th centuries, they came close to extinction. They have since increased in abundance and distribution, and presently are found in most coastal areas of southern Alaska. Sea otters prey on a variety of invertebrate species, including mussels, clams, crabs and sea urchins, and may have a strong influence in structuring prey populations.

B. Summary of Injury

Immediate losses of sea otters due to the *Exxon Valdez* oil spill probably ranged from 3,500 to 5,000 animals. Current sampling of sediments and sea otter prey items indicate exposure of otters to hydrocarbons may be continuing. The results of several NRDA studies indicate that this exposure, at a minimum, may be affecting sea otters at an organismic level and, at a maximum, may be affecting survival and therefore recovery of the population. Comparisons of post-spill sea otter surveys found no change in abundance between July 1990 and July 1991, with significantly lower densities in the oil spill area compared to non-oiled areas. The age distribution of sea otter carcasses recovered in oiled areas of Prince William Sound continues to reflect elevated mortality in prime-age sea otters, and a 1990-91 study determined the survival rate of weanling sea otters was significantly lower in oiled than nonoiled areas of PWS. This evidence, together with results from blood and contaminant analyses, suggests that the sea otter population within the spill zone may still be compromised by exposure to oil and that recovery to pre-spill levels is not occurring.

C. Location

The major focus of this project will be on sea otters in Prince William Sound.

WHAT

A. Goals

The overall goal of this project is to restore sea otter populations affected by the *Exxon Valdez* oil spill by determining what is limiting their recovery and identifying areas with high value for sea otter habitat within Prince William Sound for possible protection.

B. Objectives

1. Monitor the recovery of sea otters in oiled areas by determining their abundance, distribution and mortality
2. Construct a population model to evaluate the potential recovery of the sea otters
3. Identify patterns of habitat use
4. Identify and evaluate areas with high value of sea otter habitat within PWS for possible protection

WHY

Studies to date have determined that initial damages to the sea otter population were severe (a loss of 3,500 to 5,000 sea otters), and suggest that chronic damages to sea otters are also occurring, delaying recovery of affected populations. Through monitoring of affected populations and evaluation of patterns of habitat use, this restoration project will guide the development of strategies to aid in the recovery of the otters. The various project activities will enhance our understanding of the demographics of sea otter populations, and identify potential sites for protection of sea otter habitat. Protection of habitats important to sea otters (including foraging, pup rearing, pup weaning and haulout areas) will promote population recovery over the long-term as well as provide protection for other members of the nearshore marine community.

HOW

A. Methodology

In order to evaluate recovery of the sea otter population affected by the oil spill, annual monitoring will be undertaken. Since the spill, detailed data on population size has been collected primarily in the Prince William Sound portion of the spill area. Efficient standardized survey techniques to increase precision and accuracy of population estimates were being developed through RESTORATION FEASIBILITY PROJECT #3, which was conducted in 1991 but not in 1992. The project evaluated the feasibility of using a small float-equipped airplane (Piper P-18 super-cub) as a survey platform in a strip transect survey of sea otters. The design involves counting otters along transects according to a strict protocol and conducting "intensive searches" at pre-determined intervals to estimate the proportion of animals that remain uncounted (e.g., due to diving) during the strip count. Through the information gleaned in the feasibility project and subsequent work by the USFWS, this census technique can be implemented within Prince William Sound in 1993. Survey methodology will be field tested outside Prince William Sound in 1993, and an extended monitoring program may be implemented in subsequent years. In addition to aerial surveys, mortality surveys (recovery of beach-cast carcasses) will be continued as part of

Project Descriptions

this project. The mortality surveys will build on data collected over a decade in PWS.

A population model will be developed based on age structure and age-specific reproduction and survival rates estimated from the carcasses recovered following the oil spill. Model parameters will be modified to reflect available information on post-spill population size, reproduction and survival rates (including data from a 1992-93 USFWS study on juvenile sea otter survival in PWS) to predict recovery rates under a range of assumptions, including those related to potential restoration or management strategies. Data collected in subsequent years will be used to refine and update the model and predictions. This work will be conducted cooperatively with Service personnel and other individuals having expertise in modeling sea otter populations.

The habitat evaluation component of the project will 1) utilize data from a 1992-93 USFWS juvenile survival study to develop a database on sea otter movements and patterns of habitat use, 2) integrate this information with other sea otter data on distribution and abundance (pre- and post-spill), and 3) evaluate available data on commercial, recreational, and subsistence uses of PWS. Continuing efforts (planned for 1994-95) will utilize the database compiled on habitat use patterns to identify and evaluate potential areas of high habitat value in PWS for protection.

B. Coordination with Other Efforts

To date, aircraft and boat surveys have not been conducted concurrently. Collection of survey data by both methods in 1993 would complement both projects by providing a basis for comparison of methods and continuity of data collection in subsequent years. Data from both surveys will contribute to the analyses of habitat use patterns.

ENVIRONMENTAL COMPLIANCE

This project does not involve capture or handling of sea otters, or any other methods that are intrusive. It appears to qualify for categorical exclusion under the National Environmental Policy Act.

WHEN

The first year of the project will be April 1, 1993 to March 31, 1994. The population and reproductive surveys will be conducted in the summer of 1993. Mortality surveys will be conducted in the late spring of 1993. The population modeling and evaluation of habitat use patterns do not involve field work. Data compilation and analyses for these components of the project will occur throughout the year. Progress reports for all components of the project will be produced by January 30, 1994, and "final" reports on 1993 activities will be produced by March 31, 1994. The identification of potential sites for habitat protection would occur in 1994-95. Monitoring of population recovery (through abundance, distribution, reproduction and mortality, and continued modeling) is planned as a long-term activity, extending through 2001 (pending availability of continued funding), or through recovery.

April 1993	Data compilation and entry; preparation for field work
April - Nov. 1993	Compilation and analysis of existing data for habitat and population modeling work
May - Sept. 1993	Field activities for population, reproductive and mortality survey work
Sept. 1993-Jan. 94	Data entry, analysis, report preparation
Jan. 30, 1994	Annual report due on progress to date
Feb. 1, 1994	Draft report to peer review
March 31, 1994	Final report on 1993 activities due

BUDGET (\$K)**USFWS**

Personnel	\$ 142.8
Travel	10.0
Contractual	42.7
Commodities	16.9
Equipment	27.5
Capital Outlay	<u>0.0</u>

Sub-total \$ 239.9

General Administration	<u>24.4</u>

Project Total \$ 264.3

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93045

Project Title: Surveys to Monitor Marine Bird and Sea Otter Populations in Prince William Sound during Summer and Winter

Project Category: Restoration Monitoring

Project Type: Birds, Marine Mammals (Sea Otters)

Lead Agency: Department of the Interior, Fish and Wildlife Service

Cooperating Agencies: None

Project Term: January 1, 1993 to March 15, 1994

INTRODUCTION

A. Background

The U.S. Fish and Wildlife Service conducted boat surveys of marine bird and sea otter populations in Prince William Sound in the early 1970s, the mid-1980s and in 1989, 1990 and 1991 following the *Exxon Valdez* oil spill. These surveys documented overall declines in Prince William Sound marine bird populations between 1972-1973 and the years after the spill for grebes, cormorants, northern pintail, harlequin duck, oldsquaw, scoters, goldeneyes, bufflehead, black oystercatcher, Bonaparte's gull, black-legged kittiwake, arctic tern, pigeon guillemot, marbled murrelet, Kittlitz's murrelet, and northwestern crow. For five of these species or groups--cormorants, harlequin duck, black oystercatcher, pigeon guillemot and northwestern crow--populations declined more in the oiled area than in the non-oiled area, suggesting an oil spill effect. Specific studies of three of these species--harlequin duck, black oystercatcher and pigeon guillemot--have corroborated the population changes found by the survey project. In addition, these studies have investigated how the reproduction and foraging ecology of these species have been affected by the spill. These studies have also examined hydrocarbon contamination in these species. Links between the oil spill and effects on these species are still being investigated.

Relative to sea otters, the boat surveys documented declines in sea otter density and abundance in shoreline habitats of Prince William Sound following the spill. The surveys also detected a continuing pattern of significantly lower sea otter densities in oiled coastal areas, suggesting that mortality or displacement of sea otters from these areas was considerable.

B. Summary of Injury

About 35,000 birds and 1,000 sea otters were recovered following the spill. Based on modeling studies using carcass, search effort, and population data, the total number of marine birds killed by the spill was between 300,000 and 645,000 birds, with the best approximation between 375,000 and 435,000 birds. The majority of birds killed were murre. The total number of sea otters killed by the spill in Prince William Sound was estimated to be between 3,500 and 5,000

otters. These estimates reflect direct mortality occurring in the first five months after the spill and do not include chronic effects or loss of reproductive output.

C. Location

This study will be conducted in Prince William Sound. The entire sound, including oiled and unoiled areas, will compose the study area.

WHAT

A. Goal

The purpose of this study is to obtain annual estimates of the summer and winter populations of marine birds and sea otters in Prince William Sound to determine whether species whose populations may have declined due to the *Exxon Valdez* oil spill are recovering.

B. Objectives

1. To determine distributions and estimate abundances, with 95% confidence limits, of marine birds and sea otters in Prince William during summer and winter.
2. To estimate trends in populations of marine bird species whose populations declined more in oiled areas than in unoiled areas of Prince William Sound since the early 1970s, specifically cormorants, harlequin ducks, black oystercatchers, and pigeon guillemots.
3. To support restoration studies on harlequin ducks, black oystercatchers, pigeon guillemots, marbled murrelets, other marine birds and sea otters by providing data on population changes, distribution and habitat use of Prince William Sound populations.

WHY

A. Benefit to Injured Resources/Services and Relationship to Restoration Goals

This study meets the Trustee Council restoration goal of restoration monitoring. Restoration of marine bird and sea otter populations will require population estimates to determine whether recovery is occurring or if declines are continuing. This project will benefit marine birds and sea otters by revealing species that show continuing injury due to the *Exxon Valdez* oil spill; this information is necessary to plan meaningful restoration actions.

This project will also provide valuable information on the distribution and habitat use of these species. Survey data from this project have been used for these purposes by investigators of harlequin ducks, marbled murrelets, black oystercatchers and sea otters. Survey methods are flexible enough to provide for collection of more detailed information (such as age class data) if such information is requested by investigators of those species.

Project Descriptions

HOW

A. Methodology

Boat surveys will be conducted using methods developed by NRDA Bird Study 2. Surveys will be conducted in March (winter) and July (summer) of each year. Surveys will be conducted using three 25-foot boats each staffed by an operator and two crew members. All three will serve as observers. Observers will record all birds and mammals within 100m of each side of the boat within survey transects, and whether the animal is in the water, on land or in the air. The survey window will extend approximately 40-50m ahead of and 100m above the moving boat, but will be extended for animals that exhibit strong avoidance behavior when the boat is more than 50m away (e.g., scoters, murrelets, harlequin ducks, harbor seals). Surveys will be conducted only when seas are less than two feet. Date and time of survey, and environmental variables including wind velocity and direction, air and water temperature, weather, observation conditions, sea state, tide, presence of oil, and presence of human activity will be recorded for each transect.

A stratified random sampling design using shoreline, coastal/pelagic and pelagic strata will be used. The current design is powerful enough to detect small population changes (e.g., 15%) for some species. Data collected previously will be used to improve the design for other species, possibly lowering costs at the same time. The size of individual blocks in pelagic and coastal/pelagic strata will be decreased, and blocks reselected, to decrease variances. Such alteration will not affect our ability to compare population estimates among years.

Analyses aimed at reducing survey variances, detecting population changes, and identifying habitat use and distribution will continue. Such analyses include exploration of post-stratification by habitat (using shoreline type or bathymetry to define habitats), examination of differences among observers' abilities to identify and count animals, and calculation of optimal sampling unit size and number of samples. Future analyses should include the effects of survey vessel disturbance and distance from the vessel on counts of different species.

B. Coordination with Other Efforts

This study will provide data on distribution and abundance of selected species for use by restoration study investigators (assuming these studies are approved). Proposed studies that would use data collected by this project include the following: sea otters, black oystercatchers, pigeon guillemots, habitat (marbled murrelet portion), murres, and habitat acquisition.

ENVIRONMENTAL COMPLIANCE

This study relies on observations from boats and is a non-intrusive study. Based on a review of the CEQ regulation 40 CFR 1500-1508, this study appears to be categorically exempt from the requirements of NEPA in accordance with 40 CFR 1508.4.

WHEN

This project will require, at minimum, 15 months to complete. Surveys are proposed to continue for several years. The need to continue the surveys on an annual basis, and the need to conduct both winter and summer surveys in each year, will be evaluated.

Jan. 1 - Mar. 1, 1993	Logistical planning
Mar. 1 - Mar. 20, 1993	Winter survey - data collection
Apr. 1 - May 30, 1993	Data compilation
July 1 - July 20, 1993	Summer survey - data collection
Aug. 1 - Nov. 15, 1993	Data compilation and data analysis
Dec. 15 - 1994	Draft report for internal review
Feb. 1 - 1994	Draft report to peer review committee
Mar. 31 - 1994	Final report complete

BUDGET (\$K)

USFWS

Personnel	\$ 108.5
Travel	12.0
Contractual	80.0
Commodities	10.0
Equipment	30.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 240.5

General	<u>21.9</u>
Administration	

Project Total \$ 262.4

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93046

Project Title: Habitat Use, Behavior, and Monitoring of Harbor Seals in Prince William Sound, Alaska

Project Category: Restoration Monitoring, Habitat Protection

Project Type: Marine Mammals

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: National Marine Fisheries Service (NMFS)

Project Term: January 10, 1992 to September 30, 1995

INTRODUCTION

Harbor seals (*Phoca vitulina*) occur year-round in Prince William Sound (PWS) where they often haul out on rocks, reefs, beaches, and glacial ice. They pup, breed, molt, and feed in the Sound. During extensive surveys of PWS in 1991, 2,500-3,000 harbor seals were counted on haulouts. Another 1,700 were counted in the Copper River Delta and Orca Inlet. This under-estimates the population since some seals were in the water and some small haulouts were not surveyed. From 1984 to 1988, harbor seal numbers at trend sites in PWS declined by 43% for unknown causes. The decline continued in 1989-1990, exacerbated in oiled areas by the *Exxon Valdez* oil spill (EVOS); 1990 counts were 57% lower than in 1984. Following the oil spill, counts of harbor seals at oiled trend count sites declined by 35%, compared to 13% at unoiled sites, indicating a reduction of about 20% at oiled haulouts. It is likely that over 200 harbor seals were killed by the EVOS in PWS. Although molting surveys in 1991 suggested that numbers might be increasing, pupping counts were 10% lower in 1992 than in 1991. Whether there are long-term effects is unknown.

Harbor seals are important to residents of PWS for subsistence. In 1987-1989, they made up 13%-19% of the total harvest of subsistence foods in Tatitlek. In Chenega Bay in 1985-1986, harbor seals accounted for 27% of the total pounds harvested. Harbor seals are also watched by tourists and recreational users of PWS and they interact with and are incidentally killed in commercial fisheries. Like all marine mammals, they have special Federal protection under the Marine Mammal Protection Act. If the current decline continues or if up-to-date population data are not available, harbor seals could be placed in a more restrictive legal classification.

The proposed study will take place in PWS. The information obtained will benefit residents of Tatitlek, Chenega Bay, and other PWS communities who use harbor seals for subsistence, and tourists and other recreational users by providing information on trends in abundance, biology of the seals, and insight into possible causes for the ongoing decline. Data will benefit PWS fishermen by ensuring that restrictive measures regarding incidental take of harbor seals are not implemented unnecessarily due to lack of data. Information contributed by this study may lead to management recommendations will ensure that human activities do not have further impacts on

harbor seals.

WHAT

A. Goals

The goals of this study are as follows:

1. to monitor the abundance and trends of harbor seals in oiled and unoled areas of PWS in order to determine trends in numbers since their decline following the EVOS; and
2. to characterize habitat use and hauling out and diving behavior of harbor seals so that important habitat can be identified and properly managed.

B. Objectives

The objectives are as follows:

1. to conduct aerial surveys of harbor seals at 25 trend count sites in PWS during pupping and molting in 1993 and 1994;
2. to compare data from surveys to data collected following the EVOS to determine whether seals are recovering; 3) to describe hauling out and diving behavior, and by inference, feeding behavior of satellite-tagged seals in PWS relative to date, time of day, and tide; 4) to describe use of and frequency of movements between haulouts; and 5) to determine movement patterns within PWS and between PWS and adjacent areas.

WHY

We cannot assume that the number of seals in oiled areas will return naturally to pre-spill levels. It is necessary to have current data to know whether seal numbers in PWS have stabilized or are continuing to decline. The proposed surveys will provide such information. To date, the data are equivocal: 1991 molting counts increased slightly but 1992 pupping counts declined. Molting counts in oiled areas were 30% lower in 1991 than they were in 1988 before the EVOS. By comparison, counts at unoled sites were approximately the same in 1988 and 1991. Overall since 1984, there has been a decline of more than 50% in numbers that have left much of the harbor seal habitat in PWS vacant. Subsistence hunters and other local residents complain about the scarcity of seals and want to know why there has been a decline.

While count data are essential for monitoring trends in abundance, they are of little help in explaining the decline or designing conservation and management measures to facilitate recovery. There is no information on site fidelity, movements between sites, seasonal changes, habitats used for feeding, or feeding behavior. It is clear based on data from harbor seals that were satellite-tagged as part of a pilot EVOS restoration study that some seals in PWS make unexpectedly long movements in short periods of time, and that there is more interchange among

Project Descriptions

seals in PWS and the Copper River delta than was anticipated. Areas of particular biological significance must be identified and appropriately managed to be able to aid recovery in any way possible.

Under Federal law, subsistence is the priority use of marine mammals. Data on seal abundance should be shared with PWS residents so that hunters can regulate their seal harvest to ensure that the harvest is sustainable. If data are not current and adequate to determine that subsistence takes and fisheries removals are sustainable, this could result in very restrictive incidental take regulations for PWS salmon fisheries. While it is not clear what caused the declines prior to the EVOS, there is little question that the EVOS compounded the decline. Consequently, post-spill monitoring must continue until residual effects of the EVOS are no longer evident. This project will complement other activities of NMFS on conservation and management of harbor seals.

HOW

We are proposing a two-year field study (1993, 1994) with final data analysis and reporting to take place in year three. Harbor seal abundance will be monitored by flying aerial surveys during pupping (June) and molting (August/September). A fixed-wing aircraft will be used to fly a survey of 25 trend count sites at an altitude of 500 feet. These 25 sites have been used for PWS harbor seal trend counts since 1984, including NRDA studies in 1989-1991. The observer will count all seals and photograph large groups. Pups will be counted separately in June. We will attempt to survey each site 7-10 times during a survey period to reduce statistical variance of the counts. Methodology and observers will be the same as those used in 1989-1991 NRDA studies. Several surveys will also be conducted of seals in the Copper River Delta to gain understanding of the relationship between seal counts in PWS and the Delta. Counts will be compared to data collected prior to and during the EVOS in order to document whether and how rapidly recovery in the oiled area occurs. Project investigators will travel to Chenega Bay and Tatitlek at least once each year to exchange information with village residents.

Satellite-linked time-depth recorders (PTTs) will be attached to 12 seals per year (6 each in spring and autumn) at a variety of locations in PWS in order to better evaluate geographical and seasonal differences in movements and behavior. Seals will be caught by nets placed near haulouts and PTTs will be glued to their backs with epoxy resin. Each PTT will transmit signals to polar-orbiting satellites when the seal is hauled out or when it surfaces for a sufficient time. Sensor information will indicate when the animal is hauled out, and how deep and for how long it dives. PTTs will be shed during the annual molt in autumn. Pilot studies demonstrated that the project is feasible. During 1991-1992, PTTs were attached to eight seals and data were received for 3-67 days. Several seals made substantial movements within PWS and to the Gulf of Alaska and the Copper River Delta.

Aerial survey data will be analyzed using the trimean statistic as the measure of central tendency. Between-year comparisons of pup production and abundance during the fall molt will be done using a Repeated Measures Analysis of Variance (ANOVA) performed on the trimeans of site count data. Hypotheses will be tested using orthogonal contrasts derived from the specialized ANOVA. Data on geographic location and movements will be plotted by computer. Rates of movement and average lengths and depths of dives will be calculated depending on location,

date, and size of the seal. Hauling out periods relative to tidal stage will be examined by analyzing sensor data that indicates whether the seal is on land or at sea.

ENVIRONMENTAL COMPLIANCE

No environmental analysis is required for this study. As required by the Marine Mammal Protection Act, ADF&G has been authorized under Permit No. 700 to instrument up to 100 harbor seals with PTTs during the period 1992-1995. No additional permits are required.

WHEN

This project will be conducted during 1993 and is proposed for 1994 also, with final report submission in either 1994 or 1995 depending upon whether the second year of field effort is conducted. Aerial surveys will be conducted during June and August/September of each year. Each survey period will be 7-14 days, depending on weather and tides. One of the investigators will visit Chenega Bay and Tatitlek once a year to discuss survey results with residents. Satellite tags will be attached during 10-14 day periods in May and September of each year. Because a lead time of 3-6 months is required to obtain PTTs, we will have to order PTTs by November of 1992 and 1993. Satellite data acquisition costs must be prepaid to Service ARGOS by February of each year. Data are received monthly and preliminary analysis will begin as soon as data diskettes are received. Final analyses cannot be completed until the PTTs have ceased to function (April-June 1995). A report of field activities will be submitted in letter form within 30 days following any field activity. Annual progress reports will be submitted by 31 December 1993 and 1994. A final report will be submitted by 30 September 1995. Results will be prepared for publication in a peer-reviewed journal.

BUDGET (\$K)

	ADF&G
Personnel	\$ 104.7
Travel	10.2
Contractual	46.7
Commodities	49.9
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 211.5
General Administration	<u>19.0</u>
Project Total	\$ 230.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93047

Project Title: Subtidal Monitoring: Recovery of Sediments, Hydrocarbon-degrading Microorganisms, and Eelgrass Communities in the Shallow Subtidal Environment

Project Category: Restoration Monitoring

Project Type: Subtidal

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: Alaska Department of Fish and Game; Alaska Department of Environmental Conservation

Project Term: March 1, 1993 to September 30, 1995

INTRODUCTION

A. Background

This project will monitor the recovery of subtidal sediments, hydrocarbon-degrading microorganisms, eelgrass communities, and bottom fish from shallow subtidal areas of Prince William Sound. An important component of this study is tracking the loss of oil from the environment and from organisms in the spill area.

Hydrocarbons were found in the shallow subtidal sediments and in species (rockfish, flounders) associated with the shallow bottom sediments. Investigators attempting to restore or monitor recovery of populations of shallow subtidal organisms following the *Exxon Valdez* oil spill will want to know what concentrations of petroleum hydrocarbons are present in sediments, and if they continue to contaminate the organisms and have sublethal impacts.

We anticipate that complete recovery to background levels of hydrocarbons in subtidal sediments in the Sound is likely to take several years.

B. Summary of Injury

Subtidal sediments have been found to be contaminated by oil at no fewer than 15 sites within Prince William Sound by June 1990. Hydrocarbon contamination of sediments had reached a depth of 20m at least 8 sites. Evidence of hydrocarbon movement down-slope into subtidal sediments was detected by 1991; further oil movement to greater depths is suspected (from weathering, cleaning, etc.) but is unknown.

A few dead rockfish were found after the spill. Species exposure in rockfish and flounders (contaminated bile) was documented between 1989-91, but not since. Eelgrass beds in oiled areas were affected by the spill. Persistence of hydrocarbons and their impacts on associated species were not examined in 1992, and the current status of recovery is unknown.

C. Location

All locations of the study will be in Prince William Sound (PWS; except for potential control sites outside PWS if needed). All projects within the study will sample the same oiled sites all of which were sampled in previous years. Five oiled and five reference sites will be studied intensively by all agencies cooperating in the project.

The oiled sites will include Herring Bay, Northwest Bay, Sleepy Bay, Snug Harbor, and Bay of Isles. The control sites will include Drier Bay, Lower Herring Bay, Moose Lips Bay, Olsen Bay, and Zaikof Bay. All sites were sampled repeatedly under the NRDA program. Sites will be sampled in June-July 1993 and 1994.

WHAT

A. Goal

Monitor recovery of sediments, hydrocarbon-degrading microorganisms, eelgrass beds, and shallow fish species in the subtidal environment.

B. Objectives

1. National Oceanic and Atmospheric Administration
 - a. Determine Hydrocarbons concentration and composition in subtidal sediments in PWS by GC-MS (6 depths; 10 sites).
 - b. Determine hydrocarbon movement down slope in three oiled bays (150 samples per bay, all from 0-20 meters) by fast screening UV-Fluorescence procedures.
 - c. Determine changes in exposure of fishes to hydrocarbons by monitoring bile, MFO activity and histopathological lesions in near-shore bottom fish.
2. Alaska Department of Environmental Conservation
 - a. Measure the numbers of hydrocarbon-degrading microorganisms and their activity as an indicator of persistence of biodegradable oil in PWS sediments.
3. Alaska Department of Fish and Game
 - a. Determine impacts and recovery of shallow eelgrass communities in western PWS that were impacted by the spill.

Project Descriptions

WHY

A. Benefit to Injured Resources/Services

The sediment hydrocarbons sub-project will determine the recovery of oiled sediments, if any, and the movement of subtidal oil, if any. The other sub-projects will determine if contamination continues in species, and if responses to contamination or impacts continues.

Management of species and habitats may be influenced by the level of recovery (e.g., no contamination or detectable responses would permit higher rates of harvest for target species). Information on rates of recovery of contaminated habitats and species is needed to protect those habitats and species.

HOW

A. Methodology

All of the sites proposed for sampling by this project were sampled by the cooperating agencies between 1989-91. None of the sub-projects proposed here were implemented in 1992. All sub-projects will use methods comparable to the methods they employed in 1989-91 to insure temporal comparability of the results. The project will be limited to 10 sites within PWS.

Specific methods vary considerably between sub-projects. Sediments will be collected primarily by divers (some grab samples will be taken at greater depths) and will be analyzed by GC-MS. All sediment samples will be screened using the UV-Fluorescent procedures developed for analyzing sediments from the mussel bed study. Details of the methods for monitoring biological impacts/contamination will be given in detailed study plans and will follow the methods used in previous years.

Chain of custody procedures will be followed after collection of all samples.

B. Coordination with Other Efforts

The sub-projects will coordinate closely with each other to insure concurrent sampling dates and similar stations between studies. Also, this project will coordinate with the mussel bed project, and will make use of the shoreline evaluations particularly to identify stations for the intense subtidal sampling at 3 oiled bays.

ENVIRONMENTAL COMPLIANCE

It is not anticipated that this study will have a significant effect on the environment and an Environmental Impact Statement or Environmental Assessment will not be necessary.

WHEN

All field work will be conducted in June-July 1993 and 1994. An interim progress report will be completed by 1 December 1993 and 1994. Final reports for sub-projects with one field season

will be completed by 1 May 1994; those for sub-projects with two field seasons will be completed by 1 May 1995.

BUDGET SUMMARY

All sub-projects are self-contained. Budgets include analytical costs, vessel-field logistics, university overhead, and final analyses/interpretation/write up.

Note: Because the summer field season occurs in the fourth quarter of the fiscal year, much of the sample analysis will fall in the first two quarters of the next fiscal year.

Project Descriptions

BUDGET (\$K)

	NOAA	ADEC	ADF&G	TOTAL
Personnel	\$ 230.6	\$ 2.5	\$ 7.0	\$ 240.1
Travel	20.8	0.0	0.0	20.8
Contractual	185.0	62.4	230.0	477.4
Commodities	51.0	0.0	0.0	51.0
Equipment	9.0	0.0	0.0	9.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 496.4	\$ 64.9	\$ 237.0	\$ 798.3
General Administration	<u>47.6</u>	<u>4.7</u>	<u>17.2</u>	<u>69.5</u>
Project Total	\$ 544.0	\$ 69.6	\$ 254.2	\$ 867.8

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93051

Project Title: Habitat Protection Information for Anadromous Streams and Marbled Murrelets

Project Category: Habitat Protection and Acquisition

Project Type: Survey

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: Alaska Department of Fish and Game; Department of Interior, Fish and Wildlife Service

Project Term: October 1, 1992 to September 30, 1994

INTRODUCTION

This project will acquire detailed information on the locations and characteristics of habitats and services of injured resources so that habitat/protection or acquisition options can be evaluated. Data collection efforts will focus on anadromous fish and murrelets. Anadromous fish were affected by the oil spill in a number of ways: pink salmon had high egg and fry mortalities, reduced growth rates, and possible morphological abnormalities; sockeye salmon suffered poor smolt survival due to overescapement. Murrelet populations were impacted by initial mortalities and continue to be depressed.

This project will encompass lands throughout the spill-affected area.

WHAT

This project has two components:

1. Murrelet nesting habitat assessment; and,
2. Stream habitat assessment.

1. Murrelet Nesting Assessment

The purpose of this sub-project is to help restore murrelet populations injured due to the *Exxon Valdez* oil spill by providing information that could be used to protect, through acquisition or other means, murrelet nesting habitat. This sub-project will further characterize the nesting habitat of marbled and Kittlitz's murrelets in the spill-affected area. Two objectives will be implemented to achieve this goal:

- a. Determine habitat features that are reliable indicators of high density murrelet nesting areas in the spill-affected area.

- b. Determine feasibility of using radio telemetry to determine nesting habitat of murrelets in the spill-affected area.

2. Stream Habitat Assessment

The stream habitat assessment project is intended to be a comprehensive survey of anadromous fish stream resources that will provide basic information needed to evaluate candidate lands for restoration, protection, enhancement or acquisition actions.

The project is composed of two sub-projects:

- a. **Stream Habitat Assessment Study:** Surveying anadromous fish distribution and documenting the total number and extent of anadromous fish streams on candidate lands.
- b. **Stream Classification Study:** Developing channel typing procedures that will allow comparative evaluations of stream habitat on private and public lands.

WHY

Marbled murrelets and anadromous fish, were injured by the oil spill. Murrelets nest in trees throughout the spill area but little is known about their nesting requirements. Work conducted in 1992 is providing some information on nesting requirements but additional information is needed before nesting habitat can be reliably determined. Any habitat protection applied to uplands for murrelets would be dependent on the ability to accurately estimate the quality and quantity of nesting habitat.

Anadromous fish, such as pink salmon were also injured by the oil spill. The surveying portion of the project will locate and map new anadromous streams within candidate lands that may require habitat protection. The stream classification study will provide a GIS-based tool that will allow comparative evaluations of streams throughout the spill area. This component will also provide a level of information that can be expanded upon through additional field work, should such information become necessary.

HOW

Based on results from the 1992 season, selected habitat types will be tested for predicted levels of murrelet activity, particularly behaviors indicating occupation of the habitat for nesting. Potential nesting areas will be surveyed using intensive dawn watches along elevational or distance-from-water gradients. Previously monitored high-density nesting areas will be surveyed to determine the relative level of murrelet upland activity for 1993. The U.S. Forest Service will determine forest cover attributes (specifically, forest structure, volume and stand class as well as plant associations) for dawn watch sites within each survey area. These data will be used to determine the habitat characteristics of occupied and unoccupied sites. The study area for this portion of the project will include Prince William Sound (PWS) and areas outside PWS (Kenai Peninsula, Kachemak Bay, Afognak Island). The specific areas to be studied outside of PWS will be determined after results from 1992 field work are available.

Project Descriptions

Radio-telemetry could be a useful technique for determining the nesting areas of murrelets, however, capture methods, radio life-span and ability to track murrelets are still experimental. We propose to conduct a pilot study on capturing and tagging murrelets to determine the feasibility of using radio-telemetry to determine the nesting habitat of murrelets in the spill zone. Given the experimental nature of this work, we propose to conduct the study in Kachemak Bay, which is relatively accessible and has a high density of both murrelet species.

Streams within candidate private lands will be walked to determine the extent of anadromous fish habitat. Concurrent with the streams walks, information on channel types will be collected and entered into the stream classification study.

The stream classification study will use existing air photographs to classify streams within the spill area. Selected sites will be surveyed during the field season to verify and correct the maps. All the maps will be placed into an ARC-INFO based GIS.

ENVIRONMENTAL COMPLIANCE

The proposed project qualifies for a categorical exclusion under terms of the National Environmental Policy Act.

WHEN

Several of the planned project components are continuing studies previously funded by the Trustee Council. The general timelines for the individual components are as follows:

1. Stream habitat assessment: Present - September 1994.
2. Murrelet nesting habitat assessment: Present - September 1994
3. Stream channel typing: January - September 1994

BUDGET (\$K)

	USFS	ADF&G	USFWS	TOTAL
Personnel	\$ 195.6	\$ 182.8	\$ 106.0	\$ 484.4
Travel	19.0	15.0	20.0	54.0
Contractual	255.1	101.0	102.0	458.1
Commodities	21.0	1.0	5.0	27.0
Equipment	42.5	1.5	14.0	58.0
Capital Outlay	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 533.2	\$ 301.3	\$ 247.0	\$ 1,081.5
General Administration	<u>47.1</u>	<u>34.4</u>	<u>23.0</u>	<u>104.5</u>
Project Total	\$ 580.3	\$ 335.7	\$ 270.0	\$ 1,186.0

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93053

Project Title: Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the *Exxon Valdez* Oil Spill

Project Category: Technical Support

Lead Agency: National Oceanic and Atmospheric Administration

Cooperating Agencies: None

Project Term: January 1, 1993 to September 30, 2000

INTRODUCTION

A. Background

The analytical expertise of this project was developed through rigorous performance criteria and quality control/quality assurance standards imposed on participating analytical labs during the damage assessment process. Several thousand environmental samples have been collected and analyzed for hydrocarbons in support of the *Exxon Valdez* NRDA effort, and it is anticipated that at least several hundred more samples will be collected and analyzed as part of Restoration efforts to evaluate the recovery of areas affected by the spill. The data from completed NRDA analyses are stored in a database at the Auke Bay Laboratory, where methods are under continuing development to distinguish samples containing oil from the *Exxon Valdez* oil spill from samples containing oil from other sources, and to determine the oil concentration and weathering status of *Exxon Valdez*-oiled samples. The results of these efforts provide numerical correlates that are directly related to oil, and that may be used by principal investigators (PIs) of other restoration projects, by other governmental agencies, and by the public, to assess associations of observed biological effects with concentrations of *Exxon Valdez* oil. The purpose of the proposed project is to apply and extend these hydrocarbon interpretation methods to samples analyzed for the restoration effort, and to insure the comparability of analytical and interpretive results with those of the NRDA effort.

B. Summary of Injury

This project provides technical support to other projects addressing injuries resulting from the *Exxon Valdez* oil spill. This project will provide fundamental interpretive services to all restoration PIs, governmental agencies, and the public at large, and as needed.

C. Location

This project will be undertaken at the Auke Bay Laboratory in Juneau, Alaska.

WHAT

A. Goal

This project will support the measurement of other restoration projects performances with respect to achieving standards and success criteria of those projects. The goal of this project is to estimate the amount of *Exxon Valdez* oil that is present in environmental samples analyzed for hydrocarbons that are collected for the restoration effort, such that the methods used and the results are comparable with those used for *Exxon Valdez* NRDA samples and to continue maintenance of results in a database for access by all appropriate parties. This project will not be responsible for archival and disposal of collected samples.

B. Objectives

1. Provide a statistically defensible basis for deciding which environmental samples analyzed for hydrocarbons contain oil from the *Exxon Valdez* spill;
2. Estimate the original concentration of *Exxon Valdez* oil in environmental samples that have been determined to contain *Exxon Valdez* oil;
3. Assess the weathering status of sediment hydrocarbon samples; and
4. Archive these results in a database extension of the NRDA database and as physical maps.

WHY

A. Benefit to Injured Resources/Services

This project will make possible the evaluation of the following:

1. the recovery of areas affected by the oil spill by identifying the amount of *Exxon Valdez* oil remaining, and
2. the association of continuing biological impacts of the spill with *Exxon Valdez* oil remaining in impacted areas.

B. Relationship to Restoration Goals

The Trustees should fund this project so that they can determine the extent of recovery (here defined as absence of *Exxon Valdez* oil) of areas oiled by the spill.

Project Descriptions

HOW

A. Methodology

Hydrocarbon data from environmental samples will be examined using pattern recognition techniques related to principal component analysis. The pattern of hydrocarbon measurements in a sample will be compared with the pattern in samples of pure and of weathered *Exxon Valdez* oil, and the pattern variance of known samples of weathered *Exxon Valdez* oil will be used to evaluate the likelihood that the pattern observed in an environmental sample could have derived from *Exxon Valdez* oil contamination. Samples with patterns that could likely have derived from *Exxon Valdez* oil will be presumed to contain *Exxon Valdez* oil, and the concentration of oil initially present will be determined after correction for weathering or biological alteration by calculating the minimum concentration of *Exxon Valdez* oil necessary to explain the observed hydrocarbon pattern in the sample. Sample archival and database procedures will follow NRDA. NRDA and restoration databases will be merged and placed on a database server to facilitate data retrieval.

B. Coordination with Other Efforts

This project will provide basic, interpreted hydrocarbon results that will be of great use to all other projects that either monitor the persistence of *Exxon Valdez* oil in affected areas, or assess the biological effects of persistent *Exxon Valdez* oil. In addition, this project will promote consistency among published results by providing a uniform and consistent approach to hydrocarbon interpretation.

ENVIRONMENTAL COMPLIANCE

This is not a field study nor does it have any significant effect on the environment. Consequently, neither an Environmental Impact Statement nor Environmental Assessment need to be provided.

All Federal, State, and local laws are followed in the management of chemical analysis.

WHEN

The project will continue as long as samples are collected and need interpretation. Restoration sample data will be interpreted as received. Therefore, there is no set beginning or ending time. We intend to work with PIs to interpret and map their data to their needs on an ongoing basis. We anticipate this need to continue as long as restoration hydrocarbon samples are collected. We propose to interpret and analyze a set of data within several months of receipt.

BUDGET (\$K)

NOAA

Personnel	\$ 82.9
Travel	6.2
Contractual	0.0
Commodities	4.0
Equipment	0.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 93.1

General	<u>12.4</u>
Administration	

Project Total \$ 105.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93057

Project Title: Damage Assessment GIS

Project Category: Technical Support

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: None (USF&WS considered separately)

Project Term: March 1, 1993 to September 30, 1993

INTRODUCTION

A. Background

This project provides a baseline information repository (shoreline, oiling, Environmental Sensitivity Index, shore type, ownership, salmon streams, bathymetry data) for statistical analysis and mapping in support of damage assessment projects scheduled for completion during this last budget period, and for final database and product documentation, repository storage, and distribution and dissemination.

WHAT

A. Goal

Complete statistical analysis and GIS mapping support for existing damage assessment studies, and provide a quality controlled and documented database of baseline information for restoration study use and data publication.

B. Objectives

Complete statistical reports and maps for shoreline assessment; produce updated land status maps and anadromous streams maps; deliver fully documented, digital GIS database of oil spill related themes for final public release, and for use by restoration and habitat acquisition projects; provide direct technical support to PIs on document graphics and maps. Workload and analysis based on those projects scheduled for completion by September 1993.

WHY

A. Benefit to Injured Resource/Service

Completing the damage assessment database of baseline information will provide restoration studies with information relevant to their projects: current ownership and designated use status, oiled areas, oiling change over time, beach treatment areas, geographic links to injury determinations, baseline information critical to habitat acquisition objectives.

HOW

A. Methodology

Complete major documentation project to prepare data layers for final publication. Quality control newly acquired data, and produce statistical reports and maps for the shoreline assessment study, against Spring 1991 and Spring 1992 data. Acquire current ownership data from various sources (BLM, DNR, USFS), synthesize data, produce most current land status maps, and distribute to damage assessment and restoration studies.

ENVIRONMENTAL COMPLIANCE

ADNR GIS is a technical service project, and is subordinate to the environmental compliance of the damage assessment projects supported.

WHEN

Data publication, ready for public distribution by August of 1993. Spring 1991 shoreline data maps quality controlled, and produced Spring 1993. Produce shoreline maps and reports from Spring 1992 data within 3 to 4 months of receipt and quality control of data. Technical assistance to PIs subject to PI deadlines, all work complete by October 1993.

BUDGET (\$K)

	ADNR
Personnel	\$ 53.0
Travel	0.0
Contractual	5.0
Commodities	1.5
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 59.5
General Administration	<u>8.0</u>
Project Total	\$ 67.5

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93059

Project Title: Habitat Identification Workshop

Project Category: Habitat/Land Protection

Project Type: Technical Support

Lead Agency: Department of Agriculture, Forest Service

Cooperating Agencies: Alaska Department of Environmental Conservation; Alaska Department of Fish and Game; National Oceanic and Atmospheric Administration; Alaska Department of Natural Resources; U.S. Department of the Interior

Project Term: January 10, 1992 to September 30, 1993

INTRODUCTION

Public comment, to date, has overwhelmingly supported use of the Habitat Protection and Acquisition option as a method of preventing further harm to, and assisting the recovery of, natural resources and services injured by the oil spill. Numerous proposals or nominations of lands believed to be deserving of protection or acquisition were received from the public as FY93 work plan proposals.

In response, where an imminent threat is determined to exist, this project accelerates important elements of the Habitat Protection and Acquisition option within the context of maintaining the integrity of the overall Restoration Planning process and accompanying compliance with NEPA and other legal and regulatory requirements. An imminent threat is defined as a change in land use which (1) is likely to foreclose restoration options, and (2) can reasonably be expected to occur before adoption and implementation of the Restoration Plan.

WHAT

A. Goal

The goal of this project is to identify those parcels of non-public lands within the oil spill affected area which contain critical habitats necessary for the recovery of natural resources and services injured by the oil spill and which are determined to be under imminent threat.

WHY

The Habitat Protection and Acquisition option is but one of a number of restoration tools being considered in the draft Restoration Plan scheduled for release for public review and comment in February 1993. A final Restoration plan is expected in May 1993. In the interim, protection of key parcels of non-public lands which contain critical habitats is needed to ensure that the Habitat Protection and Acquisition option is not foreclosed by events preceding Trustee Council adoption

and implementation of a final Restoration Plan.

HOW

1. BY NOVEMBER 1, 1992 - The Habitat Protection and Acquisition workgroup, in cooperation with The Nature Conservancy, will conduct and document a series of workshops to be attended by scientists and other resource specialists for the purpose of (1) assessing the rate and degree of recovery of resources and services injured by the oil spill, and (2) identifying and characterizing the habitats associated with the recovery of injured resources or services.
2. BY NOVEMBER 1, 1992 - The Habitat Protection and Acquisition workgroup will identify those parcels of non-public land within the oil spill affected area which face an imminent threat.

If the threat analysis indicates that there is no imminent threat, further analysis of the nomination may be deferred to the more detailed evaluation process emanating from the Restoration Planning process.

ENVIRONMENTAL COMPLIANCE

This project, which is initial data gathering, is categorically excluded from formal documentation in an Environmental Impact Statement or environmental analysis.

WHEN

The project will commence October 1, 1992. The initial imminent threat analysis is expected to be completed by January 1993. Each subsequent year lands will be evaluated for imminent threat and, if necessary and appropriate, protection tools will be applied.

BUDGET (\$K)

	USFS
Personnel	\$ 0.0
Travel	0.0
Contractual	39.5
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 39.5
General Administration	<u>2.8</u>
Project Total	\$ 42.3

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93060

Project Title: Accelerated Data Acquisition

Project Category: Habitat Protection

Lead Agency: U.S. Department of Agriculture Forest Service

Cooperating Agencies: Alaska Department of Environmental Conservation, Department of Interior, Alaska Department of Natural Resources, National Oceanic and Atmospheric Administration and Alaska Department of Fish and Game.

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

This project, in cooperation with The Nature Conservancy, accelerates the collection, and compilation of existing resource data needed for evaluation of proposals for habitat protection and acquisition and for other restoration activities.

WHAT

A. Goal

Facilitate acceleration of the Habitat Protection and Acquisition option by collecting and organizing existing resource data needed to evaluate habitat protection and acquisition proposals and for other restoration activities.

WHY

A substantial amount of data on injured resources and services is essentially unusable in its present form due to the data being located in a variety of different Federal and State agencies and in a variety of different and sometimes conflicting formats. A common database usable by all of the Trustee Agencies is needed for these data to be most useful in analysis and identification of critical habitats in the spill affected area.

HOW

The Nature Conservancy, in cooperation with the Trustee Council Agencies and others, will complete collection and compilation of existing resource data from the oil spill affected areas into a database having the following characteristics and "layers":

DATABASE CHARACTERISTICS

The database will be compatible with existing Trustee agency hardware and software. Database "layers" will include, but are not exclusive to the following:

DATABASE "LAYERS"

SOURCE

Line graph (shoreline corrected post-earthquake)	DNR
Cities, towns, villages, roads	DNR (update with current
Land ownership (surface and subsurface; (2.5 acre resolution outside of built up areas)	DNR, FS, FWS, BLM, NPS
Hydrography (remote sensing update)	DNR, FS, USGS, FWS
Hypsography (elevation)	USGS, FS, DNR
Vegetation	FS
Anadromous streams	DFG, FS, DNR
Wildlife habitat	FWS, DFG, FS, NPS, NMFS
Shoreline oiling	DNR, DEC
Management boundaries, conservation units	DNR, FS, FWS, NPS
Easements	BLM, FS, DNR, FWS, NPS
Land use activities	DFG, COE, DNR, DEC, DGC
Bathymetry	DNR
Spruce Bark Beetle Infestation	DNR, FS

ENVIRONMENTAL COMPLIANCE

This project is categorically excluded from formal documentation in an Environmental Impact Statement or Environmental Analysis under Department of Agriculture and Forest Service regulations.

WHEN

The project will start October 1, 1992 and be completed by January 31, 1993.

Project Descriptions

BUDGET (\$K)

	USFS
Personnel	\$ 0.0
Travel	0.0
Contractual	41.0
Commodities	0.0
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 41.0
General Administration	<u>2.9</u>
Project Total	\$ 43.9

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93062

Project Title: Restoration GIS

Project Category: Technical Support

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: None (USF&WS considered separately)

Project Term: March 1, 1993 to September 30, 1993

INTRODUCTION

A. Background

Alaska Department of Natural Resources (ADNR) is currently a major repository for EVOS damage assessment GIS data, most of which is highly relevant to restoration analysis and planning. ADNR GIS provides the most comprehensive, automated land status ownership data available. ADNR also has extensive experience dealing with the various land status implications that result from State and Native selection rights, inholdings and access, and entitlement rights such as navigability and tidelands. ADNR GIS also has extensive experience providing the multi-thematic GIS analysis and mapping that will be required as habitat protection and acquisition becomes a central focus of the Restoration Team.

WHAT

A. Goal

Provide statistical and spatial analysis, and GIS mapping support for approved restoration projects. Products will be map series, data transmittal, and online query support. Consistent, current, and quality control repository services will be provided for this comprehensive geographic database.

B. Objectives

Acquire, convert, and process necessary incremental resource themes that must be integrated geographically to support restoration. For example, acquire slope/aspect data, perform needs analysis with PI, and perform the programming and data synthesis necessary to identify ideal habitats for *Fucus* recovery. Provide maps and statistical analysis products, data repository services and data dissemination. Report to the Restoration Team GIS Review Committee.

WHY

A. Benefits

Using GIS for restoration project support will allow the most informed analysis of geographically dependent information. Using ADNR GIS will allow the current economies of highly specialized personnel, database access, system and project management to transition from the historic damage assessment themes to the restoration focus. ADNR has access to, both directly and through multi-agency contacts, land use planning and land cover databases. Complex restoration alternatives may be rapidly evaluated using a GIS approach.

HOW

A. Methodology

ADNR GIS will work directly with the PIs directing the approved Restoration projects to assess necessary GIS and analysis support. The Restoration Team has provided a tentative list of data themes required for *habitat protection*. These themes are referenced and evaluated below.

<u>Line graph</u>	- Complete as of date.
<u>Cities, towns, villages</u>	- Complete as of date.
<u>Land ownership</u>	- Mostly complete as of date, precision and currency may need to be updated and revised to consider specific project needs.
<u>Hydrography</u>	- Currently being completed, 1:63360, KAP area outstanding only.
<u>Hypsography</u>	- Currently requested from USFS/USGS.
<u>Vegetation</u>	- Currently have some land cover in the affected area, will require largest data gathering and acquisition process for restoration needs.
<u>Anadromous streams</u>	- Currently integrating this information with the hydrography above. Some is complete, with the rest currently scheduled for completion.
<u>Wildlife habitat</u>	- Some of this information is already available via damage assessment studies. Habitat information for uplands will need to be acquired, converted and processed; this work may require extensive effort.
<u>Shoreline oiling</u>	- Complete as of date.
<u>Easements</u>	- Complete for State lands, need to acquire for other lands, convert, and process.
<u>Land-use activities</u>	- Need to acquire, convert, and process from various sources.
<u>Bathymetry</u>	- Complete as of date.

Project Descriptions

Additional approved Restoration projects that have high GIS potential are as follows:

Restoration of Second Growth Habitat for Wildlife in PWS

Harlequin Duck Restoration and Monitoring Study

Natural Recovery of Oiled and Treated Shoreline

Mussels and Sediments

Develop Harvest to Aid Restoration of Injured Terrestrial Mammals and Sea ducks

ADNR GIS will work with the GIS Review Committee of the Restoration Team to identify, analyze, and schedule all data acquisition, conversion, processing, and GIS production work. Additionally, ADNR GIS will work with CACI staff to design and implement an interactive GIS workstation environment to support immediate query needs of the Restoration Team. Analysis and representation of generalized data themes, such as vegetation, land use, and habitat, will be coordinated with and reviewed by the contributing agencies. This type of information coordination, in addition to work with the PIs, is anticipated with the USFS, ADF&G, USF&WS, native corporations, and ADEC. Other coordination efforts may be necessary to integrate broad resource agency information into PI studies.

ENVIRONMENTAL COMPLIANCE

ADNR GIS is a technical service project, and is subordinate to the environmental compliance of the restoration projects supported.

WHEN

ADNR GIS staff will continue to advise the Restoration Team on ongoing data acquisition and processing efforts that are projected to continue, or be initiated, in this seven month period. To the extent feasible, data acquisition that can be initiated before this period, for receipt and processing during this period, will be facilitated by ADNR GIS.

BUDGET (\$K)

	ADNR
Personnel	\$ 87.3
Travel	0.0
Contractual	11.0
Commodities	7.0
Equipment	5.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 110.3
General Administration	<u>13.0</u>
Project Total	\$ 123.3

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93063

Project Title: Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Fish

Project Category: Restoration Manipulation and Enhancement

Lead Agency: Alaska Department of Fish and Game (ADF&G)

Cooperating Agencies: U.S. Forest Service (USFS)

Project Term: March 1, 1993 to October 31, 1993

INTRODUCTION

This project will develop project designs for appropriate and cost-effective salmon spawning habitat restoration and enhancement projects. The *Exxon Valdez* oil spill injured wild pink and chum salmon eggs and fry. Various amounts of oil were deposited in intertidal spawning habitats in Prince William Sound (PWS) where up to 75% of the spawning occurs. Salmon eggs deposited in 1989 and all subsequent years have shown increasing egg mortality. Recently detected genetic damages resulting from oil contamination in spawning beds may further reduce the productivity and fitness of wild salmon populations for many years to come. This project will be undertaken in PWS where portions of the spawning habitat was injured. The benefits of the project will be realized in the communities of Whittier, Valdez, and Cordova which support the commercial fishing industry in the region.

WHAT

The goal of this project is to develop proposals and designs for appropriate and cost-effective instream habitat and stock restoration projects. The following objectives will be achieved:

1. Review existing literature and databases, determine preliminary restoration techniques for specific sites, and identify sites where field studies are needed,
2. Conduct field studies at specific sites to collect data needed to evaluate restoration techniques,
3. Compile available data and select the most appropriate fish restoration projects,
4. Collect additional field data if necessary to develop project design and cost estimates, and write proposals for specific projects, and
5. Estimate the total area of anadromous fish spawning habitat that was oiled in PWS.

WHY

This is an ongoing project currently evaluating various sites in PWS for application of established spawning habitat restoration and enhancement techniques. The project is essential to responsibly develop project proposals and designs to restore and replace damaged salmon spawning habitat. The project was initially funded in September, 1991 near the end of the field season in PWS. Field activities in 1991 focused on evaluation of 41 sites for construction of fish passes and fry weirs. Field activities in 1992 are focused on evaluation of 15 sites for construction of spawning channels. The ADF&G is currently installing standpipes and water temperature/level recorders at these sites to obtain data on groundwater stability and water temperatures. The equipment must be in place throughout the winter to determine minimum temperatures and water levels at each site. Additional funds in FY93 are essential to retrieve the equipment being placed in the field now, analyze data, and prepare project designs.

HOW

Fifteen potential spawning channel sites have been identified in PWS (Willette and Carpenter 1991). Standpipes and electronic water temperature/level recorders are currently being installed at these sites to evaluate groundwater stability and temperature. This equipment must be retrieved from the field in FY93. Data obtained from electronic water temperature/level recorders will be analyzed to evaluate groundwater stability and the probable rate of intragravel flow at potential spawning channel sites. The rate of intragravel flow is an important variable affecting egg-to-fry survival in salmon spawning beds (McNeil 1966).

Data collected from field surveys conducted in FY92 (Willette and Carpenter 1991) will be evaluated in FY93 along with data describing groundwater characteristics. Criteria outlined by Bonnell (1991) will be used to evaluate the suitability of specific sites for the construction of spawning channels. In addition, the estimated increase in fish production and the benefit/cost ratio of the proposed project will be considered. Additional field work may be required to collect engineering data needed to develop detailed project designs. All restoration survey efforts will be coordinated with local landowners and governments.

Literature Cited

- Bonnell, R.G. 1991. Construction, operation, and evaluation of groundwater-fed side channels for chum salmon in British Columbia. In: Proceedings of the Fisheries Bioengineering Symposium, American Fisheries Society Symposium no. 10, pp. 109-124.
- McNeil, W.J. 1966. Distribution of spawning pink salmon in Sashin Creek, Southeastern Alaska, and survival of their progeny. USFWS, Spec. Sci. Rpt.-Fisheries NO. 538.
- Willette, T.M. and G. Carpenter. 1991. Survey and evaluation of instream habitat and stock restoration techniques for anadromous fish. Draft Status Report to the Exxon Valdez Oil Spill Trustee Council, 34p.

Project Descriptions

Willette, T.M. and G. Carpenter. 1991. Survey and evaluation of instream habitat and stock restoration techniques for anadromous fish. Detailed Study Plan (Oil Year 4). Submitted to *Exxon Valdez* Oil Spill Trustee Council, 12p.

ENVIRONMENTAL COMPLIANCE

The project qualifies for a categorical exclusion under the National Environmental Policy Act, because it does not involve any significant manipulation of biological resources or their habitats.

WHEN

This project will continue for five months in FY93. This will allow project staff sufficient time to retrieve equipment placed in the field in FY92, analyze data, collect additional engineering design data if necessary, and prepare detailed project proposals.

June	Retrieve standpipes and electronic water temperature/level recorders from 15 sites.
July	Compile and evaluate data, select sites for development of detailed project proposals.
August	Collect additional engineering data if necessary for project design.
Sept.-Oct.	Prepare detailed project proposals including engineering designs.

BUDGET (\$K)

	ADF&G
Personnel	\$ 38.0
Travel	2.1
Contractual	17.5
Commodities	1.4
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 59.0
General Administration	<u>0.4</u>
Project Total	\$ 59.4

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93064

Project Title: Habitat Protection Fund

Project Category: Habitat/Land Protection

Project Type: Habitat Protection

Lead Agency: Alaska Department of Natural Resources

Cooperating Agencies: Alaska Department of Fish and Game; National Oceanic and Atmospheric Administration; Department of Interior; Alaska Department of Environmental Conservation; U.S. Forest Service

Project Term: January 10, 1992 until completed

INTRODUCTION

Public comment, to date, has overwhelmingly supported use of settlement funds for Habitat Protection and Acquisition as a method of preventing further harm to, and assisting the recovery of, natural resources and services injured by the *Exxon Valdez* oil spill. Numerous proposals or nominations of lands believed to be deserving of protection or acquisition were received from the public as FY93 work plan proposals.

In response, this project demonstrates a strong commitment on the part of the Trustees to accelerate important elements of the Habitat Protection process. The project would be conducted within the context of maintaining the integrity of the overall Restoration Planning process and accompanying compliance with NEPA and other legal and regulatory requirements.

WHAT

The goal of this project is to capitalize on available opportunities to provide protection for those parcels of non-public lands within the oil spill affected area which contain important habitats linked to those natural resources and services injured by the oil spill. The initial focus of the effort will be on those parcels facing imminent threat, where the lack of protection could foreclose restoration opportunities.

This project also allows for the activities necessary to acquire additional data to accurately evaluate and protect/purchase privately held lands within the spill affected area. Also, once acquisition activities commence, it will be necessary to obtain information such as appraisals, preliminary title reports, litigation reports and hazardous material surveys. Furthermore, on-site verification of habitat values may also be necessary.

WHY

Habitat protection and acquisition is one of a number of restoration tools being considered in the draft Restoration Plan scheduled for release for public review and comment in Fall 1993. A final Restoration Plan is expected in May 1994. In the interim, protection of key parcels of non-public lands which contain important habitats is needed to ensure that habitat protection and acquisition is not foreclosed by events preceding Trustee Council adoption and implementation of a final Restoration Plan. This will also allow the application of the full-spectrum of habitat protection actions ranging from moratorium to fee title. This fund provides the wherewithal to bring negotiations to closure when appropriate; exhibits good faith intent on the part of the Trustees; and allows access to monies without long delays.

HOW

1. BY NOVEMBER 15, 1992 - The Habitat Protection and Acquisition Work Group, in cooperation with The Nature Conservancy, will conduct and document a series of workshops to be attended by scientists and other resource specialists for the purpose of (1) assessing the rate and degree of recovery of resources and services injured by the oil spill, and (2) identifying and characterizing the habitats associated with the recovery of injured resources or services. This task is part of Project 93059.
2. ONGOING - The Habitat Protection and Acquisition Work Group will identify those parcels of non-public land within the oil spill affected area which face an imminent threat. If the threat analysis indicates that there is no imminent threat, further analysis of the nomination may be deferred to the more comprehensive habitat protection process.
3. BY DECEMBER 1, 1992 - The Habitat Protection and Acquisition Work Group, through the Restoration Team, will request authority from the Trustee Council to negotiate protection on specific parcels.
4. FOLLOWING DECEMBER 1992 - The Trustee Council approves the results of the negotiations on specific parcels.
5. SUBSEQUENT TO #4 ABOVE - Additional evaluations (i.e. appraisals, biological surveys, title searches) of specific parcels will occur subsequent to Trustee Council approval of the negotiated terms.

WHEN

The project will commence October 1, 1992. There is no set completion date for the project because protection measures will vary depending upon the specifics of each parcel and negotiations may occur over multiple years.

ENVIRONMENTAL COMPLIANCE

Each habitat protection action will be evaluated to determine the level of environmental analysis and documentation necessary to comply with the National Environmental Policy Act (NEPA). It is

Project Descriptions

expected that NEPA compliance for most contemplated protection measures would not exceed an Environmental Analysis level of documentation.

BUDGET (\$K)

	ADNR	ADEC	USFS	AGENCY (TBD)	TOTAL
Personnel	\$ 0.0	\$ 0.0	\$ 0.0	\$ 0.0	\$ 0.0
Travel	0.0	0.0	0.0	0.0	0.0
Contractual **	100.0	100.0	200.0	0.0	400.0
Commodities	0.0	0.0	0.0	0.0	0.0
Equipment	0.0	0.0	0.0	0.0	0.0
Capital Outlay*	<u>7,500.0</u>	<u>0.0</u>	<u>0.0</u>	<u>12,100.0</u>	<u>19,600.0</u>
Sub-total	\$ 7,600.0	\$ 100.0	\$ 200.0	\$12,100.0	\$ 20,000.0
General Administration	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Project Total	\$ 7,600.0	\$ 100.0	\$ 200.0	\$ 12,100.0	\$ 20,000.0

* The total amount dedicated to interim habitat protection may be amended by the Trustee Council following completion of the imminent threat analysis and negotiation process.

** This contractual line-item reflects the expenditure of funds to acquire data necessary to analyze parcels and support acquisition activities.

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93065

Project Title: Prince William Sound Recreation

Project Category: Recreation

Lead Agency: U.S.D.A. Forest Service

Cooperating Agencies: Alaska Department of Natural Resources

Project Term: February 16, 1993 to September 30, 1993

INTRODUCTION

Prince William Sound, the site of the *Exxon Valdez* oil spill, is surrounded by the Chugach National Forest. There are seven Alaska State Marine Parks, six proposed marine parks and large tracks of private land, primarily in Native ownership within the Sound. Prince William Sound offers numerous recreation opportunities, ranging from ocean touring kayaks to large cruise ships. The western part of Prince William Sound lies within the congressionally designated Nellie Juan and College Fiord Wilderness Study Areas and is administered by the Forest Service for its wilderness values.

Both the Chugach National Forest Land Management Plan and the Prince William Sound Area Plan for State Lands emphasize recreation uses within Prince William Sound. Private landowners are also interested in developing recreation opportunities on their lands.

Immediately after the oil spill use by both commercial and non-commercial recreation use decreased. While there is no studies documenting continued reduced levels of recreation use, public perceptions remain that the area has been changed and some tour operators indicate their business has still not returned to pre-spill levels.

WHAT

A small group of recreation experts will be formed to work with the Restoration Team to provide advice and information to the Trustee Council on:

1. Development of an integrated approach for implementing restoration options for recreation in Prince William Sound.

There is an obvious conflict between user groups on the development of any recreation facilities or opportunities that has become apparent in reviewing public input into the development of recreation options for the Restoration Plan. Reaching consensus amongst user groups on appropriate projects and locations is central to this goal. A similar approach to dealing with recreation restoration options for the rest of the oil spill area may be appropriate at a later date.

2. Evaluate recreation management in the Sound to emphasize the world class recreation

opportunities available which may include State and/or Federal special recreation designation.

Task 1 objectives:

1. Assemble and evaluate current information and public comment on the recreation opportunities in Prince William Sound.
2. Coordinate opportunities for recreation development with the various public and private land managers, recreation service providers and users in Prince William Sound and build consensus for implementing restoration options.
3. Develop integrated recreation project proposals for FY94 and beyond.

Task 2 objectives:

1. Identify the steps and/or procedures for State and Federal special designations for any or all of Prince William Sound.
2. Develop goals and objectives for the long term management of Prince William Sound.

HOW

Recreation specialists and planners with site-specific knowledge about Prince William Sound will review information collected on recreation as part of the Draft Restoration Plan and other sources. Working with landowners and commercial and non-commercial recreation user groups they will develop an implementation program for recreation restoration. Specific proposals for implementing the restoration options identified in the Draft Restoration Plan will be developed.

A major part of the work will be in developing a consensus amongst recreation users on the best way to implement restoration options. This will involve working directly with user groups. Some of the work will involve travel to local communities to get participation and agreement from the users.

Task 2 will consist of reviewing agency procedures to outline the steps for carrying out a special area designation for Prince William Sound, should the Trustee Council decide to implement this option.

ENVIRONMENTAL COMPLIANCE

This project is categorically exempt from formal documentation in an Environmental Assessment or Environmental Impact Statement under Forest Service regulations [FSH 1909.15 31.1a(3)].

WHEN

Task 1 will be completed in coordination with the 1994 Work Plan. Task 2 will be completed by September 30, 1993.

Project Descriptions

BUDGET (\$K)

	USFS	ADNR	TOTAL
Personnel	\$ 27.6	\$20.0	\$ 47.6
Travel	6.0	3.3	9.3
Contractual	3.7	2.0	5.7
Commodities	1.0	1.0	2.0
Equipment	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sub-total	\$ 38.3	\$ 26.3	\$ 64.6
General Administration	<u>4.4</u>	<u>3.0</u>	<u>7.4</u>
Project Total	\$ 42.7	\$ 29.3	\$ 72.0

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EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93067

Project Title: Prince William Sound Pink Salmon Stock Identification and Monitoring Studies

Project Category: Recovery Monitoring and Restoration

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: Prince William Sound Aquaculture Corporation;
Valdez Fisheries Development Association

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

A. Background

Wild stock production of pink salmon in PWS has ranged from 10 to 15 million fish in recent years. Much of the spawning for pink salmon (up to 75% in some years) occurs in intertidal areas. Intertidal spawning areas are susceptible to marine contaminants and there is strong evidence the March 24, 1989, *Exxon Valdez* oil spill (EVOS) adversely affected spawning success and early marine survival in Prince William Sound (Sharr et. al. 1992, Willette and Carpenter 1993). Salmon stocks impacted by the *Exxon Valdez* oil spill (EVOS) are also heavily exploited in commercial, sport, and subsistence fisheries. These stocks can most effectively be restored through stock-specific management practices designed to reduce exploitation on impacted stocks. The stocks in areas heavily impacted by the EVOS are present in fisheries dominated by hatchery and wild stocks from unaffected areas of the Sound. The management of this mixed stock fishery has historically been based on maintaining good temporal and spatial distribution of spawning escapement for groups of stocks in eight major fishing districts. The success of this management strategy relies upon the manager's ability to control stock-specific exploitation rates. Restoration premised on stock specific management of the commercial fishery for reduced exploitation of impacted stocks will require even more accurate inseason catch stock composition estimates if different harvest rates are to be achieved for damaged wild stocks versus unimpacted wild stocks or hatchery stocks.

The foundations for this project were firmly established in feasibility studies which were conducted beginning in 1986 and extending through 1988. During the damage assessment process large scale tagging and recovery projects were instituted and perfected by Natural Resources Damage Assessment (NRDA) Fish/Shellfish (F/S) Study #3. Damage assessment funds were expended for tagging hatchery releases of pink salmon in 1989 and 1990 and wild populations of pink salmon in 1990 and 1991. Tag recovery efforts for wild and hatchery pink salmon were funded by damage assessment funds in 1989, 1990, and 1991 and by restoration funds in 1992. Following the loss of funds for further tagging of hatchery stocks of pink salmon in 1990, the private non-profit aquaculture associations in Prince William Sound have continued to tag pink salmon releases at their own expense. Tags applied to pink fry from the four pink salmon hatcheries in Prince William Sound

in 1992 must still be recovered. If recovery efforts proposed here are not instituted in 1993 important restoration and population monitoring data will be irretrievably lost. Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association, and the Alaska Department of Fish and Game have pooled their resources to come up with approximately half of the funds required to field a full fledged pink salmon tag recovery effort in 1993. This project proposal is for matching funds to complete tag recovery efforts and data analyses in 1993.

B. Injury

Results of the Damage to Eggs and Pre-Emergent Fry Project (NRDA F/S Study 2 and Restoration Study 60C, Sharr et al. 1992) indicate that salmon embryos in oiled streams have exhibited a much higher mortality than embryos from comparable unoiled streams since 1989. Results of the Run Reconstruction Project (Restoration F/S Study 28) indicate that the annual adult returns from the southwestern portion of PWS alone may still be hundreds of thousands of fish lower than expected as a result of chronic damage from increased mortalities in embryos from oiled streams and from reduced growth and survival among juveniles rearing in oiled portions of the Sound. This level of chronic population level damage may result in severe over exploitation and drastic reductions in spawning escapement to affected streams. Ultimately, if corrective measures are not taken, these populations may be in danger of extinction.

In the absence of improved stock-specific management capabilities afforded by this project, salmon stocks in western PWS which have already been stressed and depleted by the oil impacts will potentially be over exploited in the commercial, sport and subsistence fisheries. Population levels of stocks may be reduced below those needed for rapid recovery and in some instances may result in virtual elimination of impacted stocks. If adequate stock monitoring programs are not in place, changes in fishing effort to areas of less oil impact could also result in over exploitation of otherwise healthy, unimpacted stocks.

C. Location

Sampling of salmon catches from commercial and cost recovery fisheries will occur in shore based processing plants in Cordova, Valdez, Whittier, and Kodiak. Extraction and decoding of tags will be accomplished by the ADF&G coded-wire tag lab in Juneau. All data analyses will be completed in Cordova with assistance from Anchorage based Alaska Department of Fish and Game biometrics staff.

WHAT

A. Goal

This project is designed to provide estimates of hatchery and wild fish contributions to commercial and cost recovery fisheries in Prince William Sound. These estimates will allow fisheries managers to lessen interceptions of wild fish in mixed stock fisheries.

This project is designed to provide accurate, real time, catch contribution estimates for pink salmon stocks of Prince William Sound. Accurate escapement estimates from ongoing ADF&G escapement monitoring projects will enable managers to identify stocks which are experiencing escapement

Project Descriptions

shortfalls. Accurate and timely catch contribution estimates from this coded-wire tag recovery project will enable managers to identify times and areas where exploitation on depleted wild stocks can be minimized and still permit the harvest of surplus hatchery returns. Post season analyses of the catch contribution estimates together with results from salmon escapement enumeration projects will provide stock-specific estimates of total return and survival and enable managers to assess the effectiveness of stock-specific management strategies.

B. Objectives

- (1) Sample approximately 20% of the pink salmon catches from commercial and cost recovery fisheries in PWS for coded-wire tags;
- (2) Sample approximately 95% of the hatchery pink salmon brood stock in PWS for coded-wire tags;
- (3) Assess the feasibility of using the number of adipose clips observed to estimate temporal and spatial contributions of tagged hatchery stocks of pink salmon to PWS commercial and hatchery harvests;
- (4) Make inseason estimates of the temporal and spatial contributions of tagged hatchery stocks of pink salmon to PWS commercial and hatchery harvests based on the number of tags detected in adipose clipped fish which are recovered during catch sampling;
- (5) Provide timely in-season estimates of hatchery and wild stock contributions to harvests by time and area to fisheries managers so they can closely regulate exploitation of injured wild stocks;
- (6) Use data from fully decoded tags recovered from commercial catches, cost recovery harvests, and hatchery brood stock to verify or adjust inseason contribution estimates;
- (7) Estimate marine survival rates for each uniquely coded hatchery release group and;
- (8) Write a final report which summarizes temporal and spatial distributions of hatchery and wild contributions to commercial and cost recovery harvests in PWS, survival estimates by stock, and fisheries management actions taken to reduce the exploitation on wild stocks based on in-season catch stock composition estimates.

WHY

A. BENEFITS

Pink salmon are the most numerous of the salmon species which spawn in PWS. They act as a vital transport mechanism for energy and nutrients from the high seas to the nearshore and upland areas adjacent to more than one thousand streams around the perimeter of the Sound. Furthermore, wild pink salmon are the cornerstone of the fisheries industry which dominates the PWS economy. Sustained production of wild pink salmon populations is essential to the health and maintenance of many other fish, bird, marine mammal, terrestrial mammals and human populations which reside in PWS. This project will provide a tool for fisheries managers to use in efforts to protect damaged wild populations from commercial fisheries which target on large hatchery returns in western PWS. Marine, freshwater, and upland ecosystems in and around affected streams will benefit as will local fisheries which ultimately depend upon the restoration and long-term health of wild populations.

HOW

A. Methodology

Tag Recovery

(1) Commercial Catches

The Alaska Department of Fish and Game will oversee the recovery of coded-wire tagged fish in commercial salmon harvests in Prince William Sound. The recovery samples will be from a stratified sample (Cochran 1977). Fisheries will be stratified by district and discrete time segments. The recovery will be further stratified by processor as described in Peltz and Geiger (1988). For each time and area-specific stratum, 15% of the pink salmon catch will be scanned for fish with a missing adipose fin. Catch sampling will be done in four fish processing facilities in Cordova, one facility in Whittier, and three facilities in Valdez. When feasible, sampling will occur at facilities in Kodiak, Kenai, Anchorage, and Seward and on large floating processors. All deliveries by fish tenders to these facilities will be monitored by radio and by daily contact with processing plant dispatchers to ensure that the catch deliveries being sampled are district specific.

Scanning commercial pink salmon catches for coded-wire tags involves visually selecting adipose clipped fish from a mixture of unclipped and clipped fish on a conveyor belt. Samplers will select fish on the basis of whether they have a good view of the adipose fin region; negative sampling bias may occur by consistent exclusion of tagged fish. This possible sampling bias will be periodically tested by comparing the tag recovery rates of sampled fish to recovery rates in a complete censuses of sampled loads of fish.

(2) Hatchery Sales Harvests

In addition to catch sampling at the processing facilities, approximately 15% of the fish in the hatchery terminal harvest areas will be scanned for fish missing adipose fins. Because sales harvests are processed at the same processing facilities as commercial harvests, methods and means of sampling sales harvest will be identical to those described for commercial catches.

(3) Hatchery Brood Stocks

Brood stock sampling is critical to estimating hatchery and wild contributions. Due to differential mortality between tagged and untagged fish as well as differential tag loss between release groups, the tag expansion factor at release for hatchery fish may no longer accurately reflect the tag expansion factor in the adult population. Theoretically, brood stock are composed of 100% fish which originated from the hatchery where sampling occurs and are representative of returns from each fry release group. Based on this assumption, tag recovery rates from brood stock can be used to adjust the initial tag expansions for each tagged hatchery release group.

There will be a brood stock tag recovery effort at each of the four hatchery facilities where tags were initially applied. Technicians will be stationed at each of these hatcheries to scan the brood stock during egg take. After the salmon are manually spawned, technicians will use visual and tactile methods to scan approximately 95% of the fish. Total number of fish scanned and total number of fin-clipped fish found will be recorded on a daily basis. Heads and their corresponding data sheets will be picked up on a regular basis and returned to Cordova for editing and shipping to the Juneau tag lab.

Project Descriptions

Results of this study will provide estimates of hatchery and wild stock contributions to commercial harvests, hatchery cost recovery harvests, hatchery brood stocks and wild stock escapements. Stock-specific catch contributions will be by date and fishing district and will be used inseason by fisheries managers to reduce effort on damaged stocks and target effort on healthy hatchery returns. Post season analyses of current year, as well as historic tag recovery data, will be coupled with escapement data for wild stocks to make estimates of wild stock total returns and survival. These data are important as a tool for assessing the effectiveness of various management strategies. Post season analyses of tagging data will also identify trends in the temporal and spatial distributions of stocks in the fisheries. Stock-specific management strategies for oiled populations and other populations affected by altered fisheries management will be developed using tagging data in conjunction with escapement data.

B. Coordination with Other Efforts

The project is funded by the Alaska Department of Fish and Game, Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association, and the Oil Spill Trustee Council. The project will be administered and supervised by the Alaska Department of Fish and Game.

ENVIRONMENTAL COMPLIANCE

All sampling activities for this project are non-intrusive and occur within fish processing plants or fish hatcheries. This project received a categorical exclusion from the requirements of the National Environmental Policy Act. No additional permits are required from the State.

WHEN

June 20 - Sept. 10, 1993	Tag recoveries in commercial fisheries, cost recovery harvests, and brood stocks. In-season catch stock composition estimates by time and area for management of commercial and cost recovery fisheries.
Nov 30, 1993	Draft report
Jan 30, 1994	Final report

BUDGET (\$K)

Personnel	\$ 155.0
Travel	9.6
Contractual	20.4
Commodities	10.3
Equipment	0.0
Capital Outlay	<u>0.0</u>

Sub-total \$ 195.3

General	<u>24.7</u>
Administration	

Project Total \$ 220.0

EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

Project Number: 93068

Project Title: Prince William Sound Chinook, Sockeye, Chum and Coho Salmon Stock Identification and Monitoring Studies

Project Category: Recovery Monitoring and Restoration

Project Type: Fish and Shellfish

Lead Agency: Alaska Department of Fish and Game

Cooperating Agencies: Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association

Project Term: October 1, 1992 to September 30, 1993

INTRODUCTION

A. Background

Salmon stocks impacted by the EVOS are heavily exploited in commercial, sport, and subsistence fisheries and their restoration can most effectively be realized through stock-specific management practices designed to reduce such exploitation on impacted stocks. The damaged populations exist in fisheries dominated by hatchery and wild stocks from unaffected areas of the Sound. The management of this mixed stock fishery has historically been based on maintaining good temporal and spatial distribution of spawning escapement for groups of stocks in eight major fishing districts and its success has relied upon the manager's ability to control stock-specific exploitation rates. Restoration premised on such a management strategy will require even more accurate in-season catch stock composition estimates if lower harvest rates are to be achieved for damaged wild stocks versus unimpacted wild stocks or hatchery stocks.

In the absence of improved stock-specific management capabilities afforded by this project, salmon stocks in western PWS which have already been stressed and depleted by the oil impacts will potentially be over exploited in the commercial, sport and subsistence fisheries. Population levels of stocks may be reduced below those needed for rapid recovery and in some instances may result in virtual elimination of impacted stocks. If adequate stock monitoring programs are not in place, changes in fishing effort to areas of less oil impact could also result in over exploitation of otherwise healthy, unimpacted stocks.

The foundations for this project were firmly established in feasibility studies which were conducted beginning in 1986 and extending through 1988. During the damage assessment process large scale tagging and recovery projects were instituted and perfected by Natural Resources Damage Assessment (NRDA) Fish/Shellfish (F/S) Study #3. Damage assessment funds were expended for tagging hatchery releases of sockeye, coho and chinook salmon in 1989 and 1990 and releases of chum salmon in 1990. Tag recovery efforts for wild and hatchery salmon were funded by damage assessment funds in 1989, 1990, and 1991. Some age classes of these tagged stocks will still be

returning in 1993. If recovery efforts proposed here are not instituted in 1993, important restoration and population monitoring data will be irretrievably lost. Funding was also provided for the Coghill Restoration Project for 1993. In order to assess the success of this project, sockeye tags need to be recovered. Without a method to segregate the wild Coghill sockeye stock from the hatchery stocks, there will be no way to determine the numbers of Coghill sockeye returning to Coghill Lake.

B. Injury

Recent wild stock production in Prince William Sound (PWS) has included from 800 to 900 thousand chum salmon, 300 to 500 thousand sockeye salmon and 10 to 20 thousand coho and chinook salmon. Up to 75% of wild pink and chum salmon spawn in intertidal areas with the greatest proportion of intertidal spawning occurring in streams flowing into the southwestern portion of PWS. Oil from the *Exxon Valdez* oil spill (EVOS) was deposited in intertidal spawning areas for pink and chum salmon and may have adversely affected spawning success and early marine survival for these species in Prince William Sound (Sharr et. al. 1992, Willette and Carpenter 1993). In addition, emergent fry and smolt of all salmon species from throughout PWS migrated through and reared in areas contaminated by oil. The suite of injuries already identified have led to a decline in the size and overall well being of wild pink salmon populations and these effects may persist for several years. Adult returns and tag recoveries for sockeye, chum, and chinook which return at older ages are not complete and the full extent of damage to these species is not yet known.

C. Location

Sampling of salmon catches from commercial and cost recovery fisheries will occur in shore based processing plants in Cordova, Valdez, Whittier, and Anchorage. There will also be sampling in Seward, Kenai, and aboard floating processors if significant numbers of Prince William Sound salmon are processed at those locations. Extraction and decoding of tags will be accomplished by the ADF&G coded-wire tag lab in Juneau. All data analyses will be completed in Cordova with assistance from Anchorage based Alaska Department of Fish and Game biometrics staff.

WHAT

A. Goal

This project is designed to provide estimates of hatchery and wild fish contributions to commercial and cost recovery fisheries in Prince William Sound. These estimates will allow fisheries managers to monitor the size and health of wild salmon populations and lessen interceptions of wild fish in mixed stock fisheries.

This project will provide accurate, real time, catch contribution estimates for salmon stocks of Prince William Sound. Accurate escapement estimates from ongoing ADF&G escapement monitoring projects will enable managers to identify stocks which are experiencing escapement shortfalls. Accurate and timely catch contribution estimates from this coded-wire tag recovery project will enable managers to identify times and areas where exploitation on depleted wild stocks can be minimized and still permit the harvest of surplus hatchery returns. Post season analyses of the catch contribution estimates together with results from salmon escapement enumeration projects will provide stock-specific estimates of total return and survival and enable managers to assess the

Project Descriptions

effectiveness of stock-specific management strategies.

B. Objectives

- (1) Sample 25% of the sockeye, chum, chinook and coho salmon catches from commercial and cost recovery fisheries in PWS for coded-wire tags;
- (2) Sample approximately 95% of the hatchery sockeye, chum, chinook and coho salmon brood stock in PWS for coded-wire tags;
- (3) Make in-season estimates of the temporal and spatial contributions of tagged hatchery stocks of sockeye, chum, chinook and coho salmon to PWS commercial and hatchery harvests based on the number of tags detected in adipose clipped fish which are recovered during catch sampling;
- (4) Provide timely in-season estimates of hatchery and wild stock contributions to harvests by time and area to fisheries managers so they can closely regulate exploitation of injured wild stocks;
- (5) Use data from fully decoded tags recovered from commercial catches, cost recovery harvests, and hatchery brood stock to verify or adjust in-season contribution estimates and;
- (6) Estimate marine survival rates for each uniquely coded hatchery release group where possible.

WHY

A. Benefits

Despite being numerically overshadowed by hatchery stocks in recent years, wild stocks of sockeye, chum, chinook and coho salmon are much more important to the PWS ecosystem and continue to play a vital role in the commercial salmon fishery. Sockeye, chinook and coho salmon also play important roles in diverse freshwater ecosystems around PWS. Sustained production of wild salmon populations is essential to the health and maintenance of many other fish, bird, marine mammal, terrestrial mammals and human populations which reside in PWS.

This project will provide a tool for fisheries managers to use in efforts to protect damaged wild populations from commercial fisheries which target on large hatchery returns in western PWS. Marine, freshwater, and upland ecosystems in and around affected streams and lakes will benefit as will local fisheries which ultimately depend upon the restoration and long-term health of wild populations.

HOW

A. Methodology

Tag Recovery

(1) Commercial Catches

The Alaska Department of Fish and Game will oversee the recovery of coded-wire tagged fish in commercial salmon harvests in Prince William Sound. The recovery samples will be from a stratified sample (Cochran 1977). Fisheries will be stratified by district and discrete time segments. The recovery will be further stratified by processor as described in Peltz and Geiger (1988). For each time and area-specific stratum, 25% of the sockeye, chum, chinook and coho salmon catch will be scanned for fish with a missing adipose fin. Catch sampling will be conducted in four fish processing facilities in Cordova, one facility in Whittier, three facilities in Valdez and one facility in Anchorage. When feasible, sampling will occur at facilities in Kodiak, Kenai and Seward and on large floating processors. All deliveries by fish tenders to these facilities will be monitored by radio and by daily contact with processing plant dispatchers to ensure that the catch deliveries being sampled are district specific.

Scanning commercial salmon catches for coded-wire tags involves visual and tactile assessments of sampled fish on a fresh-frozen line for clipped adipose fins. Technicians will sample fish on the basis of whether they have a good view of the adipose fin region.

(2) Hatchery Sales Harvests

In addition to catch sampling at the processing facilities, approximately 30% of the fish in the hatchery terminal harvest areas will be scanned for fish missing adipose fins. Because sales harvests are processed at the same processing facilities as commercial harvests, methods and means of sampling sales harvest will be identical to those described for commercial catches.

(3) Hatchery Brood Stocks

Brood stock sampling is critical to estimating hatchery and wild contributions. Due to differential mortality between tagged and untagged fish as well as differential tag loss between release groups, the tag expansion factor at release for hatchery fish may no longer accurately reflect the tag expansion factor in the adult population. Theoretically, brood stock are composed of 100% fish which originated from the hatchery where sampling occurs and are representative of returns from each fry release group. Based on this assumption, tag recovery rates from brood stock can be used to adjust the initial tag expansions for each tagged hatchery release group. For species such as sockeye, chum and chinook, which return at different ages, this brood stock information is collected and accumulated and then applied when all age classes of each brood year have returned.

There will be a brood stock tag recovery effort at each of the three hatchery facilities where tags were initially applied to sockeye, chum, chinook and coho salmon. Technicians will be stationed at each of these hatcheries to scan the brood stock during egg take. After the salmon are manually spawned, technicians will use visual and tactile methods to scan approximately 95% of the fish. Total number of fish scanned and total number of fin-clipped fish found will be recorded on a daily basis. Heads and their corresponding data sheets will be picked up on a regular basis and returned to Cordova for editing and shipping to the Juneau tag lab.

Project Descriptions

Results of this study will provide estimates of hatchery and wild stock contributions to commercial harvests, hatchery cost recovery harvests, hatchery brood stocks and wild stock escapements. Stock-specific catch contributions will be by date and fishing district and will be used inseason by fisheries managers to reduce effort on damaged stocks and target effort on healthy hatchery returns. Post-season analyses of current year, as well as historic tag recovery data, will be coupled with escapement data for wild stocks to make estimates of wild stock total returns and survival. These data are important as a tool for assessing the effectiveness of various management strategies. Post-season analyses of tagging data will also identify trends in the temporal and spatial distributions of stocks in the fisheries. Stock-specific management strategies for oiled populations and other populations affected by altered fisheries management will be developed using tagging data in conjunction with escapement data.

ENVIRONMENTAL COMPLIANCE

All sampling activities for this project are non-intrusive and occur within fish processing plants or fish hatcheries. This project meets Federal lead agency requirements for a categorical exclusion from the requirements of the National Environmental Policy Act. No additional permits are required from the State.

WHEN

May 15 - Sept. 30, 1993	Tag recoveries in commercial fisheries, cost recovery harvests, and brood stocks. In-season catch stock composition estimates by time and area for management of commercial and cost recovery fisheries.
November 30, 1993	Draft summary report
January 15, 1994	Final report

BUDGET (\$K)

Personnel	\$ 105.8
Travel	1.1
Contractual	2.8
Commodities	.6
Equipment	0.0
Capital Outlay	<u>0.0</u>
Sub-total	\$ 110.3
General Administration	<u>16.1</u>
Project Total	\$ 126.4

United States
Department of
Agriculture

Forest
Service

Alaska Region

P.O. Box 21628
Juneau, AK 99802-1628

12.4.2

RECEIVED
OCT 22 1992

EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL
October 7, 1992
ADMINISTRATIVE RECORD

Office of the Federal Register
National Archives and Records
Administration
Washington, DC 20408

Dear Sir:

Enclosed for publishing in the Federal Register is the original and two signed copies of a Notice of Availability of the 1993 Draft Work Plan concerning the EXXON VALDEZ oil spill in Prince William Sound, the Kenai Peninsula, lower Cook Inlet, the Kodiak Archipelago and the Alaska Peninsula, Alaska.

Michael A. Barton, the Regional Forester for the Alaska Region, is acting on behalf of the Trustee Council in releasing this notice.

Please notify Dave Gibbons at (907) 278-8012 of the date of publication in the Federal Register.

Sincerely,



MICHAEL A. BARTON
Regional Forester

Enclosures

cc: WO
RO PP&B

FEDERAL REGISTER NOTICE

U.S. FOREST SERVICE, DEPARTMENT OF AGRICULTURE

EXXON VALDEZ OIL SPILL RESTORATION, 1993 DRAFT WORK PLAN.

ACTION: Availability of the 1993 Draft Work Plan for the Exxon Valdez oil spill.

SUMMARY: This notice announces that the 1993 Draft Work Plan ("1993 Document") is now available for public review and comment. The Regional Forester for the Alaska Region, Michael A. Barton, is acting on behalf of the Trustee Council in releasing this notice.

DATES: Comments concerning the 1993 Document must be received by November 20, 1992.

ADDRESSES: Copies of the 1993 Document may be received by contacting the Trustee Council, 645 G Street, Anchorage, AK, 99501. All comments must be written and submitted to: Trustee Council, 645 G Street, Anchorage, AK, 99501.

FOR FURTHER INFORMATION CONTACT: The Oil Spill Public Information Center at the following telephone numbers: (907) 278-8008; In Alaska toll free 1-800-478-7745; Outside Alaska toll free 1-800-283-7745.

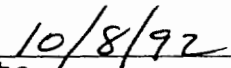
SUPPLEMENTAL INFORMATION: In October, 1991, the Federal Government and the State of Alaska agreed to a settlement for injuries resulting from the rupture of the T/V Exxon Valdez and the discharge of approximately 11 million gallons of North Slope crude oil into Prince William Sound and the Gulf of Alaska. The natural resource Trustees for the State, the Commissioners of the Departments of Fish and Game and Environmental Conservation and the Alaska Attorney General, and for the Federal Government, the Secretaries of Agriculture and the Interior and the Administrator of the National Oceanic and Atmospheric Administration will receive \$900 million in civil damages over the next ten years to be used to restore the environment of the areas affected by the Exxon Valdez oil spill to its prespill condition. A Trustee Council located in Alaska, which is comprised of the Federal Trustees' designees and the State Trustees, are responsible for decisions relating to the assessment of injuries, uses of the funds received for restoration, and all restoration activities, including the preparation of a Restoration Plan. The Trustee Council is continuing a process intended to identify issues that need to be addressed in preparation of the Restoration Plan.

This Notice announces the availability of the 1993 Document and requests comments from the public concerning the proposed damage assessment and restoration activities to take place in 1993 detailed in the Work Plan. Those who have not already requested a copy of the 1993 Document may do so by contacting the Trustee

Council indicated in the above address. Written comments concerning the 1993 Document must be received no later than November 20, 1992.



MICHAEL A. BARTON
Regional Forester
,



Date

U.S. GOVERNMENT PRINTING OFFICE

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