Draft
Fiscal Year 1995 Work Plan

Supplement Volume II

Brief Project Descriptions

Prepared by:

***Exxon Valdez* Oil Spill**
Trustee Council

645 G Street
Anchorage, Alaska 99501
(907) 278-8012

Toll-free within Alaska
1-800-478-7745

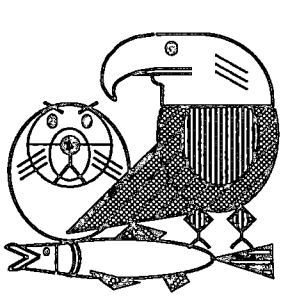
Toll-free outside Alaska
1-800-283-7745

August
1994

ar 12.6.10

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



September 6, 1994

Dear Reviewer:

In late June, you received a three-ring binder that included all FY 95 proposals in response to the *Invitation to Submit Restoration Projects for Fiscal Year 1995*, followed by three "supplement" packets of proposals. Since that time, as a result of a preliminary technical and policy review, these FY 95 proposals have been organized for publication as part of a 4-volume set of documents:

- *Draft Fiscal Year 1995 Work Plan — Summary*
- *Draft Fiscal Year 1995 Work Plan — Supplement Volume I* (category 1 and 2 brief project descriptions)
- *Draft Fiscal Year 1995 Work Plan — Supplement Volume II* (category 3, 4, 5, and 6 brief project descriptions)
- *Draft Fiscal Year 1995 Work Plan — Supplement Volume III* (detailed project budget information)

These documents are being made widely available for public review and comment. (You should have already received a copy of the *Draft Fiscal Year 1995 Work Plan — Summary* and *Supplement I.*) **In order to avoid future confusion, further review and comment on FY 95 proposals should be on the basis of the current versions of the brief project descriptions.** That is, a number of the brief project descriptions you received in late June have been superseded. The most current version of each proposal is included in *Supplement Volume I* and *Supplement Volume II.* These documents will serve as the principle reference documents for FY 95 project proposals.

In a very few instances, there may be some further proposed project modifications. Any additional proposed revisions will be provided to you by September 15. Enclosed, for your reference, you will find a listing of projects indicating those proposals that have been modified since you received the initial 3-ring binder (Attachment A). In most cases, revisions were minor or involved only the budget. Also attached is a listing of projects that have had their numbers changed (Attachment B). If you have questions, please contact Sandra Schubert in the Anchorage Restoration Office (278-8012).

Sincerely,

Molly McCammon

Molly McCammon, Director of Operations

Attachment A

Project No.	Project Title		cat.
95007A	Archaeological Site Restoration - Index Site Monitoring	95007A and proposal intially submitted as 95007-CLO (closeout) were combined into a single project.	1
95007B	Archaeological Site Restoration	Further explanation added to BPD.	1
95019	Distribution and Abundance of Forage Fish as Indicated by Puffin Diet Sampling	Revisions to budget.	1
95021	Seasonal Movement and Pelagic Habitat Use by Common Murres from the Barren Islands	Revisions to budget.	2
95025A	Factors Affecting Recovery of Sea Ducks and Their Prey	Revised along with other parts of the nearshore vertebrate predator project package.	1
95025B	Sea Otter Abundance and Distribution, Food Habits and Population Assessment	Revised along with other parts of the nearshore vertebrate predator project package.	1
95025C	Pigeon Guillemots and River Otters as Bioindicators of Nearshore Ecosystem Health	Revised along with other parts of the nearshore vertebrate predator project package.	1
95025G	Relation of Clam Population Structure to Recovery of Injured Nearshore Vertebrate Predators	Revised along with other parts of the nearshore vertebrate predator project package.	3
95025H	Effects of Predatory Invertebrates on Nearshore Clam Populations in PWS	Revised along with other parts of the nearshore vertebrate predator project package.	1
95026	Hydrocarbon Monitoring: Integration of Microbial and Chemical Sediment Data	Modified methods, changed budget.	1
95027	Kodiak Shoreline Assessment. Monitoring Surface and Subsurface Oil	Modified methods, revised budget.	2
95039	Common Murre Productivity Monitoring	95039 and proposal intially submitted as 95039-CLO (closeout) were combined into a single project.	1
95041	Introduced Predator Removal from Islands - Follow-up Surveys	95041 and proposal intially submitted as 95041-CLO (closeout) were combined into a single project.	1
95075	Population Structure of Blue Mussels in Relation to Levels of Oiling and Densities of Vertebrate Predators	Revised along with other parts of the nearshore vertebrate predator project package	2
95087	Relation of Sea Urchin Population Structure to Recovery of Injured Nearshore Vertebrate Predators	Revised along with other parts of the nearshore vertebrate predator project package.	1
95090	Mussel Bed Restoration and Monitoring in PWS and Gulf of Alaska	95090 and proposal intially submitted as 95090-CLO (closeout) were combined into a single project.	1

Project No.	Project Title		cat.
95093	PWSAC: Restoration of Pink Salmon Resources and Services	Substantial revisions to address wild stock restoration.	4
95102-CLO	Closeout: Murrelet Prey and Foraging Habitat in Prince William Sound	Revision regarding need for project.	5
95110-CLO	Closeout. Habitat Protection and Acquisition	Modified objectives.	5
95117-BAA	Harbor Seals and EVOS: Blubber and Lipids as Indices of Food Limitation	Substantial revisions.	1
95126	Habitat Protection and Acquisition Support	Changes to methods and implementation sections	1
95139B	Closeout: Otter Creek/Shrode Creek Instream Restoration	This closeout project was not included in the initial preliminary review binder.	5
95139C	Montague Riparian Rehabilitation	Minor revision.	2
95141	Afognak Island State Park Interim Support	This project was not included in the initial preliminary review binder.	4
95173	Factors Affecting Recovery of PWS Pigeon Guillemot Populations	95173 and proposal intially submitted as 95173-CLO (closeout) were combined into a single project.	1
95199-CLO	Institute of Marine Science - Seward Improvements EIS	This project was not included in the initial preliminary review binder.	5
95266	Shoreline Assessment and Oil Removal	Revised substantially to include an RFP for shoreline cleanup. Large change in budget.	2
95279	Subsistence Restoration Project	Revised to include NOAA analysis role.	2
95285-CLO	Closeout: Subtidal Sediment Recovery Monitoring	This BPD was not included in the initial preliminary review binder	5
95320A	Salmon Growth and Mortality	Reduced budget	1
95320E	Juvenile Salmon and Herring Integration	Reduced budget. Modified objectives	1
95320G	Phytoplankton and Nutrients	Reduced budget. Modified objectives.	1
95320H	Role of Zooplankton in the PWS Ecosystem	Reduced budget. Modified methods	1
95320J	Information Systems and Model Development	Budget revisions	1
95320M	Observational Physical Oceanography in PWS and the Gulf of Alaska	Budget revisions.	1

Project No.	Project Title		cat.
95320N	Nearshore Fish	Budget revisions. BPD revised significantly.	1
95320T	Juvenile Herring Growth and Habitat Partitioning	Budget revisions. Objectives modified.	1
95320U	Somatic and Spawning Energetics of Herring and Pollock	Budget revisions.	1
95422-CLO	Closeout: Restoration Plan EIS/Record of Decision	Minor revisions.	5
95505B	Data Analysis for Stream Habitat	Minor revisions.	1

Attachment B

FY 95 Project Proposals with Changed Project Numbers

Old No.	Project Title	New No.	Cat.
95054	Montague Riparian Rehabilitation	95139C	2
95139	Otter Creek/Shrode Creek Reports	95139B	5
95139B	Spawning Channel- Port Dick	95139A	2
95139C	Pink Creek and Horse Marine	95139D	3

9/2/94

Dear Reader:

This document, *Draft Fiscal Year 1995 Work Plan - Supplement Volume II*, contains brief descriptions of 79 project proposals submitted to the *Exxon Valdez* Oil Spill Trustee Council for funding in Fiscal Year 1995. These 79 projects are those which, after preliminary review, have been assigned to Evaluation Categories 3, 4, 5 and 6.

Projects assigned to Evaluation Category 3 lack a clear relationship to restoration or are otherwise of low priority. Category 4 projects raise significant legal or policy issues. Category 5 projects fund only data analysis and report writing efforts associated with 1994 projects. Category 6 projects provide funding to complete projects begun in 1994. The preliminary review and categorization were conducted by the Trustee Council's Executive Director, with the assistance of the Chief Scientist, independent peer review scientists, and agency staff. Proposals were reviewed for scientific and technical merit, potential restoration benefit, and legal and policy considerations. The identification of a project in a particular category does not reflect an action or decision on the part of the Trustee Council regarding any specific project or proposal to be funded in FY 95.

Descriptions of projects identified as Evaluation Categories 1 and 2 are contained in *Draft Fiscal Year 1995 Work Plan - Supplement Volume I.* Volume I may be obtained through the *Exxon Valdez* Restoration Office (see address below). Budget information for all projects is contained in *Draft Fiscal Year 1995 Work Plan - Supplement Volume III.* Volume III is available for review at the Restoration Office, and at libraries and Legislative Information Offices throughout the spill area. Copies of individual project descriptions or budgets may be requested by calling the Restoration Office (see telephone numbers below).

A complete discussion of the Trustee Council's restoration efforts, including the project proposal and evaluation process, is contained in the *Draft Fiscal Year 1995 Work Plan - Summary.* Copies of the summary are available from the Restoration Office.

Exxon Valdez Oil Spill Trustee Council Restoration Office
645 G Street
Anchorage, Alaska 99501
Telephone (907) 278-8012 (toll-free within Alaska at 1-800-478-7745;
from outside Alaska at 1-800-283-7745)

Project descriptions contained in the *Draft Fiscal Year 1995 Work Plan - Supplement Volume II* appear in numerical order. Most of the project descriptions contain the following information:

Project Number: A numerical coding assigned for tracking purposes.

Restoration Category: The means by which a project would achieve restoration goals. The restoration categories are research; monitoring; general restoration; habitat protection and acquisition; administration, public information and science management; and restoration reserve.

Proposed By: The organization or individual that submitted the project.

Lead Trustee Agency: For projects not submitted by one of the six Trustee Agencies, the agency that has been assigned administrative responsibility for the project. The six Trustee Agencies are the Alaska Department of Environmental Conservation (ADEC), the Alaska Department of Fish and Game (ADFG), the Alaska Department of Natural Resources (ADNR), the U.S. Department of Interior (DOI), the U.S. Forest Service (USFS), and the National Oceanic and Atmospheric Administration (NOAA).

Cooperating Agencies: Trustee Agencies, other than the Lead Trustee Agency, that would participate in implementation and management of the project.

Cost FY 95: The amount of money being requested for the project in federal fiscal year 1995 (October 1, 1994 - September 30, 1995).

Cost FY 96: The amount of money that will be requested for the project in federal fiscal year 1996 (October 1, 1995 - September 30, 1996).

Total Cost: The total amount of money, if known, that will be requested to bring the project to completion.

Duration: The total number of fiscal years, if known, for which money will be requested for the project.

Geographic Area: The geographic area in which the field work on the project will take place.

Injured Resource/Service: The resource or service injured by the spill that the project is designed to restore.

DRAFT FISCAL YEAR 1995 WORK PLAN

— Evaluation Category 3, 4, 5 and 6 Projects —

(FY 95 dollar figures in thousands)

Project No.	Project Title	Project Proposer	Project Type	FY 95	Cat.
95002	Leave No Trace Education Program	Ford, National Outdoor Leadership School	General Restoration	$177.7	4
95003	Area E Commercial Salmon Permit Buyback Program	Mykland	General Restoration	$11,735.0	4
95006	Paint River Pink Salmon Development	Mears, Cook Inlet Aquaculture Assn.	General Restoration	$173.9	3
95009A	Trophics and Community Structure in the Intertidal and Shallow Subtidal	Highsmith, UAF	Research	$455.4	3
95009B	Primary Productivity as a Factor in the Recovery of Injured Resources in Prince William Sound	Stekoll, UAF	Research	$218 9	3
95009E	Community Structure of Mobile Foragers Using the Nearshore	USFS	Research	$280.5	3
95010	Intertidal Fauna and Flora Species Composition, Abundance and Variability Relative to Physical Habitat Controls	Schoch, Oregon State Univ.	Research	$73.5	3
95016	A Tribute to Prince William Sound	Kremen	General Restoration	$161.0	4
95017	Port Graham Coho Salmon Subsistence Fishery Restoration Project	Daisy, Aquafarm	General Restoration	$587.9	3
95022	Foraging Efficiencies at Temporary Food Patches	Scheel, PWS Science Center	Research	$183.1	3
95025D	Settlement Rates of Nearshore Invertebrates, Oceanic Processes and Population Recovery: Are They Linked?	DOI	Research	$435.7	3
95025G	Relation of Clam Population Structure to Recovery of Injured Nearshore Vertebrate Predators	Jewett, UAF and Van Blaricom, NBS	Research	$208.5	3
95025J	Primary Productivity as a Factor in the Recovery of Injured Resources in Prince William Sound	Stekoll, UAF	Research	$397.0	3

DRAFT FISCAL YEAR 1995 WORK PLAN

— Evaluation Category 3, 4, 5 and 6 Projects —

(FY 95 dollar figures in thousands)

Project No.	Project Title	Project Proposer	Project Type	FY 95	Cat.
95042	Five-year Plan to Remove Predators from Seabird Colonies	Harrison, Pacific Seabird Group	General Restoration	$75.0	4
95043A	Cordova Cutthroat Trout Habitat	USFS	General Restoration	$22.7	3
95043B	Carry-forward: Cutthroat and Dolly Varden Rehabilitation in Western PWS	USFS	General Restoration	$108.6	6
95045	Green Island Intertidal Restoration Monitoring	Juday and Foster, UAF	Monitoring	$26.4	3
95046	Long-term Record in Tree Rings of Climatic Features	Juday, UAF	Research	$153.6	3
95047	Seal Contamination	McKee	General Restoration		3
95049	Independent Review of Restoration and Monitoring Projects	Ruggerone, Natural Resources Consultants	Administration and Public Information	$31.9	3
95050	A Test of Sonar Accuracy in Estimating Escapement of Sockeye Salmon	Ruggerone, Natural Resources Consultants	Research	$79.3	4
95053	Cordova's Mini-Imaginarium	Trowbridge, PWS Science Center	General Restoration	$62 6	4
95055	Prehistoric Ecological Baseline for PWS	USFS	Research	$256.1	3
95060	Spruce Bark Beetle Infestation Impacts on Injured Fish and Wildlife Species of the *Exxon Valdez* Oil Spill	ADFG	Habitat Protection	$213.9	4
95065	PWSAC Pink Salmon Fry Mortality	Olsen, PWS Aquaculture Corporation	Research	$59.6	4
95071	Monitoring Nearshore Fish Species for Persistence of Oil Exposure and Ecotoxicological Effects	NOAA	Research	$231.0	3
95073	Impact of Killer Whale Predation on Harbor Seals in PWS	NOAA	Research	$228.2	3

DRAFT FISCAL YEAR 1995 WORK PLAN

— Evaluation Category 3, 4, 5 and 6 Projects —

(FY 95 dollar figures in thousands)

Project No.	Project Title	Project Proposer	Project Type	FY 95	Cat.
95077	Recreation Impacts in PWS: Human Impacts as a Factor Constraining Long Term Ecosystem Recovery	Ford, National Outdoor Leadership School	Research	$117.0	3
95078	Culture, History, and Ecosystems: Assessment of Cultural/Historical Strategies to Building Long-term Understanding of Ecosystems in the Oil Spill Area	DOI	Research	$166.7	3
95079	Pink Salmon Restoration Through Small-scale Hatcheries	Van Hyning, NERKA, Inc., Aquabionics Inc.	General Restoration	$150.0	4
95080	Fleming Spit Recreation Area Enhancements	The Cordova Sporting Club	General Restoration	$1,365.0	4
95082	"Mor-Pac Hill" Campground Improvements	The City of Cordova	General Restoration	$360.0	4
95084	Odiak Camper Park Expansion	The City of Cordova	General Restoration	$266.0	4
95085	Cordova Historical Marine Park	Cordova Planning and Harbor Commission	General Restoration	$196 5	4
95086B	Population Dynamics of Eelgrass and Associated Fauna	Stekoll, UAF	Research	$78.3	3
95093	PWSAC: Restoration of Pink Salmon Resources and Services	Olsen, PWS Aquaculture Corporation	General Restoration	$1,690.3	4
95095	Quantification of Stream Habitat for Harlequin Ducks and Anadromous Fish Species from Remotely Sensed Data	Podolsky, Avian Systems, Inc.	Habitat Protection	$88.0	3
95096	Restoration of Murres by Way of Social Attraction and Predator Removal	Podolsky, Avian Systems, Inc.	General Restoration	$167.0	3
95097	Restoration of Murres by Way of Transplantation of Chicks: A Feasibility Study	Podolsky, Avian Systems, Inc.	General Restoration	$176.0	3
95098	Identification of Seabird Feeding Areas from Remotely Sensed Data	Podolsky	General Restoration	$74.0	3

DRAFT FISCAL YEAR 1995 WORK PLAN

— Evaluation Category 3, 4, 5 and 6 Projects —

(FY 95 dollar figures in thousands)

Project No.	Project Title	Project Proposer	Project Type	FY 95	Cat.
95099	Murrelet Vocalization in Conjunction with Artificial Nests. A Possible Means of Attraction to Habitat	Podolsky	General Restoration	$77.0	3
95102-CLO	Closeout: Murrelet Prey and Foraging Habitat in Prince William Sound	DOI	Research	$63 8	5
95107	Subtidal Site Verification	Jewett, UAF	Monitoring	$56 2	4
95110-CLO	Closeout: Habitat Protection and Acquisition	ADNR	Habitat Protection	$143.9	5
95111	Sustainable Rockfish Yield	ADFG	General Restoration	$222.6	3
95112	Rockfish Restoration Objective	ADFG	General Restoration	$53.7	3
95113	Energetics of Intertidal Fish: The Connection between Lower and Upper Trophic Levels	Barber, UAF	Research	$392.5	3
95114	Eelgrass Community Structure Restoration Assessment Using Stable Isotope Tracers	Kline, PWS Science Center	Research	$145.1	3
95116	Restoration of Intertidal Oiled Mussel Beds by Nondestructive Manipulation/Flushing with PES-51	Rog, PES Services AK, Inc	General Restoration	$453.2	4
95119-BAA	Food Limitation on Recovery of Injured Marine Bird Populations	Sydeman, Point Reyes Bird Observatory	Research	$124.9	3
95122	Mapping Potential Nesting Habitat of Marbled Murrelets in PWS Using Geographic Databases	DeVelice	Habitat Protection	$167.5	3
95123	Tatitlek Community Store	Komkoff, Tatitlek IRA Council	General Restoration	$300.0	4
95124A	Tatitlek Mariculture Development Project	Daisy, Tatitlek IRA Council	General Restoration	$109.5	4
95124B	Tatitlek Mariculture Development Project - Capital Outlay	Daisy, Tatitlek IRA Council	General Restoration	$405.0	4

DRAFT FISCAL YEAR 1995 WORK PLAN

— Evaluation Category 3, 4, 5 and 6 Projects —

(FY 95 dollar figures in thousands)

Project No.	Project Title	Project Proposer	Project Type	FY 95	Cat.
95125	Tatitlek Sockeye Salmon Release Program	Komkoff, Tatitlek Traditional Council	General Restoration	$39 0	4
95127	Tatitlek Coho Salmon Release Program	Komkoff, Tatitlek Traditional Council	General Restoration	$39.0	4
95128	Teaching Subsistence Practices and Values	Callaway, NPS	General Restoration	$69.0	4
95129	Tatitlek Fish and Game Processing Center and Smokery	Komkoff, Tatitlek IRA Council	General Restoration	$515.5	4
95130	Mental Health Center	Vlasoff, Chugachmuit and Copper Mountain Foundation	General Restoration	$106.1	4
95134	Chenega Bay Mariculture Development Project	Evanoff, Chenega Bay IRA Council	General Restoration	$184.3	4
95135	Subsistence Harvest Support	Chenega Bay Village IRA Council	General Restoration	$50.0	4
95136	Skin Sewing Crafts Restoration	Callaway, NPS	General Restoration	$29.9	4
95139B	Closeout: Otter Creek/Shrode Creek Instream Restoration	USFS	General Restoration	$5.2	5
95139D	Salmon Instream Habitat and Stock Restoration--Pink Creek and Horse Marine Barrier Bypass Development	ADFG	General Restoration	$61 5	3
95140	Subsistence Skills Program	Olsen, Valdez Native Association	General Restoration	$36.7	4
95141	Afognak Island State Park Interim Support	ADNR	General Restoration	$309 4	4
95165	Carry-forward: PWS Herring Genetic Stock Identification	ADFG	General Restoration	$105.4	6
95199-CLO	Institute of Marine Science - Seward Improvements EIS	ADFG	Research	$45.9	5
95200	Public Access	USFS	Habitat Protection	$50.2	3

DRAFT FISCAL YEAR 1995 WORK PLAN

— Evaluation Category 3, 4, 5 and 6 Projects —

(FY 95 dollar figures in thousands)

Project No.	Project Title	Project Proposer	Project Type	FY 95	Cat.
95259	Restoration of Coghill Lake Sockeye	ADFG	General Restoration	$333.0	3
95285-CLO	Closeout Subtidal Sediment Recovery Monitoring	NOAA	Monitoring	$121.0	5
95320B	PWS Pink Salmon Stock Identification and Monitoring (CWT)	ADFG	General Restoration	$84.3	4
95320C	Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon in PWS	ADFG	General Restoration	$642.2	4
95320I(3)	Purchase of Isotope Radio Mass Spectrometer	Schell, Institute of Marine Science	Research	$257.4	3
95320K	PWSAC: Experimental Fry Release	Olsen, PWS Aquaculture Corporation	Research	$47.3	4
95320V	Herring Predation by Humpback Whales in PWS	Matkin, North Gulf Oceanic Society	Research	$279 8	3
95417	Carry-forward: Waste Oil Disposal Facilities	ADEC	General Restoration	$232.2	6
95422-CLO	Closeout: Restoration Plan EIS/Record of Decision	USFS	Administration and Public Information	$20.0	5
95428-CLO	Closeout: Subsistence Planning Project	ADFG	General Restoration	$100.1	5

Leave No Trace Educational Program: Reducing Human Impact to Assist Long Term Ecosystem Recovery

Project Number: 95002

Proposed By: The National Outdoor Leadership School (NOLS)

Don Ford
NOLS Alaska Director
Box 981
Palmer, AK 99645
907-745-4047

Rich Brame
NOLS Outreach & Training
288 Main Street
Lander, WY 82520
307-332-8800

Lead Trustee Agency: USFS

Cooperating Agencies: ADNR

Cost FY 95: $158,700

Cost FY 96: $95,600

Total Cost: $254,300

Duration: 2 years

Geographic Area: Prince William Sound

Injured Resource/Service: Recreation and tourism

INTRODUCTION

Through a Memorandum of Understanding signed in the spring of 1993, the National Outdoor Leadership School (NOLS) has become a partner with the U.S. Forest Service, National Park Service, and Bureau of Land Management in the national Leave No Trace (LNT) program. Leave No Trace is an educational program designed to give users the best minimum-impact techniques and ethics available for their recreational use of America's wildlands. NOLS, as the leader in backcountry education and leadership, has committed to develop and distribute LNT curriculum and educational materials for all major backcountry recreational environments nation-wide.

NOLS seeks funding from the Trustees, through a contract with the USDA Forest Service, for a three phase Leave No Trace educational project. The phases can be funded and conducted as a whole or as separate and distinct projects. The three proposed phases also address a comprehensive variety of target audiences and learning styles while keeping to NOLS'

traditional strength and philosophy: hands-on education works.

By educating the users of PWS, the Leave No Trace program will help reduce the human impacts detrimental to long term ecosystem recovery.

PROJECT DESCRIPTION

The three phases of the Leave No Trace program for Prince William Sound serve to minimize the impacts caused by kayakers, tour groups, hunters, and other recreationist. This is particularly important on the Sound where the EVOS has changed the natural character and resilience of many beaches and bays. Changes in the traditional recreation patterns and locations caused by the spill mean that formerly pristine or infrequently used areas are now receiving heavier use. Additionally, with increase notoriety as a result of the spill, more people are coming to the Sound. The effect of this increased and concentrated recreational use can be mitigated through education using common themes and valid research.

A. Objectives

1. Through education, reduce impacts of recreation users on recovering resources and in areas that are experiencing increased or new use resulting from changed use patterns.

2.. Educate a wide array of user groups in PWS on minimum-impact techniques and ethics.

3. Create a contingent of educators in Alaska who can train others in minimum-impact techniques.

B. Methods

The methods used to educate recreation users of Prince William Sound on minimum-impact techniques and ethics is accomplished in three phases.

Phase I

During the summer of 1995, NOLS will reproduce and distribute 10,000 Leave No Trace Outdoor Skills & Ethics Temperate Coastal Zones booklets which present the principles, ethics, and techniques of minimum-impact sea kayaking in southern Alaska. Guides, outfitters, hunters, tour group operators and user groups will be targeted for this written information.

During the early spring of 1995, NOLS staff will adapt the existing LNT Outdoor Skills & Ethics: Temperate Coastal booklet into a shorter pamphlet format designed for casual users such as tour participants, clients and interested travelers to the area. NOLS will work with the Forest Service, AK Department of Natural Resources, and organized user groups to distribute 50,000 copies of the LNT Coastal pamphlet during the 1995 and 1996 recreational seasons.

Phase II

Over a two-season period, NOLS will train 100 grant-funded user group representatives as Masters of Leave No Trace. The LNT Masters program is a six-day field course which thoroughly covers the techniques and ethics of minimum impact use for a given environment and also teaches the Masters how to present LNT to others. This proven curriculum and pyramid-style of intensive training has the goal of improving the use and preservation on recreational lands and coasts.

Targeted participants will have strong boating or kayaking background, be interested in education, and will be in positions where they can teach others such as the public, youths, or clients. Chugach National Forest and AK Department of Natural Resources should enact measures requiring certain types of commercial permit holders and employees to go through this course.

Phase III

In order to educate recreationists well before they actually enter Prince William Sound in 1996, NOLS will create a brief (20 minute) educational video of Leave No Trace techniques and ethics in Prince William Sound and other similar temperate coastal environments. Two hundred fifty videos will be provided at no cost to education programs, user groups, youth organizations, federal and state agencies, oil spill response agencies, Alaska Native corporations, outfitters and tour operators in PWS and in the communities of Valdez, Whittier, Tatitlek, Chenega and Cordova. Additional videos will be provided for sale to the public through NOLS and the Forest Service. This video will utilize a professional production company and use the existing NOLS productions of Soft Paths and Canyon Soft Paths as basic models.

C. Schedule

1/95	Contract between NOLS and Chugach National Forest
4/95	Create short pamphlet on LNT Outdoor Skills and Ethics Identify target participants ;for the LNT Masters
5/95 - 9/95	Distribute short pamphlet on LNT Outdoor Skills and Ethics
5/95 - 8/95	Conduct five LNT Masters Training Session in PWS
11/95	Progress Report submitted
12/95	Develop Challenge Cost Share Agreement with Forest Service for video production
3/96	Video script and storyboards completed
4/96 - 9/96	Filming for video
5/96 - 9/96	Continue distribution of pamphlet and booklet
5/956- 8/96	Conduct five more LNT Masters Training Session in PWS
11/96	Video completed and distributed
12/96	Final project report due

D. Location

This project will focus on Prince William Sound. The lands and communities used by

recreationist in Prince William Sound will benefit by this educational program. The principles of leave no trace may also carry to areas outside of PWS and the program could be expanded, with additional funding, to cover the entire spill affected area.

E. Technical Support

None needed.

FY95 BUDGET ($K)

FY 1995	USFS	ADNR	TOTAL
Personnel	10.0	5.0	15.0
Travel	1.5	0.0	1.5
Contractual	139.2	0.0	139.2
Commodities	0.0	0.0	0.0
Equipment	0.0	0.0	0.0
Sub-Total	150.7	5.0	155.7
Gen. Admin.	21.6	0.4	22.0
Total	172.3	5.4	177.7

Project #95003

Doc.#9506l3003

6/10/94

Cover Page For Invitation To Submit Restoration Projects For Fiscal Year 1995

1. Area E Commercial Salmon Permit Buyback Program

2. Project leader to be determined at a later time

3. State of Alaska, Commercial Fisheries Entry Commission
   8800 Glacier Hwy, #109
   Juneau, Ak 99801

4. Estimated cost of project, $11,735,000.00

5. 1/1/95, Completion date unknown

6. Until 25% of permits are retired and not to be reissued

7. Prince William Sound

8. James L. Mykland
   P.O. Box 1241
   Cordova, AK 99574
   907-424-7115

B. Introduction:

Commercial Salmon Fishing was injured by the EVOS. Each year that commercial fishing remains below prespill levels compounds the injury to the fishermen and, in many instances, the communities in which they live and work.

Prince William Sound is the only area in the oil spill impacted area that is experiencing major salmon run failures.

Prince William Sound Acqualture Corporation, which relies on pink salmon stocks to generate cost recovery funds, have been experiencing low pink salmon survival rates during the past three years. Conversely PWSAC's board of directors have voted to increase the cost recovery rate to 40% of total hatchery produced salmon stocks. This will put an additional burden on the common property fishery which is already reeling from run failures plus low prices.

C. Need for Project:

As long as Commercial Fishing and Pink Salmon are listed as a non-recovering resources the restoration of Prince William Sound will not be completed.

The genetic damage done to pink salmon stocks may take as long as ten to twenty years to be resolved.

If the commercial salmon fishing fleet is reduced then the social economic viliability of the rest of the fleet may be preserved until Prince William Sound is restored to pre-spill conditions.

This buyback program will help restore and contribute to the recovery of the Commercial Fishing Fleet in Prince William Sound.

D. Project Design:

The objective of this buyback program would be to purchase and retire 25% of the Salmon Purse Seine, Drift Gillnet, and Set Gillnet in Area E (PWS) of the State of Alaska Commercial Fisheries Registration Area.

The permits would be bought back at current market value.

The retirement of these permits would have to be done in conjuncture and regulation with the Commercial Fisheries Entry Commission

E. Project Implementation

The State of Alaska CFEC would be the state agency that implements this program.

G. Public Process

The majority of limited entry salmon permit holders from Area E are willing to support such a program.

Summary and Conclusions:

Poor returns of salmon stocks to Prince William Sound have caused severe impacts to commercial fisheries. The economic viability for the commercial fishermen in Prince William Sound is almost nil. There are not enough salmon stocks to support the commercial fishing fleet in its present state.

Commercial Fishermen are a resouce that is non-recovering. As long as salmon run failures continue to occur more commercial fishermen will be facing economic hardships unparalleled in the commercial fishing history of Prince William Sound.

Salmon stock recovery could take Ten to Twenty years. At least 25% of commercial fishermen in Area E will not be able to survive this recovery duration.

A commercial fishing permit buyback program will help the commercial fishing resource to recover and hopefully survive until the complete restoration of Prince William Sound has been done.

This page intentionally left blank.

Project 95006

TITLE: PAINT RIVER PINK SALMON DEVELOPMENT PROJECT

PROJECT LEADER: Thomas E. Mears

LEAD AGENCY: Cook Inlet Aquaculture Association

COST OF PROJECT:

FY 95	$ 173,943
FY 96	215,000
FY 97	150,000
FY 98	30,000

PROJECT START-UP/ COMPLETION DATES:

June 1995 through August 1998

PROJECT DURATION: 4 years

GEOGRAPHIC AREA: Kamishak Bay in Lower Cook Inlet

CONTACT PERSON:

Thomas E. Mears
Cook Inlet Aquaculture Association
HC 2, Box 849
Soldotna, Alaska 99669
(907) 283-5761

INTRODUCTION

In 1989 oil from the Exxon Valdez spill fouled Kamishak Bay waters sufficiently to preclude customary commercial salmon fishing activities.

Paint River runs into the Kamishak Bay of Lower Cook Inlet about 100 miles WSW of Homer, Alaska.

Paint River watershed is contained within the expanded McNeil River State Game Sanctuary and newly created McNeil River State Game Refuge. Paint River did not previously produce salmon; a tidewater falls prevented fish access.

This project will aid restoration by developing a significant run of pink salmon at Paint River. The run, once developed, will be sustained through natural spawning.

Alaska Department of Fish and Game (ADF&G) and Cook Inlet Aquaculture Association (CIAA) have jointly determined the feasibility and desirability of establishing Paint River salmon populations. Paint River is believed capable of producing annual returns of more than 1.7 million adult salmon including up to 900,000 pink salmon.

NEED FOR THE PROJECT

This project will restore damaged pink salmon resources through development of a new naturally reproducing run.

PROJECT DESIGN

Objectives:

- Collect 8 million pink salmon eggs from Bruin Bay River for two consecutive years.

  Transport collected eggs to Tutka Hatchery for incubation.

  Transport about 6.8 million pink salmon fry from Tutka Hatchery for Paint River release.

- Construct crew cabin at Paint River intertidal fish ladder.

- Finish covering the fish ladder with bear proof grating.

- Monitor adult return as fish ascend the intertidal fish ladder for two consecutive years.

- Aerially survey Paint River watershed to determine distribution of spawning fish for 2 consecutive years.

Methods:

Pink salmon egg collections will occur at a weir erected above the intertidal zone in Bruin Bay River. Broodstock will be ripened in the River and spawned using delayed fertilization techniques. Broodstock carcasses will be returned to the River.

Iced containers of eggs and milt will be transported to Tutka Hatchery via floatplane. At the hatchery eggs will be fertilized, sanitized and loaded into NOPAD incubators. Standard incubation procedures will be utilized.

In the spring emergent fry will be transported from Tutka Hatchery to Paint River for immediate release several miles above the intertidal falls. Transport will be accomplished using an oxygenated tank slung from a helicopter.

A cabin about 18'x24' will be constructed adjacent to the Paint River intertidal fish ladder to house personnel necessary to operate the fish ladder. A bear proof fence (7' high cyclone fence with metal posts, fencing extending 4'below ground level, topped with multiple strands of barbed wire and electrified) will enclose the crew cabin.

As originally designed and constructed, about 2/3 of the upper surface of the fish ladder was fitted with grating to protect against intentional or accidental entry by bears. The remaining third was intended to be protected by fencing. The fencing appears to be inadequate and will be removed. The remaining portion of the fish ladder fitted with grating.

Adult pink salmon returns will be counted, weighed and sexed as fish ascend the intertidal fish ladder. Operating personnel will regulate ladder flows as required to afford fish passage.

As adult pink salmon migrate into the Paint River watershed, weekly aerial surveys will be conducted in order to determine the distribution of spawning fish.

Schedule:

CIAA would plan to construct the crew cabin and bear-proof fence and install grating on the fish ladder in June, 1995.

The pink salmon egg collections would occur in August of 1995 and 1996. Fry releases would occur in late May to early June, 1996 and 1997.

Ladder operation and adult return monitoring would occur through July and August of 1997 and 1998.

Technical Support:

CIAA operates Tutka Hatchery under a contract with ADF&G.

Location:

Paint River is a tributary of Kamishak Bay on the westside of Lower Cook Inlet about 100 miles from Homer, Alaska. Paint River watershed is contained within the expanded McNeil River State Game Sanctuary and the McNeil State Game Refuge.

PROJECT IMPLEMENTATION-

This project should be implemented by CIAA under auspices of ADF&G.

COORDINATION OF INTEGRATED RESEARCH EFFORT-

As fish are allowed into the Paint River watershed, ADF&G biologists will attempt to determine the effects on bear distribution or behavior.

PUBLIC PROCESS-

Through the 15-year history of the Paint River project there have been several workshops and public meetings, public involvement through the Legislative process which expanded McNeil Sanctuary and created the McNeil Refuge, public notice and review through the construction permitting process, public notice through the Alaska Board of Game process and one court action attempting unsuccessfully to prevent fish ladder construction.

Additional public and agency review would occur as State of Alaska fish transport permits and Tutka Hatchery management plan alterations are sought.

PERSONNEL QUALIFICATIONS-

Thomas E. Mears has B.S. and M.S. degrees in Fisheries Science from Michigan State University. Mr. Mears taught fisheries technician training courses at Alpena (Michigan) Community College for 10 years. Mr. Mears has been employed by CIAA as Biologist and as Executive Director since 1979 and is intimately familiar with the Cook Inlet drainage and all relevant salmon enhancement techniques.

PROJECT 95006

BUDGET- Fiscal Year 1995 Budget Summary

Construct Crew Cabin and Fence, Install Grating

Personnel	
Construction Labor	$ 3,800
Travel	0
Contractual Services	
Backhoe and Small Equipment Rental	2,000
Barge Charter	9,750
Boat Charter	750
Commodities	
Cabin Materials	6,800
Miscellaneous	1,000
Bolts and Brackets	1,500
Food	750
Equipment	
Grating (inc. shipping to Anc.)	30,750
Cabin Stove, Lights, Communications, ets	2,500
Fence Materials	12,000
Capital Outlay	0
General Administration (10%)	7,160
Subtotal	$78,760

Pink Salmon Egg Collection

Personnel	
Field Personnel	$21,484
Principal Investigator	11,640
Travel	
Field Personnel	2,021
Principal Investigator	650
Contractual Services	
Air Charter	30,323
Equipment Rentals	1,202
Egg Incubation (in kind donation)	0
Commodities	6,153
Equipment	13,049
Capital Outlay	0
General Administration (10%)	8,652
Subtotal	$95,174

FY 1995 Total $173,934

This page intentionally left blank.

Trophics and Community Sructure in the Intertidal and Shallow Subtidal.

Project Number:	95009A
Restoration Category:	Research
Proposed By:	University of Alaska
Lead Trustee Agency:	USFS
Cooperating Agency:	ADFG
Cost FY 95:	$455,418
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	2-5 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Intertidal and subtidal organisms

INTRODUCTION

Injury to the biological resources of Prince William Sound resulted from the 1989 *Exxon Valdez* oil spill (EVOS), and may be continuing. While some species are known to be recovering, the status of many others remain unknown or are known to be deteriorating. The list of injured biological resources not recovering includes birds, fish, and mammals, as well as both intertidal and subtidal organisms. Injured services include commercial, sport, and subsistence harvests of these non-recovering resources.

The disruption and recovery of community structure is the most pressing issue for research in the nearshore. Most of the non-recovering injured species are predators on nearshore marine organisms. Nearshore resources also provide important breeding or spawning habitat for many injured species. The April 1994 EVOS workshop on research priorities identified seven major hypotheses about processes limiting recovery of nearshore groups of injured resources. Of these seven hypotheses, five were directly related to the trophic structure of nearshore systems. Although the specifics vary, nearshore trophic hypotheses were considered a research priority for nearly all injured/non-recovering resources. The set of research projects proposed here are designed to address these hypotheses by examining variation in, and mechanisms affecting, trophic relationships in the nearshore ecosystem.

Trophic relationships between organisms determine energy flow through a system. These projects therefore share a common focus on major energy pathways. They are designed to examine the regulation of energy pathways in nearshore systems by first, focussing on a large, seasonal and short-lived input of energy into a restricted nearshore area (herring spawn deposition), and second, by examining variation connected to the presence or absence of a dominant predator (sea otters). Each condition is provided by a natural experiment in Prince William Sound. Large, local variation in energy input is provided by spawning runs of Pacific herring. During spawning, a large biomass of herring accumulates along sections of shoreline. Herring defecate and spawn, depositing nutrients and energy into the nearshore area where spawning occurs. Variation in predation is associated with sea otter use of an area, and with herring spawn deposition, as the abundance of food attracts numerous predators on herring and herring eggs, as well as secondary predators on animals attracted by the opportunity to prey upon herring. Herring spawn thus provides a local, intense and repeated disturbance to the system that may be used to trace the roles of nutrient and energy availability, competition, predation, and prey availability in limiting or structuring nearshore dynamics. Local variation in area use by sea otters provides an additional opportunity to examine the role of predation.

These projects examine how ocean circulation, environmental richness (e.g. primary productivity, influx of nutrients, food availability), and predator-prey relationships (e.g. food availability, patch use, grazing pressure, predation risk) interact to limit or structure communities. Regular spawning beaches of Pacific herring receive large, temporally discreet input of nutrients and energy in the form of herring eggs, feces and carcasses, as well as avian and mammalian feces from foragers attracted to the site. Three possibilities are considered for how utilization of such natural localized variation in nutrient and energy supply (e.g. herring spawn) may/may not limit populations in the nearshore. First, abundant localized energy, nutrient, and prey may increase nearshore productivity and diversity through local nutrient enrichment and increased food availability. Alternatively, an abundant supply of nutrients, energy, and food may decrease nearshore productivity and diversity through locally increased predation rates or over-nutrification. Finally, the short-term abundance of nutrients and energy may have limited or no persistent effect because trophic structure is constrained by events not related to local and seasonal super-abundance of energy, nor by the short-term intensity of predation. For example, productivity may be regulated by temperature, or trophic dynamics may determined by the severity of winter weather.

The results of this research will allow an evaluation of the strength of trophic hypotheses in explaining patterns and predicting recovery in the nearshore. Should the data continue to support trophic structure as an important factor in nearshore communities, results from this work should clearly point to specific interactions that are most important, thereby providing information for decisions about the most appropriate restoration activities in nearshore communities. Resource users (e.g. subsistence harvesters) may gain a better understanding of energy limitation, predation, and patterns in the nearshore through the results of this research. With this improved knowledge, they may be better able and more willing to adapt to the fluctuations in nearshore communities, as populations in this habitat continue their recovery from the oil spill and respond to natural fluctuations in the environment.

NEED FOR THE PROJECT

This research is designed to examine how community structure in the nearshore is (or is not) limited by trophic interactions, particularly focused on seasonal energy limitation and the impact of predation. Recovery of the nearshore is no longer believed to be greatly impeded by continued hydrocarbon exposure or toxicity. Rather, ecosystem processes now determine the course of recovery, and the future structure of communities.

The EVOS Trustee Council has identified the disruption and recovery of community structure as the most pressing issue for research in the nearshore. Of hypotheses identified by nearshore researchers at the EVOS Research Priorities workshop (April 1994), most related recovery in the nearshore to trophic issues about community structure. The need has been identified for more information to understand how prey availability, competition, predation, and physical processes influence nearshore organisms. This study uses natural variation in energy and predator abundance in the nearshore to address these information needs.

PROJECT DESIGN

A. Objectives

General Objectives

These projects examine how ocean circulation, environmental richness (e.g. primary productivity, influx of nutrients, food availability), and predator-prey relationships (e.g. food availability, patch use, grazing pressure, predation risk) interact to limit or structure communities. Three general hypotheses will be examined, utilizing natural localized variation in nutrient and energy supply (herring spawn) to examine processes limiting nearshore populations. At regular spawning beaches of Pacific herring, the re-current, large, short-lived input of nutrients and energy (in the form of herring feces, eggs and carcasses and feces of predators attracted by the herring) may:

1. Increase nearshore productivity, standing biomass, and diversity through local nutrient enrichment and increased food availability;

2. Decrease nearshore productivity, standing biomass, and diversity through locally increased predation rates or over-nutrification, or;

3. Have limited or no persistent effect on local communities because trophic structure is constrained by events not related to local and seasonal super-abundance of energy, nor by the short-term intensity of predation (e.g. productivity may be regulated by currents; trophic structure may be constrained by seasonal energy shortages in winter).

This set of interrelated studies will examine these specific hypotheses about the impact of energy influx and predator abundance as a means of addressing three more general hypotheses formulated at the EVOS Research Priorities workshop (April 1994). These three are

(numbered as in J. Bodkin, 'Report on results of nearshore working groups...') #1, Competition/predation, #4, Limited prey, and #5, Predation. Two other trophic-related hypotheses (#2, recruitment, and #6, indirect toxicity) are not specifically addressed here, but depend upon trophic relationships in the nearshore. Hence, information collected by these studies should be of use in evaluating these hypotheses.

It will not be possible to evaluate these hypotheses related to herring spawn based on a single year of data. For this reason, a 3-5 year study is proposed. A preliminary evaluation of the first hypothesis is scheduled to be available in the first year. Preliminary results for the second and third hypotheses will be available only in later years.

Objectives for 1995

The following specific objectives will be achieved for 1995:

1. Identify specific sampling sites based on site visits and criteria listed below (Methods).

2. Design interdisciplinary nested sampling schedules to examine site characteristics at several scales.

3. Within each focal study site, and following the nested sampling design, seasonally measure (FY95 spring and summer) local availability of substrate types, sunlight, nutrients, primary productivity, and detrital influx. We will also attempt to coordinate with SEA and forage-fish oceanography studies to obtain local measures of oceanographic patterns.

4. Within each focal study site, and following the nested sampling design, seasonally measure (FY95 spring and summer) abundance and distribution of specific intertidal and shallow subtidal organisms including dominant algae, sea grasses, invertebrates, and vertebrate foragers, and nearshore plankton.

5. Use measures in objectives 3-4, in conjunction with ADFG and SEA program measurements of herring spawn abundance, biomass, distribution, and duration to begin a preliminary evaluation of the hypotheses above.

B. Methods

Specific methods for each study are given in the project descriptions. However, a general approach to study sites and sampling designs common to all projects is laid out here.

Study sites will be stratified by the presence/absence of use by herring or sea otters, and by sampling scale. Sites will be matched by location in the Sound, exposure, and general characteristics. Two pairs of sites will differ in historical use by herring for spawn deposition. Candidates for these two pairs are northern Montegue Island paired with northern Green Island; and Bidarki Point paired with southern Bligh Island. Northern Montegue and Bidarki Point are the most consistent sites of herring spawn deposition over the past ten years. Nearby

Green Island and Bligh Island beaches have received little or no spawn during the same period. Bidarki Point and Bligh Island are located near the village of Tatitlik. We will explore opportunities at these sites for sampling designed around subsistence users and issues (e.g. factors influencing the abundance of octopus). A fifth site with low sea otter density (Herring Bay) will be matched with northern Montegue/Green Islands, which currently have a high otter density. Herring Bay, Green Island and northern Montegue Island also have been the site of past and ongoing EVOS research. Substantial background data is therefore available for these sites.

Foragers in the nearshore range from sessile filter feeders to deposit feeders and grazers to highly mobile predators. These organisms move over daily or seasonal feeding ranges that vary in size by many orders of magnitude. It is therefore necessary to explicitly consider scale and foraging range when examining the nearshore system. We recognize two general classes of feeders: sessile organisms (e.g. filter feeders, some grazers and detritivores) that move slowly or not at all and feed over a small area (a few cubic centimeters to a few square meters); and mobile organisms (e.g. seastars, crabs, octopus, otters, birds) that may forage over areas from hundreds of square meters to many square kilometers. While this particular distinction is artificial, it recognizes a real difference in the scale at which organisms relate to their environment, and provides a biologically relevant framework for a spatially-nested sampling design. Further detail on spatial nesting of design are provided in the individual project descriptions.

C. Schedule

Scheduled milestones for projects are included in each project description. In general, all projects will hold to the following schedule:

Winter '95: Personnel selection and equipment procurement. Site visits and site selection, sampling design, preliminary tests of experimental protocols.
Spring '95: Preparation of proposals for FY96. On-site sampling at all sites; intensive work at herring spawn sites.
Summer '95: On-site sampling at all sites; preliminary examination of data.

D. Technical Support

See individual project descriptions for details on technical support.

E. Location

This work will be conducted in Prince William Sound. Specific focal sites under consideration are northern Montegue Island, northern Green Island, Bidarki Point, southern Bligh Island, and Herring Bay. Reasons for this choice of study sites were presented under Methods.

PROJECT IMPLEMENTATION

This project should be implemented by the U.S. Forest Service through the various cooperating agencies.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project involves the coordination of several research studies under this umbrella proposal. The projects are coordinated by common themes, techniques, sampling sites, and logistics. Coordination to date has been achieved through periodic workshops, and will continue both on sampling sites and via further face-to-face interactions.

We will also be coordinating data sharing with SEA and possibly forage fish/pelagic predators research projects. Collaboration with SEA will involve at least oceanography (D. Salmon, P.I.), herring projects (J. Wilcock, E. Brown, P.I.s) nearshore fish (G. Thomas, P.I.), and avian predation on herring spawn (M.A. Bishop, P.I.).

FY 95 BUDGET ($K)

Personnel	21.3
Travel	12.3
Contractual	335.0
Commodities	1.0
Equipment	10.0
Subtotal	379.6
Overhead (@20%)	75.8
Total	455.4

Primary Productivity as a Factor in the Recovery of Injured Resources in Prince William Sound

Project Number:	95009B
Restoration Category:	Research
Proposed By:	University of Alaska
Lead Trustee Agency:	USFS
Cooperating Agency:	ADFG
Cost FY 95:	$218,850
Cost FY 96:	$213,000
Total Cost:	Unknown
Duration:	3 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Intertidal and subtidal organisms

INTRODUCTION

This project will investigate the production and flow of fixed carbon in the nearshore ecosystem of Prince William Sound and will determine the importance of benthic primary productivity in the recovery of injured intertidal and subtidal species. Results from this project would lay the foundation for understanding how fixed carbon is moved through the Prince William Sound nearshore system, and how this carbon flow is altered by seasonal events. The study will determine the relative importance of carbon input from phytoplankton, benthic production, terrestrial plants, and episodic transport (eg herring spawn). Understanding the flow of carbon will increase our understanding of factors that limit recovery of nearshore organisms.

The results of the study will give information on the relative importance of the various sources of carbon that are introduced into the nearshore system. Importance is measured by the relative abundance of each source of carbon present in the higher trophic organisms. Information will also be generated on how these proportions change seasonally and how they are affected by physical and chemical processes.

From the above information it may be possible to estimate the relative importance of the various plant communities in supplying the nearshore invertebrate community with carbon.

Further, a model could be created to predict the disturbance to a community if there are changes in the normal flow of carbon into the system. Such disturbances could be effected by oil spill treatment, El Nino events, winter storms, etc.

As a component of the multidisciplinary nearshore ecosystem study, "Trophics and community structure in the intertidal and shallow subtidal", this study will provide information on the availability and stable isotope values of various primary producers within the nearshore ecoystem. This proposal will provide the foundation for collaborative studies of higher trophic levels, such as the role of invertebrates in community structure and the role of mobile predators in the nearshore environment.

NEED FOR THE PROJECT

Injury to the biological resources of Prince William Sound as a result of the *Exxon Valdez* (EVOS) oil spill have been documented since 1989. Although recovery has occurred for many species and is progressing for others, many injured resources have been listed as not recovering. The range of such injured and not recovering species includes bird, marine mammals, fish, and both intertidal and subtidal organisms.

One hypothesis for the lack of recovery for injured species is that recovery is limited by food/prey availability. Most of the injured species from the higher trophic levels (birds, fish, mammals) are predators on nearshore, marine organisms. These nearshore organisms make their living as predators themselves, as scavengers, as grazers, and/or as suspension/deposit feeders. The ultimate source of carbon/energy for all of these organisms is from primary production. In the nearshore there are four possible sources for carbon: the first three are primary production from terrestrial plants, benthic marine plants and phytoplankton, and the fourth is episodic transport of carbon. Benthic plants (seaweeds and marine grasses) provide carbon for grazers, such as littorines, urchins, and limpets. These organisms in turn serve as food for higher trophic level organisms. Populations of many of these grazers have been altered by the EVOS. Phytoplankton and organic detritus (along with zooplankton) provide carbon for suspension and deposit feeders, such as barnacles, mussels, and clams. The relative importance of these forms of carbon depend on the organisms and area of concern, but contributions from both phytoplankton and benthic plants may be important. Carbon production provided by terrestrial plants will be important in nearshore areas in the vicinity of streams and rivers. Episodic transport could bring in carbon from areas outside of the nearshore system. Two examples of this type of transport are the annual Pacific herring spawnings in the spring and the salmon runs in the summer and fall.

A decline in primary productivity in PWS as a direct or indirect effect of the oil spill could explain the lack of recovery of some injured resources. For example, sea otters may have less prey, which feed on seaweeds, available in an area where benthic production has been depressed as a result of the spill.

This project proposes to look at primary production as one aspect of an ecosystem approach to understanding recovery of the biological resources. The general approach is to determine the relative contributions of the various sources of production into the nearshore system and also to determine whether this pattern has been altered in areas affected by the oil spill and treatment.

PROJECT DESIGN

A. Objectives

1. To determine the productivity and standing biomass of benthic marine plants in the nearshore.

2. To determine the productivity and biomass of phytoplankton in the nearshore.

3. To determine the organic input to the nearshore from terrestrial sources

4. To determine the relative contribution of these sources of carbon to the carbon budget of higher trophic level organisms.

5. To determine what factors may limit primary productivity in the nearshore.

B. Methods

About four to six sheltered rocky sites in PWS will be selected based on intertidal and subtidal vegetation and associated communities. Areas of use by higher trophic level organisms such as sea otters, herring and birds will be targeted, if possible. Site selection will be coordinated with the nearshore study groups of the National Bioilogical Survey (NBS) and University of Alaska (UAF).

Primary productivity will be measured by C-14 fixation *in situ*. Productivity will be normalized both by chlorophyll content and by biomass. Determinations will be made during the period of algal blooms for phytoplankton and at quarterly intervals for benthic algae and eel grasses. Extrapolations will be made to determine the total productivity for the system on an annual basis. Water chemistry for the determination of nutrients will be performed on samples taken in and near to the selected sites. Light irradiance data will be collected as often as feasible for correlation with productivity rates

Streams that flow into the nearshore area will be sampled for total organic carbon four times during the year. Stream flow rates and capacities will be estimated in order to estimate the total carbon input from this source.

Stable carbon isotope ratios can be used to determine the source of primary productivity used by various organisms. Nitrogen isotopes can be used to look at differences in trophic feeding.

Isotope ratios will be determined for the sources of carbon including phytoplankton, benthic seaweeds, detritus, particulate and dissolved organic matter and herring eggs. Additionally, stable isotope ratios (C and N) will be determined for several different organisms which use different feeding strategies. Such organisms will include a grazer, suspension feeder, detritus feeder and predator. Isotope ratios will be compared to those from the sources of carbon. The isotope ratio will be determined throughout the year in order to determine seasonal variation in feeding strategies and relative importance of carbon sources. This aspect of the study will be closely coordinated with the invertebrate and mobile predator trophic interaction studies proposed by NBS and UAF.

C. Schedule

Spring/95	Site selection.
June/95-June 97	Sampling for photosynthesis, nutrients, light levels and isotope ratios. These will be done four times a year at quarterly intervals. One sampling date will coincide with the spring algal bloom in March.

Data compilation and analysis will be on-going through the year. There should be a minimum of two years of sampling for estimation of year to year variation. Annual reports will be submitted by April of each year.

D. Technical Support

Laboratory analysis of stable isotope samples and CHN samples will be required.

E. Location

Field work will take place near and at selected sheltered rocky sites in Prince William Sound. Laboratory analyses will be done at the University of Alaska, both at Fairbanks and at the Juneau Center, School of Fisheries and Ocean Sciences.

PROJECT IMPLEMENTATION

This project should be implemented by the U.S. Forest Service through the various cooperating agencies.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is designed to be closely coordinated with nearshore food web studies of University of Alaska Fairbanks and the Prince William Sound Science Center, and with the nearshore trophic studies proposed by the National Biological Survey. Collaboration will occur with the SEA study through oceanography, herring projects, nearshore fish and avian predation. This

study will provide information to other studies concerning how fixed carbon is routed to the nearshore organisms.

FY 95 BUDGET ($K)

Personnel	141.0
Travel	11.4
Contractual	7.2
Commodities	16.3
Equipment	6.5
Subtotal	182.4
Gen. Admin.	36.5
Total	218.9

This page intentionally left blank.

Community Structure of Mobile Foragers Using the Nearshore

Project Number:	95009E
Restoration Category:	Research
Proposed By:	USFS
Cooperating Agency:	ADFG
Cost FY 95:	$280,500
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	2-5 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

Intertidal and shallow subtidal habitats provide important resources to many species and services injured in the *Exxon Valdez* oil spill (EVOS). At higher trophic levels, species using these habitats depend on nearshore marine organisms as prey resources. For example, juvenile fish, sea otters, harlequin ducks, and humans all feed on resources in the nearshore. Understanding changes in nearshore communities and the trophic structure of these communities has been identified as a research priority by the EVOS Restoration Office and is the focus of five hypotheses developed by the Nearshore Working Group.

This study is a component of the proposed program "Trophics and community structure in the intertidal and shallow subtidal (TCSISS)". It specifically addresses TCSISS hypotheses regarding the role and intensity of predation by mobile foragers in trophic food webs. The community of mobile nearshore predators includes birds, mammals, fish, and some invertebrates such as crabs and octopus. Three questions will be addressed in this context: First, what characteristics of the nearshore environment provide suitable foraging habitats for mobile intertidal foragers? Second, how effectively do foragers use these habitats? That is, what are the relative foraging efficiencies of mobile foragers, particularly birds. Third, what is the intensity of habitat patch use by these foragers and how are variations in habitat use reflected in the community structure, productivity or abundance of their prey?

This study is focused on avian and mammal foragers in the nearshore. Some work on invertebrates will be conducted in conjunction with the TCSISS projects "Survey of octopuses" and "Trophic dynamics and energy flow" where techniques in this project are applicable. Fish will not be not considered here because the techniques we plan to use are not suitable to also sample fish habitat use.

Mobile foragers in the nearshore may have a large effect on distribution and abundance of their prey. High predation intensity can deplete the abundance of preferred prey, sometimes resulting in dramatic changes in primary and secondary production, trophic structure, and predator populations in the nearshore ecosystem. Dramatic changes in the availability, distribution or density of prey can also impact predator populations. Predator response can include prey switching (that may in turn adversely effect alternative prey), changes in habitat or patch use, and changes in population size or growth rates.

Hence, understanding the patterns of foraging and habitat use of intertidal mobile foragers is necessary to predicting and facilitating the recovery from EVOS injury of these foragers and of their intertidal and subtidal prey. This project will provide information on the relative intensity of habitat use, and provide insight to the factors influencing use of the intertidal and shallow subtidal by an important group of nearshore foragers.

NEED FOR THE PROJECT

This project is designed to examine how community structure in the nearshore is (or is not) impacted by the community of mobile predators that forage in intertidal and shallow subtidal areas. This group of predators includes several injured species (harlequin ducks, marbled murrelet, sea otters, black oystercatchers, bald eagles, and river otters) that feed on other injured resources (pacific herring, intertidal and subtidal organisms). This community of predators and prey contribute to injured services including commercial fishing, tourism, subsistence and passive use.

Seven major hypotheses about processes limiting recovery of nearshore groups of injured resources that were identified at the EVOS research priorities workshop. Five hypotheses are directly related to the trophic structure of nearshore systems. Of these five, three (competition/ predation, limited prey, predation) hypothesize that predator-prey relationships, as described by prey choice, patch or habitat use, and population regulation, may limit recovery of resources in the nearshore. This study will provide information designed to begin to test these and related hypotheses about community processes in the nearshore.

PROJECT DESIGN

This project is designed with three objectives: first, to identify critical habitat components for the community of mobile foragers in the intertidal ecosystem (primarily birds and some

mammals); second, to measure the relative foraging efficiencies of species feeding in mixed-species aggregations; and third, to measure intensity of patch use at the study sites and estimate the general impact of these species on intertidal habitats.

These objectives relate directly to testing the three TCSISS hypotheses. Identifying critical components of habitat for foragers in the nearshore will be necessary to evaluate how the hypothesized increase in productivity from energy and nutrient input (herring spawn) affects mobile forager diversity. Relative foraging efficiencies can be used to indicate the importance of competitive versus predation effects on communities. Finally, patch use intensity and the general impact of predation must be known to examine the hypothesis that local intense predation limits nearshore recovery.

Milestones for 1995

Critical habitat components:

1. Record characteristics of habitat patches, including location, substrate type, and dominant sessile organisms (e.g. sea grasses, algae, mussels) at chosen study sites.

Relative foraging efficiencies:

2. Sampling seasonally within each site, record size and composition of foraging aggregations observed in nearshore habitats. For aggregations persisting less than several hours, record arrival and departure sequence of foragers. Within aggregations, sample behavior to measure capture rates for avian diving foragers that regularly bring prey to the surface (for sea otters, foraging behavior will be assessed in another project in "Processes structuring recovery of injured nearshore vertebrate predators in Prince William Sound").

3. Test experimental feeding trays as a method to measure relative efficiencies, costs, and risks associated with foraging.

Survey patch use:

4. Within each study site, seasonally survey the abundance and distribution of specific birds and mammals using intertidal and shallow subtidal habitats.

5. Examine data collected under Milestones 1-4 to provide a preliminary characterization of important habitat components, foraging efficiencies and intensity of habitat use.

It will not be possible to fully characterize use of nearshore habitats by the community of mobile predators based on a single year of data. For this reason, a 2-5 year study is proposed. A preliminary evaluation of the data will be available following the first year.

B. Methods

Characteristics of habitat patches:

Broad category shoreline sensitivity indices will be obtained from an existing GIS data base. In

combination with sampling efforts of other TCSISS projects, shoreline habitats at each study site will be mapped by boat and (where appropriate) foot surveys at low tide. Substrate, physical features, and dominant plant and sessile animal populations will be noted.

Size and composition of foraging aggregations: Foraging aggregations will be observed from a small boat, or from shore. All foragers present (including potential secondary predators on foragers) will be counted and identified to species if possible, or to species group, and foraging behaviors noted. Some aggregations will also be videotaped for later counting to check on-site estimates and to allow focal-animal sampling of feeding behaviors. Repeated counts throughout the observation period will be used to record arrival and departure sequence.

Feeding trays: Feeding trays containing sieved substrate and a known amount of food items will be placed at sampling stations. Three trays will be used at each station, placed in a line perpendicular to the shoreline, at fixed distances from shoreline cover. Trays will be left in place for approximately one-half tidal cycle (from the retreat of the tide at the lowest tray until its return at that site). Presence and species of foragers visiting each tray will be recorded from tracks in the tray. Tray contents will be sieved at the end of each trial. Remaining food items will be recovered and weighed. Similar techniques have been successfully used to measure bird and mammal feeding efficiencies, but this technique has not yet been tested on intertidal foragers.

Survey: The relative abundance and species composition of birds and marine mammals foraging in the nearshore will be documented using shoreline transects. Nearshore boat transect surveys will be conducted both at low and high tide along a 15-km length of shoreline. Transect width will extend from the shoreline seaward to 120m. Shorelines will be divided into transects based on habitat types (see above) and natural landmarks. Data collected will include: location, number and species (or genus), shoreline type, foraging behavior, and habitat (land, water, or air). Transects will be surveyed using methodologies as in 94320-Q SEA: Avian Predation on Herring Spawn (adapted from USF&WS marine bird and mammal surveys, 1993).

C. Schedule

Nov-Dec 94: Personnel selection and equipment procurement. Preliminary site visits if feasible depending on funding date.
Winter 95: Site visits and site selection, preliminary tests of experimental protocols. Initial field sampling.
Spring 95: Preparation of proposals for FY96. On-site sampling at each site; intensive foraging observations and transect surveys. Feeding tray experiments at each site.
Summer 95: On-site sampling at all sites; preliminary examination of data.
Fall 95: Continued sampling at all sites; data analysis and write-up begins.

D. Technical Support

None

E. Location

This work will be conducted in Prince William Sound. Specific focal sites under consideration are northern Montegue Island, northern Green Island, Bidarki Point, southern Bligh Island, and Herring Bay. Reasons for this choice of study sites are presented in a cover document "Trophics and community structure in the intertidal and shallow subtidal".

PROJECT IMPLEMENTATION

This project should be implemented by the U.S. Forest Service and should be conducted by the Copper River Delta Institute (CRDI) and Prince William Sound Science Center. This project is closely related to and builds on work conducted by Mary Anne Bishop at CRDI (94320Q SEA: Avian Predation on Herring Spawn). The theoretical basis for work proposed here developed from Science Center staff's (D. Scheel, PI and T. Vincent, PI) past work and interaction with colleagues (e.g. Vincent, Scheel, Brown & Vincent. In prep. Tradeoffs and coexistence in consumer-resource models: it all depends on what you eat.).

This work will utilize data from work proposed under both the SEA program and Pelagic Predator project. Close interaction and access to SEA researchers and data make the Copper River Delta Institute and the PWS Science Center an appropriate choice.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is part of the Trophics and community structure in the intertidal and shallow subtidal (TCSISS) integrated study program. It also is designed with input from the SEA program, and the Pelagic Predators work group and complements research proposed within those groups. Both PIs of the proposed work has been and will continue to be active participant in SEA and EVOS Trustee meetings to integrate research.

FY 95 BUDGET ($K)

	USFS	PWSSC
Personnel	80.4	78.4
Travel	3.5	4.6
Contractual	1.5	8.7
Commodities	10.9	11.1
Equipment	26.0	18.9
Subtotal	122.3	121.7
Indirect Costs	12.2	24.3
Total	134.5	146.0

Intertidal Fauna and Flora Species Composition, Abundance and Variability Relative to Physical Habitat Controls

Project Number:	95010
Restoration Category:	Research
Proposed By:	Megan N. Dethier, University of Washington Carl Schoch, Oregon State University
Lead Trustee Agency:	DOI
Cost FY 95:	$75,000
Cost FY 96:	$0
Total Cost:	$75,000
Duration:	1 year
Geographic Area:	Katmai National Park and Preserve
Injured Resource/Service:	Intertidal organisms

INTRODUCTION

In April, 1989 the National Park Service contracted intertidal ecologists to conduct pre-assessments of park shorelines that seemed to be in the path of the oncoming *Exxon Valdez* oil spill. The task was daunting since the shoreline was tremendously variable in biological assemblages and it was uncertain where the oil would contact shore. The intertidal algae and fauna were surveyed at 16 sites for potential baseline information on the pre-oiled intertidal communities. With little knowledge of the shoreline, the sites were picked arbitrarily based on accessibility, substrate type, relocation, and replication along exposure gradients (strictly for the purposes of determining pre-oiled conditions). The oil, however, only stranded sporadically along the Kenai Fjords and Katmai coasts, and none of the surveyed beaches was contaminated. Thus, although important information was gathered on a coast with virtually no baseline data, the objective of establishing a pre-oiled condition was not accomplished because no method existed to compare the surveyed sites to the oiled sites.

In the years since the spill, we have developed a procedure to link specific intertidal fauna/flora communities to physical habitats. This has significant application to the coast of Alaska, which has sparse biological transect data but, in some areas, considerable geomorphological information. With comprehensive geomorphological data now available for much of the spill area, statistical inference can be made from a limited series of biological transects to a broader

area. The results of the study outlined by this proposal will:

1. Provide information to quantify habitat disruption.

2. Define the spatial extent and spatial relationships of disrupted and of recovering intertidal communities.

3. Provide information to determine the rate of recovery and to aid in the determination of when recovery is complete.

4. Provide information on the mechanisms responsible for variations in recruitment, growth, condition and survival of intertidal communities.

5. Fill the gaps in current knowledge about the spatial distribution of intertidal communities, the seasonal variation of abundance, and how to monitor the long term productivity level of intertidal lands.

This proposal provides a systematic methodology for using available information to determine key relationships in the ecosystem that are important for injury and restoration assessment. Under the research strategies outlined by the Oil Spill Trustee Council in the Invitation to Submit Restoration Projects for Fiscal Year 1995, this proposal addresses the priority ecosystem issue of "Disruption of Nearshore Community Structure". This study will first identify fauna/flora assemblages within specific habitat types (as defined by geomorphology) in each of three intertidal zones for geomorphologically homogenous beach segments. The proposed procedure has evolved from 4 years of field work in Cook Inlet and the Gulf of Alaska on National Park shorelines. The methodology was refined and tested in Puget Sound during the spring of 1994 (Schoch et al, in review), and in the summer of 1994 will be applied to the Cook Inlet shorelines of Lake Clark National Park. The proposed study will incorporate rigorous statistical analyses to aid in defining community linkages to beach types in healthy habitats. The results of these analyses can be used to compare community structure of healthy beaches with injured beaches, ultimately for the purpose of determining recovery rates and the point of complete restoration. With a better understanding of intertidal community structure and the variability of these communities with varying physical constraints, the mechanisms controlling recovery can be examined including the effects of predation, physical habitat type, recruitment, etc.

NEED FOR THE PROJECT

Research to date in Alaska on population level injury for intertidal communities has been patchy and inconclusive due in large part to the huge spatial variation in communities. This project will begin to quantify that variation. The results can be used to determine the extent of damage, the degree of this disruption, and the degree of recovery over broad spatial scales. Intertidal community structure is difficult to determine quantitatively because of the tremendous spatial variability of intertidal organisms and the logistical complications of multiple replicates.

Past and proposed restoration projects have used *Fucus* spp. as an indicator/proxy of intertidal community health and recovery. However, the recovery of intertidal communities must be based not on the abundance of one species such as *Fucus* spp. as proposed, but rather on abundance and spatial distribution of the entire community. Further, each intertidal zone should be analyzed for recovery and this cannot be done using an indicator species generally restricted to the upper intertidal zones of semi-protected shores, such as *Fucus* spp. Therefore, a systematic methodology for determining the distribution and abundance of intertidal organisms on a large spatial scale is needed to answer questions related to recovery. Although research issues concerning habitat are not considered a high priority for fiscal year 1995 funding, we believe that natural resources (community structure) issues cannot be divorced from the habitats that support them.

Therefore, in order to address questions of natural resource recovery and community structure, basic relationships with habitat must be determined first. The extent of disruption to community structure and the recovery of this structure can then be analyzed for determining the extent of injury and recovery rates. As indicated in the Invitation to Submit Restoration Projects, the determination of disruption to intertidal community structure is a high priority due to the direct linkage to sea otters, salmon, and other high trophic level organisms. The basis of the proposed work is a detailed, 32 parameter, vertical (i.e. separated into each intertidal zone) and horizontal description of shoreline geomorphology for each homogenous beach segment (i.e. geomorphologically the same in the horizontal dimensions). This shoreline model was developed over the past 4 years for habitat sensitivity and stranded oil persistence analyses, and has been applied to the shorelines of Kenai Fjords, Katmai, Aniakchak, and Lake Clark National Park Units. We propose to develop statistical linkages between beach types defined by this model and a broader vision of natural resources (i.e. community structures) determined by existing transect data (augmented if necessary by additional fauna/flora surveys) so that inference for abundance and distribution can be made to broader geographic regions. These statistical inferences can then be used to track the recovery of injured beaches in comparison to healthy beaches, as well as to establish a database relating habitat sensitivity to intertidal community structure. With large scale information on the abundance and distribution of intertidal organisms, important questions regarding injury, recovery and the effects of intertidal resources on higher trophic level organisms can be addressed.

PROJECT DESIGN

A. Objectives

1. Identify intertidal natural resources and community structures for specific beach types, including species composition, abundance, and variability.

2. Identify the spatial distribution, both vertical and horizontal, of beach types within a specified project area.

3. Identify the degree of disruption of resources and their services by statistical comparison

of healthy beach communities (species composition, abundance, and variability) to the communities of injured and recovering beaches.

B. Methods

1. Identify project area.
There are several possibilities depending on the priorities of the restoration committee. The field work for Katmai National Park, Aniakchak National Monument, and Lake Clark National Park is 70 % complete, and for Kenai Fjords National Park the field work is about 20% complete (all data available from the National Park Service, Coastal Programs Office). Significantly more work is required for the remainder of the spill area where only partial horizontal descriptions have been completed (available from ADEC). Therefore, although the Alaska Peninsula is not a high priority restoration area, this would be the most economical place for this study since the work is significantly more complete. Other areas, such as Prince William Sound would require additional geomorphological field work to augment existing information, although this could be accomplished if deemed desirable by the Oil Spill Trustee Council (the schedule and proposed budget would have to be adjusted for this additional and/or alternative work). Assuming the selection of the Katmai shoreline for the first year effort, this work is the closest to completion and only 6 weeks of additional geomorphological field work are anticipated to complete the coverage of the 400 mile shoreline. Biological transects may require additional time with consideration of the spring tide cycles.

2. Map project shoreline.
Using digitized low altitude aerial photography (available from the National Park Service and Walker Associates) for basemaps, the homogenous shoreline segment information (32 parameters for each shoreline segment defining each horizontal and vertical unit) will be entered into a relational database.

3. Statistical analysis of beach segments.
Beach segments will be clustered into groups with similar geomorphological and physical characteristics.

4. Develop linkages between fauna/flora communities and beach types.
Using existing fauna/flora transect data (available from the National Park Service, ADEC, and Exxon) and augmenting this information with additional transect work on randomly selected beach segments, natural resources will be related to habitat types using analysis of variance (ANOVA) or multi-variate correlation (CANOCO).

5. Analysis of intertidal resources disruption.
ANOVA comparisons between healthy beach communities and injured or recovering beach communities will indicate the extent of current disruption. Replicate analyses will indicate the rate of recovery.

C. Schedule

October 1, 1994 - May 1, 1995
The compilation of the geomorphological and physical parameters into a relational database can begin immediately (i.e. October 1, 1994). Digitizing the aerial photography and compiling the digital base map can also begin immediately. Statistical analyses of beach segments and group clustering of homogenous units can be completed before the 1995 field season.

June 1, 1995 - August 31, 1995
The field season will be used to complete missing geomorphological information, and to complete missing fauna/flora transect information. The total number of field days will be determined by the extent of the missing information (anticipated not to exceed 90 days).

September 1, 1995 - November 30, 1995
This period will be dedicated to data analysis and report writing.

D. Technical Support

Digital database development will be conducted at Oregon State University using ERDAS and a relational database software such as Paradox or Oracle. Field work will require vessel support, however the size and sophistication will depend on funding, ranging from kayaks and shore camping to a full support facility. Laboratory analysis of field samples (if any) will be conducted at the Friday Harbor Laboratories, WA. Data transfer and archiving procedures are negotiable.

E. Location

Other project locations can be considered, based on funding level, restoration priorities, and logistical considerations.

PROJECT IMPLEMENTATION

By design, this proposal is intended to be implemented by the principal investigator with the assistance of state and federal agencies such as the National Park Service Regional Office, Katmai National Park and Preserve, National Biological Service, Alaska Department of Natural Resources, Alaska Department of Environmental Conservation, etc.

COORDINATION OF INTEGRATED RESEARCH EFFORT

A lot of data has been gathered since the 1989 spill by state, federal and private entities. The first step is to aggregate existing information from the National Park Service, state agencies and private entities. Any collaborative partnership facilitating this project will be considered. This project can be coordinated with other funded projects particularly those implemented by the

University of Alaska, Alaska Department of Fish and Game, and the Alaska Department of Environmental Conservation.

FY 95 BUDGET ($K)

Personnel	35.0
Travel	1.5
Contractual	21.0
Commodities	1.0
Equipment	3.5
Capital Outlay	5.0
Subtotal	67.0
Gen. Admin.	6.5
Total	73.5

A Tribute to Prince William Sound

Project Number:	95016
Restoration Category:	General Restoration (new)
Proposed By:	Gary Kremen 3605 Arctic Blvd., #2777 Anchorage, AK 99503 (602)991-2405
Lead Trustee Agency:	USFS
Cost FY 95:	$161,000
Cost FY 96:	$0
Total Cost:	$161,000
Duration:	1 year
Injured Resource/Service:	Recreation and tourism

INTRODUCTION

The injured service the project would address is tourism. The proposal is to work in conjunction with the Prince William Tourism Coalition. First to determine through public discussion what areas and recreational activities should be pinpointed. Secondly, to formulate a scheduled tour for the exhibit "A Tribute to Prince William Sound." That schedule will include various national trade shows, whereby the exhibit would promote tourism in the specified areas and concerns of Prince William Sound.

The exhibit valued at $147,000 has already been completed and has received much national and international attention.

Recovery of tourism will also occur when more people are made aware of the beauty that yet remains in the Prince William Sound area. This can be done by taking the exhibit to key high profile showings and distributing promotional material regarding the area. The exhibit already has a superb track record of generating much T.V. and press coverage wherever it has been exhibited.

PROJECT DESIGN

A. Objective

Performing as a sounding stage at key exhibitions throughout the United States, enticing people to come visit this area. The exhibition will be held at trade shows where people have the funds to travel to Prince William Sound.

B. Methods

Showing the exhibit "A Tribute to Prince Williams Sound," which generates much interest, T.V. and press and dispersing various printed material regarding tourism in Prince William Sound.

C. Schedule

The exhibit has already been completed at a value of $147,000 and has a successful proven track record. It is ready to go back on tour at any time as per an exhibition schedule is worked out in conjunction with the Prince William Sound Tourism Coalition.

D. Technical Support

Technical support would come from The Prince William Sound Coalition, which would determine the necessary promotional material to disperse and what areas of Prince William Sound should, and could be promoted for tourism.

PROJECT IMPLEMENTATION

The project could be implemented through The Prince William Sound Tourism Coalition, or the Alaska Tourism and Marketing Council, or the Alaska Department of Tourism.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The project would be coordinated with Alaska's Department of Tourism and the Alaska Tourism and Marketing Council. For instance, where and when these entities gear their promotional drives to certain locations throughout the United States is where the exhibit tour would key.

FY 95 BUDGET ($K)

Personnel	60.0
Travel	25.0
Contractual	55.0
Commodities	0.0
Equipment	6.0
Overhead	15.0
Total	161.0

This page intentionally left blank.

Port Graham Coho Salmon Subsistence Fishery Restoration Project

Project Number:	95017
Restoration Category:	General Restoration (new)
Proposed By:	David Daisy
Lead Trustee Agency:	ADFG
Cost FY 95:	$587,900
Cost FY 96:	$0
Total Cost:	$587,900
Duration:	1 year
Geographic Area:	Port Graham, Alaska
Injured Resource/Service:	Subsistence

Objectives

The goal of this project is to restore the Coho salmon subsistence fishery in Port Graham from its current harvest level of around 350 to its historic annual harvest level of around 2,000.

Methods

This goal will be achieved by creating an annual return of 6,000 Port Graham River coho to the salmon hatchery in Port Graham. A return of this size to the village hatchery will provide a subsistence harvest at the historic 2,000 level, 500 for broodstock and a cost recovery harvest of around 3,500 to pay those hatchery operating expenses that are directly related to this project. Using the standard ADFG survival assumptions, 150,000 hatchery produced coho smolt will be needed to generate a return of 6?000 adults. At a final smolt loading density of 20 kilograms per cubic meter (kg/m3) in the raceways and a total water exchange of 2 times per hour (R2), approximately 2,300 liters per minute (lpm) of high quality fresh water will be needed. Currently the hatchery has only 1,100 lpm for this project. The additional 1,200 lpm will need to be developed. A water source has been identified and an engineering study done to determine the cost of bringing this water into the hatchery.

In addition to the extra water, the project will need a separate module set up in the hatchery for the coho with its own set of incubators and raceways.

Developing the additional water for the hatchery will need to be done under a construction contract. The raceways and incubators will be built at the village welding shop. The construction of the coho module, installation of the incubators and raceways, etc. will be done by the hatchery staff.

Schedule

Oct 1 94 to Feb 28 95	Final design and permitting
March 1, 1995	Water project put out for bid; hatchery module materials ordered
March 20, 1995	Begin building incubators and raceways
March 30, 1995	Bid awarded for water project
May 1, 95 to Sep 15, 95	Water project under construction
June 1, 1995 to July 15, 1995	Construction on hatchery module

FY 95 BUDGET ($K)

Personnel	23.0
Travel	0.0
Contractual	496.7
Commodities	21.3
Equipment	46.9
Total	587.9

Foraging Efficiencies at Temporary Food Patches

Project Number:	95022
Restoration Category:	Research
Proposed By:	Prince William Sound Science Center
Lead Trustee Agency:	DOI
Cooperating Agencies:	ADFG
Cost FY 95:	$183,100
Cost FY 96:	$147,200
Total Cost:	Unknown
Duration:	2 or more years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

Populations of several bird and mammals species, particularly those that feed on fish in pelagic areas, have declined over the past twenty years. Recent EVOS Trustee sponsored workshops, as well as regional conferences (e.g., Is It Food? 1993), focused on the hypothesis that changes in food availability are responsible for these population declines, or prevent the recovery of populations following mortality from the *Exxon Valdez* oil spill. Testing of this hypothesis has been identified as a research priority by the EVOS Restoration Office.

A change in the abundance, composition, or distribution of prey will be reflected in the efficiency with which animals forage. Foraging efficiency refers to the ability of an animal to gather food from the environment: more efficient foragers can feed profitably at food availabilities too low for less efficient foragers. Marine birds and mammals often depend on food that occurs in rich, temporary patches. For example, the spring spawning of herring attracts large aggregations of predators such as humpback whales, sea lions, gulls, shorebirds and other birds that prey on both adult herring and herring eggs. Other examples include predators attracted to schooling fish or to salmon fry out-migration. The relative foraging efficiencies of species that feed on the same or similar prey can be measured in the field through studies at feeding sites.

A concentration of vulnerable prey attracts many foragers. However, as predators feed, the prey is depleted or becomes more difficult to capture. Rich patches also attract predators such as bald eagles that may prey upon animals aggregated to utilize the food source, thereby further decreasing their ability to feed efficiently. For these reasons, the concentration of available food in an area will decline once foragers begin to feed. In any mixed-species aggregation of foragers, the species least efficient at feeding will give up first as prey become more difficult to get. More efficient foragers will continue to feed until insufficient capture rates force all species to give up. If a measure of the quality of the food patch is available, this information is also useful. Only efficient foragers should be found on lower quality patches whereas all foragers can profitably feed in the richest patches. Measures of patch quality would include, for example, acoustic measurements of fish schools indicating biomass, density, and size distribution. In this manner, the composition of a foraging aggregation can be used to assess relative feeding efficiencies of competing species.

Data on foraging, the act of gathering food, provide the most direct tests possible of hypotheses concerning the limitation of populations by their ability to gather food. Observational studies of foraging aggregations in important bird and mammal foraging areas, coupled with acoustic measurements of fish, offer opportunities to quantify the foraging efficiencies of the animals attracted by such prey. This proposed study will collect foraging data on predators feeding in mixed-species aggregations, and will examine foraging efficiencies, population indices, and food web relationships in the context of the community dynamics of fish-eating birds and mammals.

NEED FOR THE PROJECT

A number of species injured by the *Exxon Valdez* oil spill and currently showing little or no sign of recovery have in common a habit of foraging in the pelagic environment on small, schooling fish. These include harbor seals, common murres, marbled murrelets, and pigeon guillemots. A 1991 workshop on population declines in these north Pacific marine birds and mammals listed studies of foraging behavior among the most useful for testing the hypothesis that food availability limits population growth and recovery for these species. Workshop participants also concluded that studies focusing on community dynamics of fish-eating predators were an important ingredient to understanding seabird declines. Investigation the food-limitation hypothesis has been identified as a research priority for these species by the *Exxon Valdez* Restoration Office.

As food becomes scarce in any environment, less efficient foragers should experience food shortages earlier and more severely than more efficient foragers. Preliminary observations from foraging aggregations on overwintering schools of 1-2 year-old herring suggest that animals are structured in this manner even within a single foraging aggregation. The food availability hypothesis predicts that population declines will be correlated with food shortages, and hence with feeding efficiency. This study of foraging efficiency thereby provides a simple approach to addressing the general hypothesis that a shortage of food is responsible for the lack of recovery of injured species.

In addition to providing a simple test of the food-limitation hypothesis, results of this study may be useful in developing: 1) indices of population size, distribution or foraging behavior for fish-eating birds and mammals; 2) estimates of mortality to some small schooling fish species (e.g., salmon fry and juveniles, herring) from bird and mammal predation; and 3) a better understanding of shifts in food web structure among seabirds, their prey, and their predators.

PROJECT DESIGN

A. Objectives

This study will estimate relative foraging efficiencies of foragers in mixed-species aggregations of birds and mammals feeding on small, schooling fish (i.e., forage fish). Results will be used as a test of the food-limitation hypothesis for declines or lack of recovery among sea birds and mammals. Specifically, I will test the prediction that, for foragers on small, schooling fish, relative foraging efficiencies measured at temporary foraging aggregations are correlated with the severity of population decline.

Sampling will be conducted during the field seasons of the SEA and the Pelagic Predator research programs, when foraging aggregations form within the focal study areas of those two programs. Objectives for this sampling are:

1. Record size and composition of foraging aggregations feeding on small, schooling fish. For aggregations persisting less than several hours, record arrival and departure sequence of foragers.

2. Sample behavior at foraging aggregations to measure dive and capture rate for foragers that bring prey to the surface before consuming them (e.g. gulls and terns). This provides a test of the assumption that foraging efficiencies for these species are indicated by the composition of, and departure time from, foraging aggregations.

3. Use data from this proposal and from acoustic surveys to conduct a test of the food-limitation hypothesis, base on foraging efficiencies.

B. Methods

1. Size and composition of foraging aggregations: Foraging aggregations will be observed from a small boat, from shore, or where necessary and if space is available, from acoustic survey boats. All foragers present (including potential predators on foraging birds) will be counted and identified to species if possible, or to species group, and foraging behaviors noted. Aggregations will also be photographed for later counting to check on-site estimates. Repeated counts through out the observation period will be used to record arrival and departure sequence. Pelagic Predator focal study areas are designed to contain important PWS foraging areas for these species, and I will request information on locations of foraging 'hot spots' from both SEA and Pelagic predator research boats.

2. Behavior: Focal-animal sampling will be conducted on-site if possible, and from video tapes otherwise to estimate dive rates for each prominent species (or species-group) of forager and to estimate capture rates for each species that brings food to the surface before consumption (e.g., gulls and terns). Response to and interactions with potential predators (e.g., eagles) will be recorded to estimate impact of predation risk on foraging.

3. Analysis: Estimates of foraging efficiencies will be made from the composition of aggregations, the arrival and departure sequence of species and the dive success rate (only for species consuming prey on the surface). The food-limitation hypotheses will be examined and evaluated in light of this data.

C. Schedule

Jan- Mar	Organize logistics, purchase equipment and hire personnel
Apr-Aug/Sep	Field work in coordination with SEA and Pelagic Predator studies
Sep-Dec	Begin analysis and report writing

D. Technical Support

This project benefits from the availability of acoustic and net sampling data from SEA and Pelagic Predator research, but is not dependant on those projects to achieve its objectives.

E. Location

Field research will be conducted primarily in Prince William Sound, and analysis will occur at the PWS Science Center.

PROJECT IMPLEMENTATION

This research is proposed by and should be conducted by the Prince William Sound Science Center. The theoretical basis for this work developed from Science Center staff's (D. Scheel, PI and T. Vincent) past work and interaction with colleagues (e.g., Vincent, Scheel, Brown & Vincent. In prep. Tradeoffs and coexistence in consumer-resource models: it all depends on what you eat.).

This work will utilize data from both the SEA program and Pelagic Predator project. Close interaction and access to SEA researchers and data make the Science Center an appropriate choice. It is also designed to complement other proposed research involving Science Center collaboration, including components of the SEA Herring program, SEA Predator-prey program, and the Science Center proposal to conduct a forage fish assessment.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is designed with input from the SEA program, and the Pelagic Predators and Nearshore work groups and compliments research proposed within those groups. The PI of the proposed work has been and will continue to be an active participant in SEA and EVOS Trustee meetings to integrate research.

PUBLIC PROCESS

This project was developed following consultation with SEA, Pelagic Predator and Nearshore work groups, and participation in EVOS workshops focused on research priorities. The public has been involved in this project through their participation in those activities. This research is integrated with two projects under the SEA program (Predation on hatchery fry, Herring overwintering), each of which will be involving interested public volunteers to collect some data. Data from these two projects may contribute to tests of hypotheses described here.

BUDGET ($K)

	FY95	FY96
Personnel	94.8	94.8
Travel	10.6	10.6
Contractual	8.4	8.4
Commodities	8.9	8.9
Equipment	29.9	0
Total direct costs	152.6	122.7
Indirect costs (20%)	30.5	24.5
Project Total	183.1	147.2

This page intentionally left blank.

Settlement Rates of Nearshore Invertebrates, Oceanographic Processes and Population Recovery: Are They Linked?

Project Number:	95025D
Restoration Category:	Research
Proposed By:	DOI
Cost FY 95:	$435,700
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	5 years
Geographic Area:	Prince William Sound (initially)
Injured Resource/Service:	Multiple resources

INTRODUCTION

The *Exxon Valdez* oil spill directly and indirectly affected numerous organisms, including various species inhabiting nearshore environments. Some species in intertidal and subtidal habitats have not recovered fully since the spill, so the question remains: What is limiting the recovery of affected organisms?

This proposal addresses the hypothesis that physical factors (climatic, oceanographic) may be limiting the recovery of some intertidal and subtidal organisms by limiting settlement and possibly recruitment into these populations. This has been judged a high priority research issue for intertidal and subtidal organisms. With a focus on the connection of the pelagic to the benthic or epibenthic, this proposal attempts to build a bridge between the SEA study and nearshore studies. Additionally, it may provide information to address the question of whether processes limiting invertebrate prey ultimately limit vertebrate predators affected by the spill. Investigations into settlement limitation may also indicate which organisms and processes would serve well as long-term, cost-effective monitoring indicators of broad-scale processes.

The central questions of this proposal are:

1. Are populations of some nearshore organisms (e.g., mussels, barnacles, clams) limited by settlement of larval forms from the plankton, and has oiling of sites affected settlement rates or recruitment?

2. Do offshore (pelagic) physical forcing functions control settlement of planktonic larvae into nearshore environments, affecting the ability of the adult populations to recover from the *Exxon Valdez* oil spill?

3. Can the distribution and abundance (or settlement rate) of larvae of select species be used as indicators of mesoscale circulation of marine waters, linking transport phenomena with a characterization of which habitats may be more resilient to disturbance (i.e. they recover from disturbance more easily)?

Future work outside of Prince William Sound would address additional questions. For example, do differences in circulation and larval biology account for some of the differences observed in the Coastal Habitat intertidal studies between and among regions (e.g., results for Prince William Sound and Kodiak/Alaska Peninsula sites being more similar than Cook Inlet/Kenai Peninsula sites for some species)?

Results from studies conducted since the *Exxon Valdez* oil spill have indicated that plants and animals living in the upper portion of the intertidal zone have suffered more extensive injury than those lower in the intertidal and have shown less recovery. Among those affected species are barnacles, limpets, littorines, and *Fucus*. Additionally, mussel beds in some sites were heavily oiled, and due to the sequestration of oil in sediments among the byssal threads, oil has remained and has shown retarded weathering.

This project will evaluate the best candidate species for investigation, based on their response to oiling and cleanup activities following the *Exxon Valdez* oil spill, their relative abundance and importance in nearshore communities, and their possession of a planktonically dispersed larval stage. This proposal focuses on settlement and recruitment of barnacles and mussels. Mussels are also taken in subsistence harvests, so injured services are indirectly being addressed.

NEED FOR THE PROJECT

This research is designed to examine whether offshore (pelagic) physical forcing functions control settlement of planktonic larvae into nearshore environments, affecting the ability of the adult populations to recover from the *Exxon Valdez* oil spill. Intensive site-specific manipulations, such as those being performed at Herring Bay, provide data on locally operating mechanisms, but this proposed study is designed to address variability in the contributions from the plankton on a broader scale, and thus may allow broader interpretation of differences observed within Prince William Sound and between Prince William Sound sites and those in the Cook Inlet-Kenai Peninsula region and Kodiak-Alaska Peninsula region.

Ecosystem processes are being viewed as the primary factors influencing the recovery of nearshore communities. This proposal addresses two of the four most important research questions relating to community structure impacts that were identified in the "Invitation to

Submit Restoration Projects" booklet (May 1994). These ask whether recruitment limitation or physical processes limit recovery of the nearshore communities.

Results of this study will indicate whether recruitment limitation and physical factors are linked and how they are affecting two important intertidal groups. Recovery may be attained when indications from this study and monitoring of oiled and non-oiled (control) sites (another study) and Herring Bay studies suggest that larval settlement is not limiting and populations of affected organisms are not different between treatments. A combination of results from this study and Herring Bay work may allow determination of intrinsic differences between oiled and control sites.

PROJECT DESIGN

A. Objectives

1. Evaluate other candidate species (than mussels and barnacles) for settlement/ recruitment studies based on synthesized information from existent studies, needs of other investigators, and degree of knowledge and appropriateness of larval life history (e.g. littorines, limpets).

2. Identify specific sampling sites in Prince William Sound based on site visits and criteria listed below (Methods).

3. Evaluate multiple methodologies for investigating settlement rates of barnacles, mussels, and other chosen species (settling plates, cleared rock substrates, passive plankton collection tubes [Yund, Gaines, and Bertness, 1991], collections of filamentous algae and plastic toughies for mussels, etc.).

4. Measure within and between site variation in settlement rates of chosen species.

5. Use PWSAC plankton watch collections (March-June) to describe the timing, duration, magnitude and species composition of larvae in the springtime zooplankton stocks. Extend plankton collections to more distant sites and for a longer season (through August).

6. Collect nearshore physical oceanographic data and integrate nearshore conditions with more offshore oceanographic conditions. Provide information for development of a nearshore oceanographic smear model.

7. Compare and integrate physical oceanographic measurements, larval distribution and abundance, and settlement rates within and across sites.

8. Work cooperatively with SEA investigators, Herring Bay investigators, and other nearshore investigators to maximize information gain, make logistics more efficient, and facilitate information exchange.

B. Methods

Specific sampling sites in Prince William Sound will be identified based on physical parameters (and the ability to tie into offshore oceanographic sampling), community composition, oiling history, proximity to PWSAC plankton watch collection locations, ability to tie into existent studies (notably CHIA and Herring Bay), and coordinated needs of other nearshore investigators.

Examination of settling rates will be conducted from April through August, with greater effort projected during the April through June period, when there are peaks of barnacles settling. Multiple methodologies will be evaluated and some tested as to their efficacy. These will include: clearing of rock substrates, settling plates, possibly a passive plankton collection tube, and specifically for mussels, seasonal scrapes of filamentous algae and artificial substrates (plastic toughies, astroturf).

Determination of recruitment limitation of populations will be based on comparison of settlement rates, relative success of settlers through time (= recruitment) and the impact of recruitment on population structure versus competition and predation. Effects of predation on recruits will be examined by comparing caged and uncaged settling plates. Permanent transects and quadrats will be established to look at community change through time. Results of the other studies will be compared to changes in focus species through time.

Nearshore physical oceanographic measures will be decided upon, in consultation with Dr. Dave Salmon, and will be conducted in conjunction with the PWSAC plankton tows.

Larval availability will be determined through interpretation of the twice weekly PWSAC plankton tows. If a passive plankton collection tube is feasible, then it may provide another measure of cumulative larval plankton abundance over the season; tubes could be set in place and more sites could be examined over the same time period.

C. Schedule

October 1994	Coordination meeting/workshop for nearshore investigators. Synthesize questions, information, decide on sites to maximize overlap and focus, coordinate for logistics, include representatives from nearby communities or subsistence investigators.
November 1994	Preparation of detailed study plan. Initiation of necessary contracts (e.g., vessel charter).
April-Aug 1995	Field work.

Sept, Oct, Nov	Data analysis.
Dec 1995	Report writing.
Feb 28, 1996	Draft annual report.
June 1996	Revised Annual Report.

D. Technical Support

Technical support needed to complete this project includes the taking and analysis of the PWSAC plankton tows. Currently this is being coordinated and analysis supported by the SEA plan. The broader success of this project will be enhanced by linking the nearshore biological and physical processes with those offshore in Prince William Sound. Effort (and money) should be dedicated to achieving that integration. Additional monies should be put towards developing a nearshore smear model. Basic computer support will be provided by the National Biological Survey. Data management needs to be broadly integrated and coordinated for EVOS Restoration Projects. Geographic Information System (GIS) services will be needed from the Alaska Department of Natural Resources to prepare publication quality maps of the sites (FY 96). Statistical or modelling support may be needed to integrate projects/data/models.

E. Location

Locations of sites will be determined in consultation with other nearshore investigators and SEA plankton and oceanographic investigators. Locations need to be in close proximity to the PWSAC plankton collections, and plankton work needs to be tied into community dynamic investigations at the Herring Bay site.

PROJECT IMPLEMENTATION

This project will be implemented by staff of the National Biological Survey (NBS), in coordination with other agencies and private organizations listed in Section F, below. It is appropriate for the NBS to implement this project, due its focus on ecosystem functioning and its designation of Prince William Sound as one of its focus ecosystems. Staff expertise to implement this project also resides within the NBS.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This effort will be integrated with other nearshore investigations to various extents. The most concerted integration will occur with projects looking at subtidal settlement, with the PWSAC collection programs and SEA plankton and oceanography studies, with other nearshore investigators - especially those focusing on whether prey are limiting vertebrate predators, and with Herring Bay studies. Because this study attempts to explain broad differences among sites, it will also be essential to coordinate with recovery monitoring of intertidal (and subtidal) sites

in Prince William Sound, and with future recovery monitoring of those sites outside of Prince William Sound. This project will also coordinate with subsistence studies. Cost reductions are expected to be achieved through coordination and integration. Some reduction in scope may be possible through integration with Herring Bay studies.

FY 95 BUDGET ($K)

Personnel	221.0
Travel	26.0
Contractual	103.0
Commodities	8.0
Equipment	31.0
Subtotal	389.0
Gen. Admin.	46.7
Total	435.7

Relation of Clam Population Structure to Recovery of Injured Nearshore Vertebrate Predators

Project Number:	95025G
Restoration Category:	Research
Proposed By:	DOI and University of Alaska Fairbanks
Lead Trustee Agency:	DOI
Cooperating Agency:	ADFG
Cost FY 95:	$208,500
Cost FY 96:	$241,300
Total Cost:	Unknown
Duration:	5 years
Geographic Area:	Central and western Prince William Sound
Injured Resources:	Clams, sea otters

INTRODUCTION

This project is one component of an integrated ecosystem-scale program entitled "Processes structuring recovery of injured nearshore vertebrate predators in Prince William Sound" (NVP). The NVP Program will assess predator-prey relationships in order to understand recovery patterns of significant vertebrate predators injured by the *Exxon Valdez* oil spill (EVOS) in Prince William Sound (PWS). As noted in the Program umbrella document, the NVP Program will utilize invertebrate prey populations as indicators of predator population density. Because of the important effects of sea otters on benthic ecosystems, abundance and size structure of significant prey should provide information on the recovery status of sea otter populations.

This project examines the status and dynamics of populations of clams, the primary prey for sea otters in PWS, in an effort to better assess the recovery status of sea otters, and to find explanations for an apparent failure of sea otters in some areas to recover from EVOS. Like sea otters, clams are a biological resource injured by EVOS. Patterns of recovery in clam populations are unknown. Two hypotheses will be evaluated:

1. Clam population status reflects the recovery status of sea otter populations in PWS. Clam abundance and availability in areas with damaged sea otter populations will be

greater than in areas with recovered sea otter populations.

2. Damage to clam populations has contributed to the failure of sea otter populations to recover from EVOS. Damaged sea otter populations are not recovering because damaged clam resources are not recovering.

Inadequate post-EVOS recruitment of clams may be constraining recovery of injured clam and sea otter populations. Dynamics of clam populations often are influenced substantially by patterns of recruitment. Intensity of recruitment in clams may vary significantly among years, and there may be some years in which recruitment does not occur. Such variations will have important consequences for species that depend on clams for food.

Although the NVP Program focuses on injured populations of vertebrate predators, our component project will, in addition, provide useful information regarding EVOS damage to subsistence use of clams. Prior to EVOS, clams were an important subsistence food at numerous locations in PWS. EVOS damage has limited subsistence use of intertidal clam resources.

This project will be effective in achieving stated goals if it is pursued over several years. However, limitation of work to FY 95 will provide information of significant value to the EVOS Restoration Program.

NEED FOR THE PROJECT

This component of the NVP Program will contribute to the ability of resource managers to understand if sea otters and clams are recovering from EVOS, and if not why not, and will allow resource managers and decision makers to use ecosystem-scale data to select appropriate restoration options for sea otters and clams in PWS.

Our project will address four important issues regarding the restoration of sea otter and clam populations in PWS:

1. Are clam populations different in areas where sea otter populations were reduced by EVOS, compared to areas in which sea otters were not reduced? This is a specific application of hypothesis H_{01} as defined in the NVP Program umbrella document. Does the pattern of difference indicate a causal relationship with injury to sea otter populations?

2. Are injured clam resources recovering? Clam populations are recognized as an injured resource, but recovery trends are unknown. Documentation of abundance, size structure, and recruitment patterns will provide useful information for determination of population dynamics for clams.

3. What factors are constraining injured resources from recovering? Clams are the most

important source of nutrition for sea otters in PWS. If current and recently past patterns of abundance, demography, and recruitment are contributing to low productivity in clam populations, sea otters may be suffering a consequent inability to recover effectively from EVOS damage.

4. How do patterns of clam abundance, size distribution, and recruitment influence subsistence clam resources in certain portions of the PWS region? An improved understanding of demographic and recruitment effects on clam availability will contribute to more judicious management of clam resources for human use during the recovery period.

PROJECT DESIGN

A. Objectives

The NVP Program will use an integrated, rigorously-managed ecosystem approach to understand why populations of nearshore vertebrate predators are not recovering from EVOS damage. Our component project will determine the current status of injured clam resources in PWS, and will assess the effects of clam abundance, size structure, and recruitment dynamics on the recovery of sea otter populations injured by EVOS. We will study both intertidal and nearshore subtidal clam populations known to be used as food by sea otters.

Our specific research objectives are:

1. Assemble, synthesize, and evaluate published literature on recruitment patterns of clam species that are common in nearshore habitats of PWS and are a significant part of the diet of PWS sea otters.

2. Determine the abundance and size structures of existing clam populations in nearshore habitats at selected study sites in PWS. Taxa to be evaluated will include, but are not limited to: *Saxidomus giganteus*, *Protothecа staminea*, *Tresus capax*, *Clinocardium nuttallii*, *Serripes groenlandicus*, *Mya arenaria*, *Mya truncata*, *Macoma spp.*, and *Hiatella arctica*. Some of the above taxa may be deleted because of individual site characteristics. Populations will be sampled in the intertidal zone and at two subtidal depths within the dive range of foraging sea otters. We will gather samples at three similar sites in NVP Program study areas distributed inside and outside of the EVOS area of PWS.

3. Determine rate and pattern of recruitment to settlement containers in study sites as indicated in objective 2 above. Settlement data will be collected quarterly, allowing assessment of variation in recruitment intensity by season and year.

4. Examine correlations of recruitment intensity of clams with habitat and oceanographic variables assessed in other EVOS-related projects.

B. Methods

Numbered sections below are keyed to task numbers shown previously:

1. This work will be done primarily by library database searches and consultation with present and past participants in EVOS Damage Assessment, General Restoration, Research and Monitoring, Habitat Protection, and related activities.

2. Samples will be gathered at three sites beginning in summer 1995 in study areas to be selected for the NVP Program. Tentative study areas are north Knight Island/Naked Island, South Knight Island, and Green Island/Montague Island. Tentative depths for subtidal samples are 6 and 12 m. Representative samples of sediment grain size distribution and organic content will be gathered at each location sampled for clams.

3. Settlement containers will be placed in each of the selected NVP study sites. Initial deployment will be done in summer 1995. During quarterly visits to study sites, containers will be retrieved for processing, and replaced with new containers. Thus, each container will have an exposure period of three months.

4. This task primarily will involve consultation with other EVOS Restoration participants working on oceanographic characteristics and planktonic ecology during the period of our study. We will attempt to collaborate with other investigators to determine associations and correlations among clam recruitment patterns and significant oceanographic and planktonic events.

C. Schedule

General milestones for this project:

Annual Progress Reports

Annual reports will be submitted each year in September.

Final Report

The final report for the project will be submitted in September 1999.

Task-specific milestones

Task 1: Compilation of information will be completed by 1 December 1995. Information will be incorporated in technical reports and publications that result from this project.

Task 2: Field samples will be gathered quarterly beginning in summer 1995 and concluding in summer 1998. Technical manuscripts will be completed and submitted by 31 March 1996 and 30 August 1999. Other manuscripts may be submitted depending on evaluation of data during the course of the project.

Task 3: Settlement containers will be deployed first in summer 1995. Quarterly

sampling will continue through summer 1998. A technical manuscript will be submitted for publication by 30 August 1999.

Task 4: Recruitment data will be integrated with other relevant data no later than 1 March of each year of the project, beginning in 1996 and concluding in 1999. A technical manuscript will be completed and submitted for publication by 30 September 1999.

Technical support for each task will be managed through the Institute of Marine Science (IMS), University of Alaska Fairbanks (UAF), and the Washington Cooperative Fish and Wildlife Research Unit (WACFWRU).

Field work for the project will be done at study sites in western and central Prince William Sound, Alaska, as specified above. Laboratory work, data analyses, and production of reports will be done primarily at IMS/UAF, Fairbanks, Alaska, and at WACFWRU, School of Fisheries, University of Washington, Seattle, Washington.

PROJECT IMPLEMENTATION

The NVP Program will be implemented through the National Biological Survey, Alaska Research Center, Anchorage, Alaska. The intertidal portion of this specific project will be implemented through the Alaska Department of Fish and Game. The subtidal portions of the project will be implemented through WACFWRU.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The NVP Program, of which our project is part, will establish and maintain a system for integrating component projects, and for integrating NVP projects with other components of the EVOS Restoration Program. NVP will include a Program Coordinator to oversee the compatibility and complementarity of component projects, ensure that milestones are met and deliverables produced, and serve as liaison with other components of the EVOS Restoration Program. In addition, NVP will include a Program Data Manager to oversee database management, facilitate the reasonable exchange of Program data among component projects and to other elements of the EVOS Restoration Program, arrange research travel and charters for NVP investigators, and support the administrative needs of the Program Coordinator. The Program Data Manager will maintain a central repository of all biological data collected by NVP Program participants.

NVP Program participants have established near-term milestones for the development of effective Program integration and management. The milestones are reviewed in the NVP umbrella proposal document.

FY 95 BUDGET ($K)

Personnel	48.6
Travel	15.0
Contractual	82.3
Commodities	21.5
Equipment	28.0
Subtotal	195.4
Gen. Admin.	13.1
Total	208.5

Primary Productivity as a Factor in the Recovery of Injured Resources in Prince William Sound

Project Number:	95025J
Restoration Category:	Research
Proposed By:	University of Alaska Fairbanks
Lead Trustee Agency:	DOI
Cost FY 95:	$315,400
Cost FY 96:	$310,000
Total Cost:	$935,400
Duration:	3 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

This project will investigate the production and flow of fixed carbon in the nearshore ecosystem of Prince William Sound and will determine the importance of benthic primary productivity in the recovery of injured intertidal and subtidal species. Results from this project would lay the foundation for understanding how fixed carbon is moved through the Prince William Sound nearshore system, and how this carbon flow is altered by seasonal events. The study will determine the relative importance of carbon input from phytoplankton, benthis production, terrestrial plants, and episodic transport (e.g., herring spawn), Understanding the flow of carbon will increase our understanding of factors that limit recovery of nearshore organisms.

The results of the study will give information on the relative importance of the various sources of carbon that are introduced into the nearshore system. Importance is measured by the relative abundance of each source of carbon present in the higher trophic organisms. Information will also be generated on how these proportions change seasonally and how they are affected by physical and chemical processes.

From the above information it may be possible to estimate the relative importance of the various plant communities in supplying the nearshore invertebrate community with carbon. Further, a model could be created to predict the disturbance to a community if there are changes in the normal flow of carbon into the system. Such disturbances could be effected by

oil spill treatment, El Nino events, winter storms, etc.

NEED FOR THE PROJECT

Injury to the biological resources of Prince William Sound as a result of the *Exxon Valdez* (EVOS) oil spill have been documented since 1989. Although recovery has occurred for many species and is progressing for others, many injured resources have been listed as not recovering. The range of such injured and not recovering species includes bird, marine mammals, fish, and both intertidal and subtidal organisms.

One hypothesis for the lack of recovery for injured species is that recovery is limited by food/prey availability. Most of the injured species from the higher trophic levels (birds, fish, mammals) are predators on nearshore, marine organisms. These nearshore organisms make their living as predators themselves, as scavengers, as graziers, and/or as suspension/deposit feeders. The ultimate source of carbon/energy for all of these organisms is from primary production. In the nearshore there are four possible sources for carbon: the first three are primary production from terrestrial plants, benthic marine plants and phytoplankton, and the fourth is episodic transport of carbon. Benthic plants (seaweeds and marine grasses) provide carbon for graziers, such as littorines, urchins, and limpets. These organisms in turn serve as food for higher trophic level organisms. Populations of many of these grazers have been altered by the EVOS. Phytoplankton and organic detritus (along with zooplankton) provide carbon for suspension and deposit feeders, such as barnacles, mussels, and clams. The relative importance of these forms of carbon depend on the organisms and area of concern, but contributions from both phytoplankton and benthic plants may be important. Carbon production provided by terrestrial plants will be important in nearshore areas in the vicinity of streamsw and rivers. Episodic transport could bring in carbon from areas outside of the nearshore system. Two examples of this type of transport are the annual Pacific herring spawnings in the spring and the salmon runs in the summer and fall.

A decline in primary productivity in PWS as a direct or indirect effect of the oil spill could explain the lack of recovery of some injured resources. For example, sea otters may have less prey, which feed on seaweeds, available in an area where benthic production has been depressed as a result of the spill.

This project proposes to look at primary production as one aspect of an ecosystem approach to understanding recovery of the biological resources. The general approach is to determine the relative contributions of the various sources of production into the nearshore system and alsso to determine whether this pattern has been altered in areas affected by the oil spill and treatment.

PROJECT DESIGN

A. Objectives

1. To determine the productivity and standing biomass of benthic marine plants in the nearshore.

2. To determine the productivity and biomass of phytoplankton in the nearshore.

3. To determine the organic input to the nearshore from terrestrial sources.

4. To determine the relative contribution of these sources of carbon to the carbon budget of higher trophic level organisms.

5. To determine what factors may limit primary productivity in the nearshore.

B. Methods

Site selection. About four to six sheltered rocky sites in PWS will be selected based on intertidal and subtidal vegetation and associated communities. Areas of use by higher trophic level organisms such as sea otters, herring, and birds will be targeted, if possible. Site selection will be coordinated with the nearshore study groups of the National Biological Survey (NBS) and University of Alaska (UAF).

Primary productivity will be measured by C-14 fixation *in situ*. Productivity will be normalized both by chlorophyll content and by biomass. Determinations will be made during the period of algal blooms for phytoplankton and at quarterly intervals for benthic algae and eel grasses. Extrapolations will be made to determine the total productivity for the system on an annual basis. Water chemistry for the determination of nutrients will be performed on samples taken in and near to the selected sites. Light irradiance data will be collected as often as feasible for correlation with productivity rates.

Streams that flow into the nearshore area will be sampled for total organic carbon four times during the year. Stream flow rates and capacities will be estimated in order to estimate the total carbon input from this source.

Stable carbon isotope ratios can be used to determine the source of primary productivity used by various organisms. Nitrogen isotopes can be used to look at differences in trophic feeding. Isotope ratios will be determined for the sources of carbon including phytoplankton, benthic seaweeds, detritus, participate and dissolved organic matter and herring eggs. Additionally, stable isotope ratios (C and N) will be determined for several different organisms which use different feeding strategies. Such organisms will include a grazer, suspension feeder, detritus feeder and predator. Isotope ratios will be compared to those from the sources of carbon. The isotope ratio will be determined throughout the year in order to determine seasonal variation in feeding strategies and relative importance of carbon sources. This aspect of the study will be

closely coordinated with other trophic interaction studies proposed by NBS and UAF.

C. Schedule

Spring 1995	Site selection.
June 1995-June 1997	Sampling for photosynthesis, nutrients, light levels and isotopic rations. These will be done four times a year at quarterly intervals. One sampling date will coincide with the spring algal bloom in March.

Data compilation and analysis will be ongoing throughout the year. There should be a minimum of two years of sampling for estimation of year to year variation. Annual reports will be submitted by April of each year.

D. Technical Support

Laboratory analysis of stable isotope samples and CHN samples will be required.

E. Location

Field work will take place near and at selected sheltered rocky sites in Prince William Sound. Laboratory analyses will be done at the University of Alaska, both at Fairbanks and at the Juneau Center, School of Fisheries and Ocean Sciences.

PROJECT IMPLEMENTATION

This project should be implemented by the National Biological Survey as part of its nearshore ecosystem study. The study should be closely coordinated with others that propose to look at energy flows in the nearshore food webs.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is designed to be closely coordinated with nearshore food web studies of University of Alaska Fairbanks and the Prince William Sound Science Center, and with the nearshore trophic studies proposed by the National Biological Survey. Collaboration will occur with the SEA study through oceanography, herring projects, nearshore fish and avian predation. This study will provide information to other studies concerning how fixed carbon is routed to the nearshore organisms.

FY 95 BUDGET ($K)

Personnel	141.0
Travel	11.4
Contractual	77.2
Commodities	16.3
Equipment	6.5
Subtotal	252.4
Indirect Costs	63.0
Total	315.4

This page intentionally left blank.

Five-year Plan to Remove Predators from Seabird Colonies

Project Number:	95042
Restoration Category:	General Restoration
Proposed By:	Pacific Seabird Group 4001 North Ninth St. #1801 Arlington, VA 22203 (202) 778-2240
Lead Trustee Agency:	DOI
Cost FY 95:	$75,000
Cost FY 96:	$0
Total Cost:	$75,000
Duration:	1 year
Geographic Area:	There is no field work for this project.
Injured Resource/Service:	Multiple resources, including marbled murrelet, common murre, pigeon guillemot, black oystercatcher

INTRODUCTION

This project will produce a practicable five-year plan whereby all introduced foxes, rats, ground squirrels and other alien mammals that have reduced nesting habitat at present and former seabird colonies in Alaska will be identified and recommendations will be made for their removal. We will produce a colony catalog on CD-ROM as well as hard copy of colonies where alien mammals should be removed. The five-year plan will identify cost-effective method(s) of removing alien mammals and establish a milestone and activity time line whereby removal from all islands can be accomplished within five years. The five-year plan will identify any needed regulatory activities (such as licensing or permitting the use of M-44's and 1080) and propose a strategy by which such approvals can be obtained.

During the past two years, the Pacific Seabird Group has asked the U.S. Fish & Wildlife Service either to fund this project itself, or to ask the EVOS Trustee Council to fund it. To the best of our knowledge, FWS has never asked the Trustee Council to fund this work, although the Trustee Council funded a pilot project to remove predators from two islands during FY94 (Project 94041).

The seabird species affected by this project include common murres, marbled murrelets, Kittlitz' murrelets, pigeon guillemots, tufted puffins, black oystercatchers, cormorants, black-legged kittiwakes and ancient murrelets. Some of these species suffered severe losses in the spill, but little work has been done to restore their populations. While most of the islands are outside of the Trustee Council's definition of spill area, all of the bird species killed in the spill are migratory. Common murres throughout their range in the Gulf of Alaska and the Aleutian Islands are probably genetically linked. Banding studies of alcids indicate that substantial numbers of young birds prospect for breeding sites long distances from their natal colony, such as the distance from the Aleutians to Prince William Sound. Colonies outside the Trustee Council's definition of the oil spill area are a source of birds that can and will recolonize damaged colonies. NOAA's proposed natural resource damage assessment rules (January 1994) allow for restoration of resources beyond the oil spill area when such resources have been damaged.

NEED FOR THE PROJECT

The five-year plan will provide state and federal trustees with a realistic approach to restoring Alaska's seabird colonies. Because biologists have eliminated predators from some breeding islands, we can estimate the increase in the population of seabirds that has occurred once predators such as rats and foxes have been removed. After Kaligagan Island was stocked with foxes in 1921, its seabird population plunged so low that the renowned Alaska naturalist Olaus Murie recommended that it continue as a fox farm. In the 1980s, after foxes had died out, Kaligagan had 125,000 burrowing seabirds. FWS biologists have described dramatic increases in bird populations after foxes were removed from Nizki-Alaid Island in the western Aleutians. They found particularly impressive increases for loons, pelagic cormorant, Aleutian green-winged teal, common eider, glaucous-winged gull and tufted puffin. At a 600 hectare island off Newfoundland, twelve foxes consumed 31,000 Leach's storm-petrels in one breeding season. Alien predators obviously can devastate seabird colonies.

Arctic fox, red fox (introduced for commercial ranching) or rats occur on dozens of islands in the Alaska Maritime National Wildlife Refuge. We cannot estimate with any precision the increase in population if the island ecosystems in the Alaska Maritime National Wildlife Refuge were restored to their natural, predator-free condition. We believe that increases per island would range from 10,000 to 150,000 birds. It is possible that a few decades following predator removal a colony of one million or more birds might be reestablished. Accordingly, alien predators on the Alaska Maritime National Wildlife Refuge depress seabird populations in the order of one to ten *Exxon Valdez* oil spills.

The Trustee Council should plan for compensatory restoration in breeding areas outside of the spill area. This project will provide a framework for large-scale, cost-effective compensatory restoration.

PROJECT DESIGN

A. Objectives

1. Identify all present and former seabird colonies that are limited by alien mammals.

2. Propose a method to remove each alien population of mammals from the colony in conjunction with the Alaska Maritime National Wildlife Refuge.

3. Develop a five-year plan whereby all such populations could be removed.

B. Methods

1. Literature search and consultations with federal, state and other natural resource managers to identify all islands with introduced predators.

2. Consult with FWS, ADFG, USDA Animal Damage Control, and predator removal experts abroad to identify the most efficacious removal techniques.

C. Schedule

Activity	Month
Contract Award	0
Work Begins	1
Literature search completed	3
Agency/experts contacts completed	5
Draft Report for comment	8
Final Report	11

The draft report can be available for public comment if the Trustee Council believes that this would be necessary.

D. Technical Support

PSG will need access to the FWS colony catalog data base.

E. Location

Juneau, Anchorage, Homer, Aleutian Islands

PROJECT IMPLEMENTATION

For over two years, PSG has urged FWS to undertake this project. PSG is prepared to facilitate this project by functioning as the lead organization.

PSG is an international organization that was founded in 1972 to promote knowledge, study and conservation of Pacific seabirds. PSG draws its members from the entire Pacific Basin, and includes biologists who have research interests in Pacific seabirds, state and federal officials who manage seabird refuges and individuals with interests in marine conservation. PSG has hosted symposia on the biology and management of virtually every seabird species affected by the *Exxon Valdez* oil spill, and has sponsored symposia on the effects of the spill on seabirds. As such, PSG is uniquely qualified to implement this project.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project can be integrated with project No. 94041 that removes predators from two colonies. Moreover, if the Trustee Council were to fund predator removal from additional colonies during FY95 (as PSG would urge it to do), this project would be integrated with any such project(s).

FY 95 BUDGET ($K)

Sub-contract(s)	50.0
Travel	8.0
Commodities (supplies, telephone, etc)	2.0
General administration/overhead	15.0
Total	75.0

Cordova Cutthroat Trout Habitat Rehabilitation

Project Number:	95043A
Restoration Category:	General Restoration
Proposed By:	USFS
Cost FY 95:	$26,400
Cost FY 96:	$0
Total Cost:	$26,400
Duration:	1 year
Geographic Area:	Streams in Eyak Lake basin and in logged areas near Cordova
Injured Resource/Service:	Cutthroat trout

INTRODUCTION

In recent years there has been increasing concern over the cutthroat trout populations in the Prince William Sound area. Studies by the Alaska Department of Fish and Game show that cutthroat trout were adversely affected by the *Exxon Valdez* oil spill. Areas in Prince William Sound have been closed to cutthroat fishing, and reduced limits and size restrictions have been imposed in the remaining areas. In addition, road construction and other development around Eyak Lake, near Cordova, has eliminated cutthroat spawning habitat. Recent timber harvesting east of Cordova could possibly have adverse effects on cutthroat habitat, although no assessment has yet been made.

The Cordova Ranger District proposes to work with the City of Cordova, the State of Alaska, and the Eyak Corporation, to identify degraded cutthroat habitat and develop a restoration or enhancement program. Although the areas identified so far are not on Forest Service land, adjacent Forest Service lands or recreation sites could be affected. In addition, if cutthroat populations in Eyak Lake and other areas are restored, there would be less fishing pressure on some of the small cutthroat stocks in streams on Forest Service lands.

The initial role of the Forest Service would be to take the lead in contacting the other groups and developing a memorandum of understanding. If the groups agree to undertake a cutthroat habitat restoration program, the Forest Service could help identify the work that needs to be done, develop proposals, obtain permits, and work on the environmental analysis.

Once the work is identified, additional funding will be needed to carry out the projects, most likely in FY 1996. The landowners should be responsible for hiring the crews to work on their lands. This will help ensure that members of the local community are hired. The role of the Forest Service at this point would be to provide some technical assistance, if needed, and to evaluate the work that has been done.

NEED FOR THE PROJECT

Historically Eyak Lake supported a good cutthroat sport fishery with estimated harvests ranging from 90 to 833 during the period from 1977 to 1989. The loss of spawning habitat from the construction of roads, a water treatment plant, and housing seems to have adversely affected the population, however. Although there is only anecdotal information and limited data from a study in 1991 by ADFG, it appears that the population has declined dramatically.

In the areas east of Cordova where timber harvesting has occurred, there is little or no information as to whether cutthroat habitat has been affected. These areas do surround several lakes which have cutthroat and include the streams where cutthroat spawning would take place.

In both cases there is a need to determine what damage has been done, what potential problems exist, and how to remedy the situation. In some of the logged areas, for example, all that may be needed could be the rehabilitation of the roads to halt sedimentation of the streams. Around Eyak Lake it may be necessary to construct additional spawning area or reset culverts so they do not block cutthroat migration. Most of all, it is important to identify the problems that exist so measures can be taken before the cutthroat populations are further impacted.

Speaking in more general terms, there are a number of other reasons for preserving or enhancing the cutthroat populations in the Cordova area. Although the Cordova area was not in the direct path of the oil spill, the study by ADFG found that cutthroat trout can stray considerable distances. Thus, it is possible that Cordova stocks have been affected. This study also suggests that the effects of the oil spill may have spread into unoiled areas in 1990, affecting the growth of Dolly Varden char. While no adverse affects were noted for cutthroat in unoiled areas, there could still be residual effects that have gone undetected.

There are also some genetic concerns that need to be addressed. Since Prince William Sound is the northern limit of the cutthroat trout's range, there may be unique genetic stocks which have adapted to the extreme conditions here. The local populations should be protected until genetic studies have been conducted.

Cutthroat trout also provide a popular sport fishery in the spring and early summer before the salmon runs begin, especially for fly fishermen. As tourism increases, and especially if the Copper River Highway is completed, fishing pressure will increase in the Cordova area. It will

be important to maintain or enhance the fish populations to preserve the recreational experience and the economic benefits derived from sport fishing, as well as the biological vitality of the stocks.

PROJECT DESIGN

A. Objectives

The main objective for FY 1995 would be to identify habitat restoration opportunities in the Cordova area. This would require coordination and cooperation among the City of Cordova, the Eyak Corporation, the State of Alaska, and the U.S. Forest Service since these entities are the principal landowners in the area. Once the opportunities are identified, the groups would need to develop a memorandum of understanding to determine the responsibilities each group will have for implementing the restoration work. The actual project work would be funded separately for FY 1996.

B. Methods

The Cordova Ranger District would take the lead in arranging and facilitating meetings with these groups and other interested parties. If there is sufficient interest and agreement, the preliminary surveys and assessments would then be carried out, preferably with representatives from all of the groups. However, the Alaska Department of Fish and Game and the U.S. Forest Service would be expected to provide technical expertise as to how to conduct the surveys and the rehabilitation work. A project work plan would then be submitted to the parties for approval.

The surveys and assessments would require a three-person crew for two months. Each of the streams in developed or altered areas would need to be surveyed. Special attention would be given to road crossings and other areas where erosion or migration barriers would be likely to occur. As the crews walk the streams, the amount of spawning and rearing area would need to be recorded, problem areas would be identified, and restoration prescriptions or enhancement opportunities would be noted.

C. Schedule

October 1994 - February 1995	Develop memorandum and commitment of personnel for preliminary surveys.
May - June 1995	Conduct surveys to assess project needs. Prepare project work plan.
July 1995	Decision on project plan.

D. Technical Support

Technical expertise on the rehabilitation of logging roads, tree planting and other silvicultural practices, and hydrology may be needed to carry out the surveys and assessments. There are qualified Forest Service personnel that could perform some of this work, but other parties may also have qualified personnel. Selection of the assessment team will need to be developed during the meetings.

E. Location

The proposed project area would include the Eyak Lake watershed near Cordova (Cordova C-5 quadrangle, T15S, R1W and R2W) and the logged areas approximately 13 miles east of Cordova (Cordova C-4 quadrangle, T15S, R1W) around Lake Elsner and several other small lakes.

PROJECT IMPLEMENTATION

The Cordova Ranger District could arrange the meetings and discussions, but after that the duties would be shared by all of the aforementioned parties. The main part of the habitat survey work and the identification of restoration and enhancement opportunities could be carried out by the Forest Service, since the agency has experience in this area. However, it would be best if all of the parties involved could provide as much input as possible. The actual implementation of the restoration work would be carried out by contractors, employees of the Eyak Corporation, or other personnel.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Not applicable.

FY 95 BUDGET ($K)

Personnel	21.6
Travel	0.8
Contractual	0.0
Commodities	0.0
Equipment	0.8
Subtotal	23.2
Gen. Admin.	3.2
Total	26.4

Cutthroat Trout and Dolly Varden Rehabilitation in Western Prince William Sound

Project Number:	95043B
Restoration Category:	General Restoration
Proposed By:	USFS
Cost FY 95:	$132,200
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Cutthroat trout and Dolly Varden

INTRODUCTION

Although cutthroat trout and Dolly Varden overwinter and spawn in freshwater, these fish use nearshore and estuarine habitat for feeding throughout their lives. The highest concentrations of petroleum hydrocarbon metabolites in bile of all fish sampled in 1989 were found in Dolly Varden. The larger cutthroat trout also showed higher levels of mortality in oiled than in unoiled areas.

Tagging studies demonstrated that the annual mortality of adult Dolly Varden in oiled areas was 32 percent greater than in unoiled areas. In 1989-1990, there was 57 percent greater mortality, and in 1990-1991, a 65 percent greater mortality, in oiled streams versus unoiled streams.

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.

Prince William Sound (PWS) is the northern extent of the range of cutthroat trout. The cutthroat stocks known to exist within PWS are few in number, rarely number more than 1,000 individuals, and are geographically isolated from each other. Of 143 streams surveyed for spawning salmon in PWS in 1989, only 10 contained anadromous cutthroat trout. These fish have a limited home range and do not migrate over great expanses of water. These small

populations are vulnerable to exploitation and habitat alterations. Dolly Varden and cutthroat trout in oiled areas may have sustained a sublethal injury (slower growth in oiled areas). Scientists cannot estimate a recovery time without further study.

A combination of habitat improvements and decreased harvests could increase overall survival of those stocks impacted by the oil spill. By decreasing mortality in the freshwater phases of the life cycle, habitat improvements in the freshwater environments can mitigate the increased mortality experienced in the nearshore and estuarine habitats. As the principal land manager in Prince William Sound, the US Forest Service will undertake habitat improvements in the freshwater habitats of Dolly Varden and cutthroat trout. ADF&G has promulgated regulations and emergency closures which increase survival by a decreased harvest of Dolly Varden during spawning periods and eliminating the harvest of cutthroat trout in the oiled areas of Prince William Sound.

PROJECT DESCRIPTION

A. Objectives

The objectives are to restore, improve, and enhance cutthroat trout and Dolly Varden rearing and spawning habitat in PWS.

B. Methods

Field surveys in 1994 will test for presence\absence and further evaluate the proposed structures at each site in order to write the NEPA documents. The interim report will consist of copies of NEPA documents prepared at that date. Habitat improvements will be constructed in 1995. Pre-monitoring will also occur in 1995.

This project entails the use of some or all of the approved instream habitat techniques, including: channel blocks, boulder placement, cover logs and root wads, tree cover, bank cribs with cover logs, logs and bank shelters, single-wing and double wing deflectors, deflectors and cover logs, channel constrictors, cross logs and revetments, wedge dams, and K dams.

Channel Blocks
Channel blocks consolidate braided channels into a single, deeper channel and, subsequently, create additional fish holding habitat. These structures may also be used to maintain stream meanders where flood flows have eroded a channel through the meander. These structures hold normal or moderately high flows in the meander channels, but still allow flood waters to overflow in the blocked channels. They can also collect gravel suitable for spawning.

Boulder Placement
Boulders provide overhead cover and resting areas. Added depth is also created by scouring as a result of reduced channel capacity and increased velocity.

Cover Logs and Rootwads
These structures provide overhead cover in sections of stream where existing water depth may be adequate but cover is lacking.

Tree Covers
Trees placed in proper locations provide excellent overhead cover and an ideal substrate for aquatic organisms. In addition, trees serve as deflectors which constrict wide, shallow channels and increase stream velocity. This results in sediment flushing and the creation of deeper scour pools and pockets of spawning substrate.

Bank Cribs with Cover Logs
These structures protect unstable banks, while at the same time providing excellent overhead cover for fish.

Log and Bank Shelters
Log and bank shelters provide overhead cover. Some streambank protection is also provided, although less than with cribs. Brush and other woody material attached to the platforms provide additional benefit by harboring insects and other fish food organisms.

Single-Wing Deflectors
These structures constrict and divert water flow so that stream meanders and pools and pockets of spawning gravel are formed by scouring and relocation of fine sediment and gravel.

Double-Wing Deflectors
Double-wing deflectors create midchannel pools through scouring action in shallow sections of streams.

Deflectors and Cover Logs
Deflector and cover logs are similar to a single-wing deflectors. Cover logs ensure bank stability where suitable boulders, tree stumps, or stable banks are lacking.

Channel Constrictors
These structures serve as modified deflectors designed to create overhead cover similar to that provided by undercut banks.

Cross Log and Revetment
Cross log and revetments create scour pools by the action of water pouring over or under cross logs. Revetment logs create overhead cover and protect the bank at the same time.

Wedge Dam and K Dam
These structures create pools or deeper water through scouring action in shallow sections of stream. In continuous, steep gradients, the short, upstream break in gradient also provides resting and spawning area, often holding more fish than the deeper pool below. The quiet water above the structure and the edges of the pool below also act as a trap for spawning gravel and organic material used as food by stream invertebrates .

Gabions
Where proper size rocks are available, Gabions can be used in lieu of logs for structure designs such as deflectors, dams, and bank abutments.

Brush Bundles
Brush bundles can be used to provide fish hiding cover in a stream or lake which can decrease competition for space with more aggressive species. Bundles create visual obstructions, reducing interspecific competitive interactions, allowing more fish to inhabit preferred habitats.

Alternative Methods
In addition to the present proposal, alternatives considered to mitigate effects on cutthroat trout and Dolly Varden included: decreasing fishing mortality, transplanting cutthroat trout and Dolly Varden char from healthy populations, starting new cutthroat trout and Dolly Varden populations, and redirecting sport fisheries by planting other species in barriered lakes. These alternatives were dropped from further consideration for reasons described below.

Decrease fishing mortality
Decreasing fishing mortality, especially during the vulnerable spawning seasons, can increase the overall survival of cutthroat trout and Dolly Varden. The most effective method of changing fishing mortality is through controlling fishing seasons, bag limits and areas. This alternative is not available to the principal land manager, the US Forest Service, under the present management authorities but is being implemented by ADFG. Harvest regulation for sport and commercial fishing is managed by the Alaska Department of Fish and Game. ADFG has promulgated regulations and emergency closures which increase survival by a decreased harvest of Dolly Varden during spawning periods and eliminating the harvest of cutthroat trout in the oiled areas of Prince William Sound.

Transplant cutthroat trout and Dolly Varden char from healthy populations
Populations sustaining higher mortalities or decreased reproductive success due to hydrocarbon metabolites could be supplemented by trout from other healthy populations. Because no genetic evaluations of stock separation among the populations in Prince William Sound have been undertaken, and because little information is known of immigration between geographic areas, there is little basis for evaluating whether a potential donor stock is available.

Start new cutthroat trout and Dolly Varden populations
New populations established in presently uninhabited locations could increase the effective population size of the cutthroat trout and Dolly Varden meta-populations in Prince William Sound. Because competitive abilities of these two species is low compared to other salmonids, this would need to be habitats in which pacific salmon are at low abundance or absent. At this time, no areas have been identified in which to start new populations. Due to lack of information on present stocks, there is little basis for selecting either parent stocks or appropriate locations for stocking.

Redirect sport fisheries by planting other species in barriered lakes
Harvest mortality on cutthroat and Dolly Varden trout could be decreased by substituting other

sport fishing opportunities. New fishable populations of trout such as rainbow or grayling could decrease fishing pressure on cutthroat and Dolly Varden trout. These would have to be planted in lakes in which they will not cause harm to other species, such as barren or barriered lakes. Because rainbow trout and grayling are not endemic to Prince William Sound, it is likely that they will have limited survival ability. Monitoring of rainbow planted Granite Bay Lake, western PWS in 1990 by ADF&G will give further information relevant to their ability to survive in Prince William Sound and to substitute for cutthroat trout and Dolly Varden sport fisheries.

C. Schedule

Because approval and funding of projects were delayed, the anticipated schedule listed in the proposal (Table 1) must change. The National Environmental Policy Act (NEPA) requires that actions affecting resources on the National Forest be analyzed for their potential effects on the environment prior to implementation of the project .

The original time line scheduled the EA's to be completed between 10/93 and 1/94. Prior to 10/93 all the instream field reconnaissance had not been completed. The funding and the opportunity to complete the field work were not available during the fall and winter of 1993. Without site specific stream habitat information the EA cannot be completed.

Construction of habitat improvements in 1994 was predicated on completion of NEPA documents prior to planning for the 1994 summer field season. Since potential effects of construction of instream structures are to be mitigated by limiting these activities to timing windows outside those periods in which spawning adults or eggs are present in the streams, streams with both spring and fall spawning species may have severely constricted windows limited to two to four weeks in May and June.

The Forest Service initiated public scoping in January 1994. Habitat surveys must precede the EA decisions. These surveys would be completed during the 1994 field season (5/94-10/94). After the surveys are complete the EA's can be completed for public review and a decision made. Instream enhancement activities could then be allowed, depending on the decision that is made. These enhancements would most likely be constructed in May and June, 1995, to meet the narrow construction time window allowed for instream habitat improvements. The attached budget reflects the changes requested to complete the project in 1995.

Table 1: Anticipated schedule of events for proposed projects. Time periods listed in brackets are the time period projected in the original proposal.

Activity	Time Period
Habitat surveys	05/94 - 11 /94 (02/94 - 07/94)
Stream monitoring	05/94 - 05/95 (02/94 - 06/94)

NEPA scoping & writing	01/94 - 12/94 (10/93 - 01/94)
Project construction	05/95 - 07/95 (05/94 - 07/94)
Estimate fish abundance & distribution	08/95 - 11 /96 (08/94 -11/94)
Analyze data, write project report	12/94 - 04/95, 12/95 - 04/96 (10/94 - 04/95)
Submit annual project report	04/95 ,04/96 (04/95)

D. Technical Support

The Forest Service hydrologist will be requested to review the suitability of the proposed structures for the hydrological regime of each stream.

E. Location

All sites are located in Prince William Sound. Potential improvements which will be further investigated include:

Otter Creek and Lake, Bay of Isles, Knight Island
Otter Creek is the site of a fish pass which is being modified to improve passage for pinks and cutthroat (project 94139). The value of brush bundles for hiding cover, structures to collect spawning gravel and brush cover structures in the steeper area with larger substrate will be investigated.

Cowpen Lake, Unakwik Inlet
The emphasis at this lake will be cover structures in the inlet and outlet stream to provide additional cover and spawning gravel for cutthroat trout competing with coho salmon. Structures to collect spawning gravel and create resting pools with hiding cover are planned for the inlet stream. Cover in the form of increased pool size and hiding areas made of brush bundles are being considered in the upper end of the outlet stream which flows intermittently in dry periods trapping cutthroat trout and Dolly Varden in pools.

Gumboot Lakes, Eshamy Bay
The creek, also called Gunboat Creek, is located in a muskeg flat on the northeastern shore of the lake. The channel has two small faces which impede fish passage upstream. Potential enhancements include blasting two pools in the lower gradient boulder/bedrock section to lower the gradient and provide pools and placing five brush bundles in the upper section.

Billy's Hole, Long Bay (Northern PWS near Columbia Bay)
A short, wide and shallow channel connects a small lake to the larger 80 acre lake. Small structures to provide cover would be provided in this short connecting stream. Trout habitat can potentially be improved by constructing cover structures in a large semi-braided inlet channel

Sockeye Creek and Lake, Bay of Isles, Knight Island
The major western inlet will be considered for large structures to stabilize gravel in the high gradient section and brush bundles will be considered for the lower gradient areas where no salmon spawning is occurring. Large woody debris may be placed in the upper end of the southeast tributary of the lake to stabilize gravel. Implementation of the project on this site must await confirmation that moneys can legally be spent by the Forest Service on private lands.

Unnamed lake in Heather Inlet, Columbia Bay
This site is an alternate site that will be considered if approval to expend money on private lands is delayed. Structures designed to create pool habitat for cutthroat trout in the shallow, low gradient inlet stream are being considered. Possible modification of barriers in the outlet stream will be evaluated .

F. Environmental Compliance/Permit/Coordination Status

EA's will be required with information specific to each project. EA's must be reviewed for compliance with Coastal Zone Management regulations by the State of Alaska. Projects in eastern Prince William Sound may require review at the District level while projects in the Wilderness Study Area in western Prince William Sound require extensive review at the District, Forest and Regional levels of the Forest Service. These projects also require coordination with the land owners and are as follows.

Title 16 compliance is needed for activities on private lands. Cooperative agreements with the land owners will specify the need for them to apply for Title 16 permits.

Table 2: Land ownership and Wilderness status of proposed sites, and NEPA documentation required for proposed projects.

Project Location	Land Owner	NEPA
Otter Creek and Lake	USFS land, within Wilderness Study Area	EA

Cowpen Lake	USFS land, within Wilderness Study Area	EA
Gumboot Creek and Lakes	USFS land, within Wilderness Study Area	EA
Billy's Hole Lake	USFS land, within Wilderness Study Area	EA
Sockeye Creek and Lake	CAC land, within Wilderness Study Area	EA
Columbia Bay	USFS land, within Wilderness Study Area	EA

FY 95 BUDGET ($K)

Personnel	82.9
Travel	1.6
Contractual	4.4
Commodities	16.8
Equipment	13.8
Subtotal	119.5
General Administration	12.7
Project Total	132.2

Green Island Intertidal Restoration Monitoring.

Project Number:	95045
Restoration Category:	Monitoring (new)
Proposed By:	University of Alaska Fairbanks
Lead Trustee Agency:	USFS
Cost FY 95:	$113,414
Cost FY 96:	$112,955
Total Cost:	$343,033
Duration:	3 years
Geographic Area:	Prince William Sound

INTRODUCTION

We propose the first year of a three year effort to update and expand a project to monitor natural recovery of biological diversity and community structure in intertidal and shoreline ecosystems of outer Prince William Sound affected by the *Exxon Valdez* oil spill. In 1986 we began a project to document the biological diversity features of Green Island. In late March 1989 oil from the *Exxon Valdez* arrived at Green Island. In August 1989 we established intertidal and shoreline monitoring transects in 3 locations at Green and Little Green Island that had received heavy, moderate, and light oiling. The plots were remeasured in June 1990, and two publications resulted. Funding and support came from the University of Alaska and USDA Forest Service PNW Research Station. No money from the *Exxon Valdez* process was obtained to support the Green Island project. The study has been halted for lack of funding since. With this project we propose to continue our monitoring at Green Island and Little Green Island, and add a control (unoiled) site to be established at Hinchinbrook Island. This project will:

1. Update and analyze changes in abundance of intertidal organisms on the transects since 1989-90;

2. Determine overall changes in species richness since 1989/1986;

3. Document growth and community structure of *Fucus* that have recruited since 1989;

4. Compare community structure and species richness of the oiled sites with non-oiled sites to be established.

This project will provide a basis for determining the rate and degree of recovery from the spill in a representative heavily affected area, continue and update documentation of a site studied before the spill and now dedicated to long-term research and monitoring use, and generate reports, data bases, scientific literature, and public information.

NEED FOR THE PROJECT

Intertidal organisms are listed as one of the biological resources not recovering from the spill. Monitoring natural recovery has been identified as one of the primary restoration strategies for intertidal organisms, along with conducting research to find out why these resources are not recovering. While the lower and to some extent the middle intertidal zone are recovering, injury persists in the upper intertidal zone. In a previous paper on our Green Island study we proposed a conceptual scheme and explanation for why oil damage should be expected to be most severe at the upper intertidal level. We also suggested in that change to community structure was one of the major effects of the spill in our study area.

This proposed project will identify the pattern and rate of natural recovery on sites of different oiling severity and especially the *continuing* effects of the disruption cause by the spill - how community structure and composition has changed. A unique element of this proposed project is that we carried out taxonomic surveys in 1986 before the spill and thus we have some idea of how our site has been affected by the spill in particular. We also have voucher specimens, quantitative data, and photo documentation of intertidal sites matched to beach transects above with derived index values for the amount of oiling from 1989 and 1990. These are particularly valuable data sets given the importance of the time dimension in recovery processes. Any totally new studies begun now, no matter how well planned, would have to ignore or infer the previous condition of the community, making meaningful comparison difficult.

PROJECT DESIGN

A. Objectives

There are three main elements to successful data collection in a biotic monitoring project:

1. establishing high-resolution spatial control in order to be able to relocate individual small areas and organisms,

2. positively identifying species to ensure that changes seen between monitoring dates are properly assigned among species, and

3. quantifying the abundance of species.

To date, our Green Island project has concentrated on tasks 1 and 2; we propose to expand that

work at Green Island and establish an unoiled control site on Hinchinbrook Island. We have been impressed with the dynamic forces in the surf zone and have already experienced a significant loss of our permanent plot markers. Rehabilitation of markers is an important continuing task.

To accomplish our objectives we have identified four project tasks.

1. Update beach and intertidal transects. We propose to monitor our original transects in field season 1995, and thus be able to report results based on a comparison with 1989 and 1990 data. We will establish spatial control on the study locations and intensive study locations will be grided.

2. Expand the area of coverage and obtain and unoiled control site. A gap in our existing data base is the lack of an unoiled control site that matches the characteristics of our study area. We have identified a suitable area on Hinchinbrook Island and propose to establish a replicate monitoring installation early on in the project. We also are convinced of the need to expand the size of the plots we are monitoring to collect more data for the field effort and to overcome a large natural variability term.

3. Complete a biosystematic survey, species lists, and design a protocol to resample with the same intensity for the future. A master species list is a cumulative product, but we believe it is necessary to design a species diversity sampling protocol that can be repeated at intervals with some confidence of comparability.

4. Investigate winter and spring conditions. We have observed already the dramatic differences between summer and winter beach conditions. We believe that fall/winter site visits are necessary to observe and document some of the forces and immediate effects of winter storms.

Our three working hypotheses at this point are:

1. Mussels and other bivalves formerly restricted to crevice refuges on Green Island will successfully colonize exposed habitats, reducing the abundance of formerly dominant primary producers.

2. Simultaneous mass mortality disrupted the natural patch dynamic regime of disturbance in rocky intertidal habitats and is leading to a uniform, locally less diverse community structure in the area affected by the *Exxon Valdez* spill.

3. Opportunistic green filamentous algae will occupy growing space released by delayed mortality of the pre-spill organisms. To the degree that the green algae persist in local habitat patches in the 1993-1996 time period they are indicators of continuing, local chronic oil injury.

B. Methods

In 1989 at each site we established horizontal beach transects to map the extent and distribution of oil. Mapping extended from about MHHW (or 3 m above tidal datum) inland to the line of alder shrubs. Patches of oil along the beach larger than 30 cm along either axis were mapped in their entirety. The extent of oil coverage along the beach was mapped in percent cover classes. In the intertidal zone, we established 3 parallel transects oriented perpendicular to the shoreline. Along each transect line we established plots of 0.5 m x 0.5 m at vertical intervals of 1.0 m to determine the condition of marine organisms and communities. We photographed the intertidal plots and took notes and made collections of the plants and animals present, and noted the oiling condition. We made cover and abundance measurements from 8" x 10" black and white prints of the photos. Both the horizontal and vertical transects were permanently marked. During an extreme high tide stage we observed patches of oil or tar that were stranded on the lower beach to determine the potential for oil remobilization.

We will follow the methods of Jones et al. (1980) for monitoring rocky intertidal sites. We will obtain quantitative measures of cover/abundance through direct observation and sequential photography. We will expand the coverage of plots in our existing transects to an area that will allow characterization of the entire community and statistically valid estimation of the abundance of special species.

Special target species will be closely monitored within the transects and surrounding area because of their known important ecological roles elsewhere. A working list will be developed early in the project and adjusted as results dictate. Candidate species include the following:

The surfgrass *Phyllospadix serrulatus*, blue mussel *Mytilus edulis*, and brown rockweed *Fucus garderni*, three of the species that appear to have sustained the heaviest damage from the oil spill in our area.

The seastars *Pisaster ochracea* and *Evasterias troschelli*. The first is one of the most conspicuous animals along much of the Pacific coast intertidal zone where it has a major effect through predation on barnacles, snails, limpets, and chitons.

The snails *Nucella lamellosa* and *N. lima*, and the nudibranch *Onchidoris bilamellata*. The first species is a regulator of marine community structure.

The grazers *Strongylocentrotus droebachiensis* and *Katherina tunicata*. The second species is a significant herbivore in the region.

C. Schedule

Start project in February 1995 to prepare for 1995 field season. Visit site in spring low tide sequence to rehabilitate plot markers. Sample during summer low tide series and establish control site. Visit and assess site during fall/winter low tides. Recruit graduate student for fall 1995. Prepare first year report on 6-year (1989-95) changes. Coordinate with other restoration projects in

winter 1995-96 and modify plans. First year report in June 1996. Continue study in 1996 and 1997 seasons. Plan for permanent archiving of database and long-term future study at appropriate intervals.

D. Technical Support

University of Alaska Museum facilities (reference collection and archiving), computer mapping and access to previous Green Island study database, rock drill, taxonomic expertise in nearshore benthic organisms, statistical and ecological consulting.

E. Location

Green Island, Little Green Island, and north Montague Island

PROJECT IMPLEMENTATION

Because of the continuing nature of the project which would build upon a previous effort, the University of Alaska team that conducted the original study and which has the database and knows the study locations should implement the project. In addition Nora Foster is the taxonomic expert for aquatic and marine invertebrates in the state of Alaska.

COORDINATION OF INTEGRATED RESEARCH EFFORT

We propose to develop cooperation with the Institute of Marine Science at the University of Alaska Fairbanks including through support of a graduate thesis project. We plan to coordinate our study with others taking place at Green Island, especially studies of sea otter population changes. Taxonomic samples will be archived in the University of Alaska Museum for permanent referencing.

FY 95 BUDGET ($K)

Personnel	57.0
Travel	10.0
Contractual	0.0
Commodities	2.0
Equipment	12.0
Subtotal	81.0
Overhead (@ 47%)	32.4
Total	113.4

This page intentionally left blank.

Investigation of the Long-term Record in Tree Rings of Climatic Features that Control Key Ecosystem Variables Related to Recovery in the Spill-affected Area

Project Number:	95046
Restoration Category:	Research
Proposed By:	Columbia University University of Alaska Fairbanks
Lead Trustee Agency:	NOAA
Cost FY 95:	$153,620
Cost FY 96:	$166,302
Total Cost:	Unknown
Duration:	1 year pilot study, probable 3 years overall
Geographic Area:	Prince William Sound, Kenai Peninsula, Kodiak Island
Injured Resource/Service:	Multiple resources

INTRODUCTION

We propose to sample tree-rings from a variety of sites in the spill-affected area to develop a long-term master chronology and proxy record of climatic conditions over the last 2 to 4 centuries. This project will calibrate tree growth compared to instrument-based climate records during the 20th century in order to determine the climatic sensitivity of the trees, and then extend the inferred climate record back in time as far as tree-ring records will permit. Climatic/oceanographic features can control populations of a variety of injured resources either directly or through their control of ecosystem variability. Studies of climatic/oceanographic variability have been identified as a high priority restoration research item. Long-term climate changes and/or cycles are potential explanations or additional factors that may be preventing the recovery of injured resources. Instrument-based climate records are limited in time in the spill-affected area, and the long-term perspective that tree-ring

Tree-rings, when properly sampled, measured, and interpreted, have proven to be useful and reliable indicators of climatic events. Different trees growing on different sites respond to a variety of factors in the environment. Trees on some sites slow their growth when summers are cold or accelerate growth when conditions are wet, for example. As a result, the long time series available from tree-ring records are an especially valuable source of information on long-

term environmental change. In addition, individual trees damaged by unrecorded natural disasters (volcanoes, heavy snow loads, droughts, abnormal short-term weather events, or insect attacks) produce thin tree-rings that can pinpoint these events. Whole stands of trees integrate and then record growing conditions over whole regions.

This project will provide a basis for determining whether natural climate cycles or trends are responsible for preventing the recovery from the spill, expand coverage of tree-ring work in a potentially climate-sensitive area, and generate reports, data bases, scientific literature, and public information.

NEED FOR THE PROJECT

Several of the injured resources that are not recovering are higher trophic level animals that are highly dependent of the fluctuating larger ecosystem of the spill-affected area. Climatic and oceanographic conditions can both augment and limit the productivity of this system, and the resulting ecosystem conditions may largely explain the status of injured resources. Studies and monitoring in the spill-affected area greatly benefit from a long time perspective, but few techniques are available to investigate the past. Tree-ring research is one of the best-established tools of investigating the past and this project can draw upon an emerging picture of the eastern Pacific climate system from other tree-ring studies in western North America. The forests of Prince William Sound are the northernmost expression of the coastal forest of western North America, and they are sustained in their extreme northern location to a great degree by advected heat from the North Pacific/Gulf of Alaska system. When that system changes in state it should be reflected in the growth of trees. The forests of Kodiak Island are the westernmost extent of the coastal forest and grow under a rigorous limitation by summer temperature, although a general treeline advance is continuing along the western margin of the coastal forest limits.

PROJECT DESIGN

A. Objectives

1. Develop a master chronology of climate response as reflected in tree-ring width and density correlated to the instrument-based record of the 20th century.

2. Identify the sensitivity of ring-widths and densities to key ecosystem-forcing properties of climate and ocean state in the spill-affected area.

3. Collect samples of ring-width series across the spill-affected area on sites that are sensitive to summer temperature, precipitation, and other factors.

4. Identify any unusual ring signatures that indicate volcanic events, extreme weather events, etc.

5. Develop a high-resolution proxy climate record for the 18th and 19th centuries, and if possible for the 16th and 17th centuries.

6. Integrate the proxy record into models of the larger spill area ecosystem.

B. Methods

Tree-ring analysis methods are fairly well established and involve cross-dating to assure precision of ring series, transformation of raw ring-width chronologies to unitless standardized ring width indices through user-specified function fitting, theoretically based and empirical application of spline and filter functions, and residual transformation.

1. Identify growth-sensitive sites in forests of the spill area and the particular factors of climate that tree-rings are responding to on such sites.

2. Correlate degree of sensitivity to master chronologies for all strongly correlated climatic/oceanographic parameters during instrumented period.

3. Extend record of proxy climate back by obtaining high-resolution tree-ring samples from Prince William Sound, Kenai Peninsula, and Kodiak Island. Attempt a 400-year chronology.

4. Provide input to ecosystem assessment team on pattern, trend, and periodicity of climatic/ocean state conditions. Formulate input into ecosystem model.

C. Schedule

Start project in February 1995 to prepare for 1995 field season by examining climate models and collecting instrument-based climate records. Visit low-elevation forest sampling sites in PWS in early summer 1995. Sample and revisit reference stands during July and August 1995. Visit high elevation treeline sites and take cores in PWS in July and August 1995. Prepare data and determine potential of different growth sensitive tree-ring sampling sites in fall 1995. Coordinate with other restoration projects in winter 1995-96 and modify plans. First year report in June 1996. Continue study in 1996 and 1997 seasons and expand to Kenai and Kodiak. Plan for permanent archiving of database.

D. Technical Support

See Project Implementation below.

E. Location

1995 - Prince William Sound (possible other coastal forest locations for background sampling).
1996 - Expanded PWS sampling on best sites, Kenai Peninsula.
1997 - Kodiak Is. and final sampling in other localities.

PROJECT IMPLEMENTATION

The conduct of this restoration project requires the combination of state-of-the art tree-ring analysis facilities, knowledge of the potential forest sampling base in the spill-affected area, and availability for involvement and interaction with ecosystem research teams in Alaska. A collaborative partnership recently established between the Tree-Ring Laboratory (TRL) at Lamont-Doherty Earth Observatory (LEDO) and the University of Alaska Fairbanks (UAF) Agricultural and Forestry Experiment Station (AFES) has the unique capabilities required.

TRL (at LEDO)has 3 computerized (Macintosh) measuring machines of its own design. The UAF AFES) recently acquired all the components for a similar measurement system and is being assisted by LDEO in making the system operational and compatible by the fall of 1994. These machines measure to an order of magnitude more precisely (.001) than commercially available units. For data analysis AFES has a newly acquired Macintosh Power PC 7100. AFES has one Zeiss binocularscope for ring boundary sighting; TRL has several microscopes, with one equipped for photomicrographs. TRL has fully operational x-ray and densiometric analysis systems, including a new high capacity image analysis system.

There are shop facilities for preparing specimens for ring-width or densiometric analysis at both LEDO and AFES. TRL has humidity-controlled storage rooms set up for preserving specimens. AFES is attempting to build an Alaska tree-ring archive for permanent archiving of Alaska specimens. TRL offices and labs occupy all of one building at LDEO. In addition, TRL has the use of support facilities at LDEO, machine and wood shops, libraries, etc. TRL has its own library of specialized computer programs for the reduction and analysis of tree-ring data. AFES has a data base on several large, precisely mapped forest reference stands in Prince William Sound and potential areas of similar vegetation with different climate in southeast Alaska that are permanently marked. These reference stands could serve as permanent sample/future monitoring sites.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Once the master chronologies and tree-ring sensitivities have been established, a close collaboration will be formed with ecosystem-level integrated programs such as the Sound Ecosystem Assessment (SEA). Input will be provided for ecosystem modeling efforts. Based on past patterns of climate-forcing as revealed in the tree-ring record, a projection of future

probabilities will be attempted that should serve as an indication of restoration outlook for dependent injured resources.

BUDGET ($K)

		FFY 1995	FFY 1996	FFY 1997
Personnel (include Indirect)				
	G. Jacoby	$38,212	$39,846	$42,850
	Other TRL	$30,042	$32,294	$34,535
	G. Juday	$19,747	$22,004	$23,697
	Other AFES	$18,619	$21,158	$22,004
	Grad student	$16,500	$17,500	$18,500
Travel (include Indirect)		$19,000	$23,000	$22,000
Contractual		$2,000	$3,000	$4,000
Commodities		$3,500	$4,500	$3,000
Equipment		$6,000	$3,000	$4,000
Capital outlay		$0	$0	$0
Gen. Admin.		$0	$0	$0
TOTAL		$153,620	$166,302	$174,586

This page intentionally left blank.

Project # 95047

1508 W 43rd #7
Anch, AK 99503
6/15/94

My proposal for the actual restoration of the Prince William Sound would be to estacle the perimary eleiment within the Turnagain Arm an to seal the migrating contamination in place, seperating the contamination from the water colum.

Now I don't cotton to the idea of the presumptuous an there schematice in Salmon habitat restoration of Prince William Sound, when they having a felonious postion of assessment to grants.

The above proposal being a cost plus project not unlike the pipe line it self, will also pay dividends!.

Please see copyright filed TXu 545 416 and other documents plus attements

signed Charles E. McKee
6/15/94

This page intentionally left blank.

Independent Review of Salmon Restoration and Monitoring Projects

Project Number:	95049
Restoration Category:	Administration, Public Information and Science Management
Proposed By:	Natural Resources Consultants, Inc.
Lead Trustee Agency:	ADFG
Cost FY 95:	$31,874
Cost FY 96:	$0
Total Cost:	$31,874
Duration:	1 year
Geographic Area:	Kenai River, Kodiak Island, Coghill Lake
Injured Resource/Service:	Multiple resources

INTRODUCTION

The *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) has funded and will continue to fund numerous monitoring and restoration projects related to the *Exxon Valdez* Oil Spill. These projects have been conducted by personnel with excellent qualifications. However, good science is incomplete without thorough, independent review. Independent review of monitoring and restoration projects is needed to maximize the benefit of the projects and to minimize costs.

The purpose of this proposal is to offer the expertise of Natural Resources Consultants (NRC) and associates for the review and evaluation of salmon monitoring and restoration projects.

PROJECT DESIGN

The review and evaluation process would focus on the methodology and sampling design of the study in relation to the stated objectives, statistical procedures used in the analyses, interpretation of the results, and identification of assumptions used in the investigation. The evaluation will include recommendations for the reviewed investigation as well as

recommendations for future studies. All comments will be made with a thorough discussion of the issue. The goal of the review process will be to improve the investigation in order to better meet the goals of the EVOSTC. The schedule of the review process would be determined by the availability of draft reports.

PROJECT IMPLEMENTATION

NRC offers the expertise of three scientists who have extensive experience with salmon management, salmon ecology, habitat restoration, and limnological issues in Alaska. These scientists are Dr. Gregory T. Ruggerone, former project leader of FRI's Alaska Salmon Program, Dr. Donald E. Rogers, Research Professor at the University of Washington's Fisheries Research Institute (FRI), and Dr. F. Joan Hardy, who has conducted limnological and lake fertilization projects related to salmon enhancement in Alaska and British Columbia. These scientists are intimately familiar with monitoring and restoration projects of the type planned by the EVOSTC and could provide valuable insight to the studies

Projects that these scientist could evaluate include:

- Coghill Lake Sockeye Salmon Restoration
- Kenai River Sockeye Salmon Restoration
- Sockeye Salmon Overescapement
- Coded Wire Tag Recoveries from Pink Salmon in Prince William Sound
- Coded Wire Tagging of Wild Pinks for Stock Identification
- Forage Fish Study in Prince William Sound

COORDINATION OF INTEGRATED RESEARCH EFFORT

Drs. Ruggerone, Rogers, and Hardy frequently interact with agencies such as the Alaska Department of Fish and Game, who has conducted many of the monitoring and restoration projects. Drs. Ruggerone and Rogers have a long working relationship with ADFG and have also been asked by various clients to critically evaluate reports by the department. Our working relationship with ADF&G would facilitate the exchange of information needed to conduct reviews of their work.

PERSONNEL QUALIFICATIONS

Dr. Gregory T. Ruggerone has conducted salmon projects in Alaska during the past 15 years, including areas such as Upper Cook Inlet, Kodiak, Chignik, Bristol Bay, and coastal and offshore areas of the Gulf of Alaska. During the 1984-1993, he was Project Leader of the Alaska Salmon Program at the Fisheries Research Institute, University of Washington.

He designed, directed, and conducted salmon studies at the Chignik Research Station where his research goal was to determine factors influencing salmon survival, monitor salmon populations and their prey, develop techniques to improve harvest management, define escapement goals, and identify habitat restoration projects. Dr. Ruggerone has refereed numerous salmon studies for scientific journals, including *Canadian Journal of Fisheries and Aquatic Sciences, North American Journal of Fisheries Management, Transactions of the American Fisheries Society, Aquatic Living Resources, and Fishery Bulletin.* He has published over 10 investigations in peer-reviewed journals and over 40 technical reports involving salmon ecology, predator-prey interactions, salmon management, limnology, and habitat. Dr. Ruggerone is presently the Northwest District Director of the American Institute of Fisheries Research Biologists.

Dr. Donald E. Rogers, Research Professor at the Fisheries Research Institute, has conducted salmon studies in Alaska since 1958. During his 35 years of field research in Alaska, Dr. Rogers has investigated nearly all aspects of salmon life history and management. He developed an extensive monitoring program of sockeye salmon lakes in the Bristol Bay in an effort to determine factors influencing salmon survival and to develop salmon escapement goals. He conducted one of the first major lake fertilization projects in Alaska in an effort to enhance sockeye growth and survival. He has chaired the graduate committees of over 15 graduate students. Dr. Rogers is considered to be one of the most knowledgeable scientists on salmon management and biology issues in Alaska and is frequently requested by ADFG or other groups to provide expert opinions on salmon related issues.

Dr. F. Joan Hardy has over 15 years experience as a limnologist and aquatic toxicologist. During 1975 to 1980, she participated in one of the first large-scale lake fertilization studies in Alaska. Following her doctoral program at Fisheries Research Institute, University of Washington, Dr. Hardy received a two year NSERC fellowship with the Fisheries and Oceans Canada to conduct limnological studies involving the fertilization of sockeye salmon lakes. She was a Research Scientist with Canada's National Hydrology Research Institute and conducted additional limnological studies there. She assisted with the development of a limnological monitoring program for the Quinault Indian Tribe's sockeye lake and recently developed the aquatic plant management program for the State of Washington. She is presently investigating toxic cyanobacteria (bluegreen algae) in western Washington lakes.

FY 95 BUDGET ($K)

Personnel	31.9
Total	31.9

NOTE: This budget was generated for the review of the Coghill Lake Sockeye Salmon Restoration Project, the Kenai River Sockeye Salmon restoration project, and the Sockeye Salmon Overescapement project. Budgets for other projects would be provided as needed.

This page intentionally left blank.

A Test of Sonar Accuracy in Estimating Escapement of Sockeye Salmon

Project Number:	95050
Restoration Category:	Research
Proposed By:	Natural Resources Consultants, Inc.
Lead Trustee Agency:	ADFG
Cost FY 95:	$79,290
Cost FY 96:	$78,030
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Wood River and Kenai River, Alaska
Injured Resource/Service:	Sockeye salmon

INTRODUCTION

Knowledge of salmon spawning density is paramount to conservation management of salmon runs in Alaska. Spawning density and the timing of the spawning escapement are primary factors that harvest managers can control during a fishery. Proper management of the spawning escapement is needed not only to perpetuate the salmon run but also to maximize the sustainable harvest of the run).

The *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) has identified Kenai River sockeye salmon as a biological resource that is not recovering from the 1989 *Exxon Valdez* oil spill. The primary reason for the declining run to Kenai River is the large escapement resulting from the closure of the drift gillnet fishery after oil contaminated the fishing grounds. The overescapement in 1989 was the third consecutive large escapement to the Kenai River. The first excessive escapement resulted from the *Glacier Bay* oil spill in 1987.

A primary issue surrounding the overescapement of salmon to the Kenai River is whether the sonar counters undercount sockeye salmon. The accuracy of the sonar counters was initially contested during the 1987 *Glacier Bay* oil spill trial and is an issue in the *Exxon Valdez* oil spill trial.

Natural Resources Consultants and its associate Dr. Donald E. Rogers, University of Washington, have provided evidence that adult salmon sonar counters underestimate salmon

escapement in Upper Cook Inlet based on information about their performance in Bristol Bay. In brief, sonar estimates of sockeye, pink, chinook, and chum salmon abundance in the Nushagak River, Bristol Bay, were less than expected based on comparisons with visual counts from towers and aerial surveys during an eight-year period. The sonar estimates of salmon abundance averaged 24% less than visual counts, but this error increased to 55% during years of large escapement. The greater undercounting error by sonar during large salmon escapements was predicted by John Suomola, an acoustic engineer at the Massachusetts Institute of Technology, because sonar may not discriminate between individual fish at high densities. Additional evidence that sonar is undercounting in Upper Cook Inlet is the fact that harvest rates for UCI sockeye salmon are high relative to other major sockeye salmon systems, even though sockeye runs to the Susitna River are frequently managed as "weak" and the Kenai and Kasilof rivers include glacial lakes that are generally less productive than relatively clear water lakes, such as Becharof and Chignik. Underestimation of sockeye escapement could explain the unexpectedly high harvest rates in the UCI management area. Finally, aerial counts of salmon, which are known to be biased low, are not that much lower than total sonar counts in the Kenai and Kasilof river systems. In 1988 and 1975, the peak spawning count for seven index streams (primarily aerial counts) in the Kasilof drainage actually exceeded the sonar count for the system even though the peak counts did not cover all spawning areas and no attempt was made to expand the index counts. The Alaska Department of Fish and Game discarded the sonar estimate in favor of the index count in 1988.

The issue of sonar undercounting reached a peak in December 1993 when the ADFG's sonar expert Paul Skvorc announced that sonar undercounted salmon abundance. Problems with sonar include high frequency which limits the ability of sonar to detect salmon, changing attenuation with conductivity of the water, and automation of the sonar counting procedure. The accuracy of sonar continues to be debated among ADFG personnel.

Although sonar has been used to count salmon in Alaska since at least 1978, no experiments have been designed to field test sonar using visual observations other than the Nushagak River analysis described above. The Kenai River appears to have received more salmon than counted by the sonar. The accuracy of sonar needs to be determined in order to help restore and monitor the declining sockeye runs to the Kenai River and to help manage the sockeye salmon runs in Upper Cook Inlet and other parts of Alaska. The proposed project will develop a correction factor that could be applied to historical sonar counts of adult salmon in the Kenai River and other rivers in Upper Cook Inlet. Thus, the proposed project will be beneficial both to conservation of injured resources and to fishermen injured by the reduced salmon harvests. The EVOSTC has identified the need to improve abundance estimation techniques and has funded genetic stock identification and coded wire tag studies. The proposed study would enhance the value of these funded studies.

The objectives of the proposed project are to:

1. test the accuracy of sonar on a seasonal and daily basis,

2. determine whether sonar counts are linearly or curvilinearly related to salmon

abundance,

3. compare automatic counts made by the Bendix sonar with acoustic marks made on a chart recorder,

4. develop a correction factor that could be applied to Bendix sonar counters in the Kenai River and other rivers in Alaska.

NEED FOR THE PROJECT

The declining sockeye runs to the Kenai River are believed to be related to overescapement in 1987, 1988, and 1989. ADFG estimates of escapement were based on sonar, which may be undercounting the escapement. Thus, escapement of sockeye salmon to the Kenai River, Kasilof River, Susitna River, and Crescent River in the Upper Cook Inlet Management Area may actually be much greater than previously estimated by the ADFG. Given the curvilinear relationship between actual escapement and sonar estimated escapement in the Nushagak River, the actual escapement to the Kenai River during 1987-1989 could be 70% more than the estimate made by sonar.

In order to evaluate the effect of overescapement on sockeye production in the Kenai River, it is imperative to determine the accuracy of the escapement enumeration procedure. Surprisingly, no studies have been designed to field test sonar estimates of migrating adult salmon. Evaluation of sonar by comparing visual and sonar counts over the course of the sockeye spawning migration is needed not only to evaluate overescapement in the Kenai River but also to evaluate sonar counts in all areas of Alaska where sonar is used as the primary enumeration process.

Results of the sonar test at Wood River could be used to correct sonar counting errors in the Kenai. Because Wood River is considered an ideal location for deployment of sonar, any error discovered at Wood River is likely to be equal to or less than that at glacial rivers such as the Kenai. Thus, correction factors at Wood River could be used to provide a minimum correction factor to historical sonar data in the Kenai River and other rivers in Upper Cook Inlet where sonar has been deployed. Results of this study would help resolve some of the questions related to the dispute over sonar accuracy.

PROJECT DESIGN

We propose to test the accuracy of Bendix sonar by comparing sonar with visual tower counts of sockeye salmon. The tower count method is considered to be one of the most accurate methods for enumerating salmon. Comparison of tower and sonar counts will determine whether sonar undercounts salmon and whether sonar undercounting is greater when large numbers of salmon are migrating, as indicated in the Nushagak River.

The investigation will occur in Wood River near Bristol Bay during 15 June to 20 July 1995. Wood River is a good location to test sonar because (1) the ADFG has a long history of enumerating sockeye salmon in Wood River from a tower, (2) the spawning escapement to Wood River (1 million fish) is similar to the Kenai River (750,000 fish), (3) Wood and Kenai rivers are similar in size, (4) large numbers of salmon may migrate upriver in a short time period, and (5) Wood River is an ideal location for sonar. Thus, the test will occur during ideal conditions, thereby allowing a test of sonar accuracy without complicating factors such as channel morphology.

The enumeration of sockeye salmon by sonar will be conducted without knowledge of daily or cumulative tower counts of sockeye salmon. Furthermore, visual observations of sockeye salmon in Wood River will not be used by the sonar crew to calibrate sonar. Wood River will be treated as if it were a glacial river similar to the Kenai River. The blind test approach is essential to objective testing of sonar accuracy.

A chart recorder will be used to record potential fish targets. These charts will be analyzed post-season to determine whether potential sonar counting error was caused by the automatic counting procedure of the Bendix equipment or by the sonar itself. Presently, sonar crews in Upper Cook Inlet rely on the automated counting procedure rather than interpretations of chart recordings. Additionally, conductivity of Wood River will be measured on a daily basis because conductivity may influence sonar accuracy. A video camera equipped with a polarizing filter will be used to document the methodology and to photograph the migration density of sockeye salmon during peak escapement periods.

Sonar methodology will be the same as that used on the Kenai River. Al Menin, who developed the Bendix sonar and who oversees ADFG sonar operations throughout Alaska, will assist with sonar set up, calibration, and operation. Additionally, a staff member of the statewide Sonar and Technical Services Unit will assist with the operation of the sonar to insure that the project is conducted to ADFG specifications.

Hourly escapement data from tower observations at Wood River will be obtained from the ADFG after field observations have been completed. Hourly, daily, and seasonal tower counts will be compared to sonar counts. The project should be conducted for three years in order to fully evaluate potential error in total annual escapement.

PROJECT IMPLEMENTATION

The project will be conducted by Dr. Greg Ruggerone, Natural Resources Consultants, Dr. Donald E. Rogers, Fisheries Research Institute, University of Washington, and Al Menin who developed the Bendix sonar. This team brings a strong background in salmon escapement techniques, salmon ecology, hydroacoustic applications, field investigations, and knowledge of the proposed test site.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The ADFG has two Bendix sonar units available for this project and has approved the use of the equipment for the project. Al Menin, who developed the Bendix sonar and inspects the operation of Bendix sonar by the ADFG, will assist with the setup, calibration, and general operation of the sonar. Additionally, a staff member of the statewide Sonar and Technical Services Unit will assist with the operation of the sonar to insure that the project is conducted to ADFG specifications. The sonar crew will stay at the University of Washington's field station at the outlet of Lake Aleknagik, approximately five miles from the likely sonar site. Boats and supplies will be provided through the field station.

FY 95 BUDGET ($K)

Personnel	54.0
Travel	7.7
Contractual	0.0
Commodities	15.5
Equipment	2.1
Total	79.3

This page intentionally left blank.

DOC.#9506160070 E

Project 95053

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

FORMAT FOR IDEAS FOR RESTORATION PROJECTS

Title of Project: Cordova's Mini Imaginarium

Justification: Service and education -- To understand the impacts of the EXXON VALDEZ oil spill and ongoing activities to restore the damage.

Description of Project: (e.g. goals(s), objectives, location, rationale and technical approach)

Everyone loves "hands-on" experiences. The best possible way to help someone learn is to provide them with an experience they can see, hear, smell and feel. The oil spill had a tremendous impact upon Prince William Sound and its communities. A mini-imaginarium in Cordova would provide the perfect means to help residents and visitors, young and old, learn more about the Sound and the impacts of the oil spill.

The mini-imaginarium would be modelled after the very successful Anchorage Imaginarium. Realistic displays and hands-on activities exploring our abundant and diverse wildlife, varied habitats, oil spills and other hazarouds waste problems, impacts, response mechanisms, clean-up technology, energy conservation, among others, would be exhibited.

The project would be completed over a period of two years. The first year would be dedicated to planning which would include building plans and renovations. The second year would be dedicated to creating exhibits and interpretive displays, acquiring educational materials and hiring and training staff.

The mini-imaginarium, potentially located on the docks of Cordova next to the Prince William Sound Science Center, would be a first-rate creative learning environment providing valuable experiences in oil-related areas, encouraging a better understanding of Prince William Sound and promoting educated decision-making for all ages.

Estimated Duration of Project: Two years for planning and set-up; ongoing support will be sought from other funding sources.

Estimated Cost per Year: $62,589 each year

Other Comments: A cooperative agreement is being established with the U.S. Forest Service, Chugach Ranger District, acknowledging 1) the need for an imaginarium/environmental education center, and 2) the willingness of both parties to work together to fulfill this need. Negotiations are underway for the use of a Forest Service warehouse as the basic structure.

More detailed information is available from the Science Center's Education Coordinator, Beth Trowbridge.

Project 95053

Name, Address, Telephone:

Dr. G.L. Thomas, Director
Beth Trowbridge, Education Coordinator
Prince William Sound Science Center
P.O. Box 705
Cordova, AK 99574
(907) 424-5800 — FAX 424-5820

Oil spill restoration is a public process. Your ideas and suggestions will not be proprietary, and you will not be given any exclusive right or privilege to them.

Prehistoric Ecological Baseline for Prince William Sound

Project Number:	95055
Restoration Category:	Research
Proposed By:	USFS
Cost FY 95:	$144,500
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	2 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

The mosaic of contemporary ecosystems in Prince William Sound are subject to intensive study by specialists from a variety of specialties. These ecosystems represent a biological snapshot in time - only one condition among many over the past 10 millennia. Most restoration projects are providing information only on the present condition, the latest manifestation of a changing ecosystem mosaic. The ecosystems which found root at the end of the Pleistocene and the beginning of the Holocene have changed over time to their present states, and will continue to change in the future. To more adequately understand the present ecosystems and to better forecast the future condition the changes in the ecosystem over the past several thousand years needs to be more fully studied.

The proposed project is a multidisciplinary endeavor to acquire ecological information from the past, using information gathered on biological species, on geomorphologic structures, and on archaeological remains. Information on climactic changes, species types and distributions, the effects of glaciation and tectonic events, and the role of humans as part of the ecosystems will be gathered and correlated. The goal is to establish an ecosystem baseline of the Prince William Sound, on decadal and millennial time scales, which will be usable by researchers into rates and degrees of contemporary species recovery, and which will be extendible to (or provide the basis for additional work considering) other areas affected by the EVOS. The project could address potentially each of the injured biological resources, but will concentrate on those represented in archaeological contexts in Prince William Sound. Specifically addressed will be nonrecovering resources such as clams and mussels, harbor seals, salmon, and sea otter.

Additional information may address various seabirds, killer whales, and animals not categorized as injured by the EVOS. The results will also address archaeological resources and subsistence uses.

NEED FOR THE PROJECT

Over time, Prince William Sound has developed productive and biologically diverse ecosystems, supporting plant and animal species, as well as the people who depended on them. This information may be used by researchers of the contemporary ecosystems to assess where contemporary population numbers and distributions fit within long-term trends. This, in turn, would provide additional information to managers about expected recovery times, especially if climate and other factors are determined to be important indicators of cyclical fluctuations in biological resources. It may provide great insight into natural causes that may be limiting recovery. The role of humans in the ecosystem of Prince William Sound is important because people have utilized a broad spectrum of resources throughout much of the Holocene. Archaeological sites function as preservers and concentrations of biological data. The archaeological context provides the link between temporal and geographic distribution for ecological data. This information is only available through geomorphological, paleobiological, and archaeological study.

The proposed project should be considered a pilot study. The project will include a synthesis of findings and results, and will assess the need for additional information in consultation with other researchers and representatives from the Trustee Council. The project will allow adaptive modification of methods and questions in view of results and EVOS restoration management needs for long-term research on ecosystem processes.

PROJECT DESIGN

A. Objectives

1. Review archaeological, geomorphological, climatological, and paleobiological information available for Prince William Sound;

2. Contact interested public groups, communities, and individuals to encourage participation in project planning, design, implementation, and review.

3. Conduct coordinated and integrated fieldwork to gather appropriate data from sufficient sources to produce a base for a paleoecological model for Prince William Sound.

4. Complete analyses of literature review and gathered data, and produce a report for the Trustee Council on findings and recommendations. This document will be of

professional scientific standard.

5. Complete and make public a summary of research and findings. This document will be less technical, geared to the general public, and will be used to solicit public input on process, methods, findings and conclusions.

B. Methods

Archaeology: Review of literature and existing collections of faunal material, and correlation with cultural and temporal indicators will provide a guide to where additional materials may be needed through controlled excavations at site(s) within Prince William Sound. Samples of soils, animal bones, shells, pollen, and other organics from existing collections and selected archaeological sites will be used to conduct radiocarbon, stable isotope, and other analyses for paleoecological reconstructions.

Geomorphology: Review of existing literature on the geomorphology of Prince William Sound (especially glacial history, sea level changes, and tectonic displacement) will provide a guide to where additional data may be needed through field observations and sampling. Geologic mapping and geomorphological studies will be used to develop a model of landform transformation and sea level/landform relationships for the Holocene. This will be used to identify possible early habitat for specific species/species groups and for human occupation.

Paleoclimatology: Review of existing literature on pollen, diatom and other sedimentological studies and other climatic indicators for Prince William Sound will provide guidance to where additional field samples are needed to best tie together the archaeological and geomorphological data. Coring of selected bogs and/or lakes will provide additional samples that will be used to accomplish that objective.

Overall: The archaeologists, geomorphologists, paleoclimatologists, and other specialists will work as an integrated team, using known archaeological sites as a focus for information gathering. Standard procedures established for Arctic and Subarctic regions will be used for all studies. The facilities and expertise of the USDA Forest Service (Chugach National Forest) and the University of Alaska Fairbanks will be used collaboratively - with public involvement - to accomplish the stated objectives.

C. Schedule

Pre-field activities (public contacts, literature reviews, collection identification and permitting): Winter/Early Spring, 1995.

Field activities (archaeological excavations, geomorphological studies, pollen and other sample gathering): May through September, 1995.

Data compilation and analysis (collaborative mapping, radiocarbon, pollen, O_{18}, and other analyses): September through November, 1995.

Final Technical Report for Trustee Council: By April 15, 1996.
Final Public document: By April 15, 1996.

D. Technical Support

Special analyses: Radiocarbon analyses will be conducted by Beta Analytic or Washington State University Radiocarbon Laboratory. Geologic and pollen analysis will be conducted by the University of Alaska. Other specialized analyses will be conducted in accordance with the project team specialists' established procedures.

Transportation: Pre-field investigations will determine the number and locations of data gathering sites. An analyses will be conducted once the locations are selected to determine the most cost effective mode of transportation and field support, whether a float-plane or boat based operation.

E. Location

Specific sites will be selected in the pre-field phase, but it is anticipated that three general areas will be selected for field investigations: one in the Western, one in the Eastern, and one in the Southern parts of the Sound. Tatitlek, Cordova, Chenega Village, Valdez, and Whittier will be contacted during planning and after the fieldwork is completed.

PROJECT IMPLEMENTATION

The proposed project is envisioned as a collaborative effort between agencies, universities, and the public sector. The project requires a high level of expertise in a number of disciplines, expertise that is available through Alaska-based institutions. It may be possible to offer the project through a competitive contract process. Since the locations for the projects are likely to be on State or Federal lands, projects would require monitoring and permitting through the land managers. Cooperative projects with Native organizations are possible and will be pursued in the planning stages of the project.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The project implementation, analyses, and reporting will be conducted collaboratively by team specialists. In addition, information sharing with biologists with specialties in contemporary species will be integrated into the project from the beginning through reporting. Fieldwork will be coordinated as much as possible with other projects efficiently use transportation, supplies, and information distribution systems. Projects which will be coordinated with include the archaeological site stewardship and monitoring project (lead agency:ADNR). The methodology and information will be compatible with that of other funded projects, such as that

of D.Schell and T.Kline (UAF) dealing with modern food web dynamics and ecosystem changes.

FY 95 BUDGET ($K)

	USFS	UAA	Total
Personnel	21.7	56.7	78.4
Travel	5.5	12.7	18.2
Contractual	0.0	9.5	9.5
Commodities	0.6	5.4	6.0
Equipment	0.0	20.0	20.0
Subtotal	27.9	104.2	132.1
Gen. Admin.	3.3	9.2	12.4
Total	31.1	113.4	144.5

This page intentionally left blank.

Spruce Bark Beetle Infestation Impacts on Injured Fish and Wildlife Species of the *Exxon Valdez* Oil Spill

Project Number:	95060
Restoration Category:	Research
Proposed By:	ADFG
Cooperating Agency:	USFS
Cost FY 95:	$213,900
Cost FY 96:	Unknown
Total Cost:	Unknown
Project Duration:	Minimum of 2 years
Geographic Area:	Prince William Sound, Kenai Peninsula, Gulf of Alaska
Injured Resource/Service:	Multiple resources

INTRODUCTION

Spruce bark beetles (SBB) are infesting white, Lutz, and sitka spruce trees within the range of fish and wildlife species injured by the *Exxon Valdez* Oil Spill (EVOS). There is only minimal knowledge of the geographic extent, intensity, or effects of the role of mature spruce trees as habitat for injured species, and the geographic extent, intensity, or effects of the SBB infestation on injured fish and wildlife species and their habitats. Decreases in essential habitats resulting from bark beetle infestations would further stress these populations and prevent population recovery or lead to further population declines.

Injured resources that will benefit from this project include : marbled murrelet, harlequin duck, pink salmon, sockeye salmon, Dolly Varden, cutthroat trout, river otter, bald eagle, and the forest ecosystem upon which they depend and with which they interact.

NEED FOR THE PROJECT

This project will provide information describing the geographic extent of spruce bark beetle infestation within the range of habitats previously demonstrated to be important to the EVOS species. The project will identify specific critical habitats for each applicable injured species and evaluate impacts to these critical habitats resulting from SBB infestations.

PROJECT DESIGN

A. Objectives

1. Determine the role of the spruce forest as habitat for each of the injured species.

2. Evaluate whether the current and potential level of spruce bark beetle infestation within the EVOS area is impacting injured species habitats.

3. Increase existing knowledge levels of SBB infestation impacts on injured fish and wildlife species through intensive literature searches of automated databases, contacts with governmental agencies at the state, provincial, and federal levels in Canada and the U.S.

4. Increase public awareness of current and potential impacts of SBB infestations on injured species habitats through multi-media presentations.

5. Enhance the capability of Alaskan biologists, foresters, and land managers to access information and communicate with professional counterparts throughout Alaska and in other states and provinces.

B. Methods

1. Identify critical habitat requirements of each injured species

   a. Review existing studies and conduct intensive literature review to supplement with additional information
   b. Interview principal investigators for each species
   c. Compile existing databases (e.g., Anadromous Stream Atlas) for spill area
   d. Based upon 1-3 above, characterize and map critical habitat for each injured species in GIS

2. Identify the historic, current, and potential geographic distribution of spruce bark beetle infestations

   a. Conduct an intensive review of historical literature
   b. Compile and reconcile all existing GIS-based maps and databases
   c. Evaluate potential infestation areas using USFS Spruce Beetle Expert software
   d. Cooperate directly with USFS and DNR/DOF entomologists in achieving 1-5
   e. Based upon 1-4 above, produce GIS map layers depicting the distribution of historic, current, and future beetle infestation ranges

3. Define the degree of overlap between the geographic distribution of critical habitat for each injured species and the historic, current, and potential ranges of SBB infestation.

a. Using GIS analytical techniques, overlay the bark beetle infestation ranges with the critical habitat maps for each species
b. Evaluate the degree of overlap by species and geographic region

4. Identify primary and secondary effects of SBB infestations on the landscape

a. Conduct a thorough literature review
b. Based upon the critical habitat characteristics compiled in A.4, describe changes in infested stands that might affect injured species

1) Evaluate changes via appropriate field methods (plots, transects, evaluations of adjoining uninfested stands)
2) Evaluate appropriate characteristics of comparably infested stands

c. Cooperate with USFS and DOF entomologists and silviculturalists as well as appropriate agency personnel in other states and Canadian provinces
d. Based upon 1-3, describe the impacts of spruce bark beetle infestations on the critical habitat components of injured species

5.. Evaluate whether the results of 4(d) are significant by species and by region

6. If the results from section 5 above, or a portion thereof, are affirmative, determine appropriate responses

a. Identify plausible habitat management responses to ameliorate infestation impacts
b. Compare the impacts to critical habitats of injured species resulting from "no management action" strategy with the suite of management responses developed in 6(a) above
c. Recommend appropriate habitat management responses by species by region
d. Identify knowledge gaps.

7. Develop recommendations to aid EVOS Trustee Council habitat acquisition process

8. Produce a multi-media presentation specifically designed for public use that will increase public awareness of current and potential impacts of SBB infestations on injured species habitats

9. As the majority of bark beetle impact information is not contained in the conventional literature, establish an INTERNET discussion group for biologists, foresters, entomologists, land managers, and other interested parties. This forum will provide an opportunity for free exchange of technical literature and habitat management information, encourage the influx of new problem-solving techniques, and will improve our limited abilities to readily communicate with other professionals due to travel constraints. Naturally, this forum could also be available to public users or public interest groups.

C. Schedule

October 1, 1994 - December 31, 1994

* Project planning and mobilization of GIS
* Initiate literature reviews
* Initiate planning for multi-media presentation
* Public meeting
* Identify and map critical habitats
* Complete establishing INTERNET discussion forum

January 1, 1995 - March 30, 1995

* Mapping ranges of SBB infestations
* Compare SBB infestation ranges with critical habitats
* Initiate field analyses

April 1, 1995 - June 30, 1995

* Complete production of multi-media presentation
* Continue field analyses
* Develop recommendations
* Completion of annotated bibliography database
* Analysis of mapped information
* Evaluate effects of SBB infestation and impacts analysis
* Develop recommendations for habitat acquisition process

July 1, 1995 - September 30, 1995

* Complete field analyses

October 1, 1995 - December 31, 1995

* Complete writing final project report
* Assemble project components for submission
* Public meeting to review project results

D. Technical Support

The following areas of technical support will be needed and utilized to accomplish this project:

* GIS
* Cartography
* Forest Ecology
* Fisheries Biology
* Wildlife Biology
* Professional Library Services
* Multimedia Production

E. Location

The project will include all of Prince William Sound, the area east of Cordova to the Copper River, the Kenai Peninsula, western Cook Inlet to Cape Douglas, and the Kodiak Archipelago.

PROJECT IMPLEMENTATION

This project will be conducted as a cooperative effort between the Alaska Department of Fish and Game and the U.S. Forest Service-State and Private Forestry. Actual day-to-day project management responsibility will be designated to the ADFG. S&P has the longest experience and greatest expertise in spruce bark beetle biology, distribution, and management in Alaska. The same is true for the ADFG with respect to all injured species except for marbled murrelets and bald eagles. In addition, the department has played an active role in bark beetle management planning with the USFS and the DOF.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The project will be a cooperative effort between the Alaska Department of Fish and Game (ADFG) and the U.S. Forest Service - State and Private Forestry (S&P). Other cooperators include the Alaska Department of Natural Resources, Division of Forestry (DOF), Division of Parks and Outdoor Recreation (DPOR), and the U.S. Fish and Wildlife Service (FWS). The project will utilize data and mapped products compiled by the Habitat Work Group and work completed by species principal investigators. All computerized products resulting from this project will be produced in a format that will allow easy integration into the Exxon Valdez Information Management System.

(DETAILED FY 95 BUDGET NOT PROVIDED)

This page intentionally left blank.

PWSAC Pink Salmon Fry Mortality

Project Number:	95065
Restoration Category:	Research
Proposed By:	Prince William Sound Aquaculture Corporation
Lead Trustee Agency:	ADFG
Cost FY 95:	$59,600
Cost FY 96:	$60,200
Total Cost:	Unknown
Duration:	Unknown
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon

INTRODUCTION

Pink salmon hatcheries operated by the Prince William Sound Aquaculture Corporation annually release approximately 400 million pink salmon fry from three hatcheries located in the northern, northwestern, and southwestern corners of Prince William Sound. Since the EVOS, PWSAC has observed unusual mortality in second and third generation of the odd year cycle pink salmon that returned through oil in 1989. Abnormally high pink salmon fry mortality (5% - 15%) occurred at Cannery Creek Hatchery in 1992 just prior to and after salt water entry. In 1994, similar mortality occurred at both AFK Hatchery (18%) and again at Cannery Creek Hatchery (7%).

NEED FOR THE PROJECT

This project will determine the cause of mortality and provide recommendations for reducing mortality and restoring the pink salmon production to its pre-spill level.

PROJECT DESIGN

A. Objectives

These will be detailed and forwarded to the EVOS Office.

B. Methods

(Information not provided.)

C. Schedule

(Information not provided.)

D. Technical Support

The PWSAC salmon program receives technical support from permitting agencies, University of Alaska Fairbanks, University of Alaska Juneau, and PWS Science Center. The ADFG pathology lab, genetics lab, and coded wire tag lab are among specific expertise areas overseeing the hatchery salmon program.

E. Location

This project will take place in PWS at the Armin F Koernig Hatchery on Evans Island, the Wally Noerenberg Hatchery on Esther Island, and the Cannery Creek Hatchery in Unakwik Inlet.

PROJECT IMPLEMENTATION

PWSAC will implement the project in conjunction with ADFG as the lead agency.

FY 95 BUDGET ($K)

Personnel	3.0
Travel	0.0
Contractual	52.5
Commodities	0.0
Equipment	0.0
Subtotal	55.5
Gen. Admin.	4.1
Total	59.6

Monitoring Nearshore Fish Species for Persistence of Oil Exposure and Ecotoxicological Effects

Project Number:	95071
Restoration Category:	Research
Proposed By:	NOAA
Cost FY 95:	$231,000
Cost FY 96:	$46,500
Total Cost:	Unknown
Duration:	3 years
Geographic Area:	Prince William Sound and nearshore habitat along the Alaskan and Kenai Peninsulas
Injured Resource/Service:	Subtidal organisms

INTRODUCTION

There has been persistent oil exposure of the nearshore subtidal habitat, and this project proposes to continue recovery monitoring of the benthic fishes of this ecosystem component, together with making a final effort to ascertain any biological dysfunctions resulting from persistent exposure. The results from this study will 1) delineate the geographic areas where subtidal oil contamination is continuing; 2) allow a determination of the rate of recovery, if any, for those areas which were still showing persistent exposure into 1992 and 1993; 3) allow a determination of ecotoxicological effects in the benthic fish compartment of the Prince William Sound and Kenai/Alaskan Peninsula nearshore habitat. The need for incorporation of this compartment into the ecosystem studies of Prince William Sound have been clearly stated in the Implementation Management Structure workshops in Anchorage, and in the Cordova planning and review workshop for the Sound Ecosystem Assessment proposal. Portions of this type of study have been previously funded by the NRDA and Restoration programs, under Fish/Shellfish 24b and 24, Subtidal 7, and Subtidal 1. Funding was stopped after the 1991 and 1993 collections, but analyses of the final collections made under these projects have shown a continuation of exposure at some sites both inside and outside the Sound.

NEED FOR THE PROJECT

There has been extensive and continuing exposure of nearshore subtidal fish species to oil in

and around Prince William Sound following the EVOS, as documented in Progress Reports and the Final Report from F/S 24 (1989 and 1990), ST 7 (1991), and ST 1 (1993). Biological exposure, while generally decreasing with time in species examined in these studies, could nevertheless still be documented in 1991 and 1993. There are some data to suggest that oil has moved from intertidal areas to deeper sediments, due to wind and wave action, and also perhaps due to some cleanup procedures. However, sampling of subtidal sediments in 1993 and 1994 failed to show any detectable hydrocarbons derived from the *Exxon Valdez*. Biological monitoring, however, allows for integration of overall contamination of a geographic area and thus may be a more sensitive measure of subtidal contamination. Because of the ecological importance of the benthic community to ecosystem modeling efforts, the rates and extent of natural recovery of these species need to be determined. In addition, it is critical to determine if the demonstrated persistent exposure of this community has resulted in any biological dysfunction that may impact the ecosystem as a whole.

PROJECT DESIGN

A. Objectives

1. Collect three flatfish species (rock sole, flathead sole, and yellowfin sole) from six sites inside Prince William Sound in May and June of 1995 and four to six sites along the Kenai and Alaska Peninsulas in May and June of 1996, at depths from 10-30 meters.

2. Analyze liver samples for levels and/or activities of cytochrome P450 1A (CYP1A) and bile samples for levels of fluorescent aromatic compounds (FACs) in order to determine oil exposure and biochemical effects in the collected animals.

3. Analyze liver samples for evidence of DNA damage

4. Assess histopathological alterations in several tissues, including liver, kidney, gonad, and gill.

5. Assess reproductive function in males and females (primary target species is yellowfin sole), utilizing histopathological methods, levels of circulating sex hormones, and appropriate biomarkers of reproductive function.

6. Measure levels of petroleum-derived compounds in stomach contents of collected animals.

7. Provide synthesis reports in February of 1996 and 1997 detailing levels of oil exposure and associated ecotoxicological effects in benthic fish species from Prince William Sound (1996) and the nearshore habitats of the Kenai and Alaska Peninsulas (1997).

B. Methods

Methods are as described in previous detailed study plans and final and progress reports, and in previous peer-reviewed publications. Summaries of these methods and appropriate citations can be found in:

Collier, T K., C.A Krone, M M. Krahn, J E Stein, S -L. Chan, and U Varanasi (1994) Petroleum exposure and associated biochemical effects in fish following the *Exxon Valdez* oil spill 1 1989-1991 Submitted to Trans Am Fish Soc

Collier, T.K., M.M. Krahn, C.A Krone, L L Johnson, M S. Myers, S.-L Chan, and U Varanasi. (1993) Oil exposure and effects in subtidal fish following the *Exxon Valdez* oil spill. In Proceedings 1993 International Oil Spill Conference pp 301-305

C. Schedule

January, 1995	Contract for vessel support
March, 1995	Solicit public input concerning sites and additional target species, especially from subsistence consumers
April/May, 1995	Finalize cruise plans and schedule
May/June, 1995	Field collections in Prince William Sound
June-October, 1995	Analysis of collected samples
September, 1995	Submission of report detailing samples and species collected
January, 1996	Submission of draft synthesis report
January, 1995	Contract for vessel support for year 2
February, 1996	Submission of final synthesis report covering Prince William Sound collections and results
March, 1996	Solicit public input concerning sites and additional target species to be sampled outside Prince William Sound, especially from subsistence consumers
April/May, 1996	Finalize cruise plans and schedule
May/June, 1996	Field collections along Kenai and Alaskan Peninsulas
June-October, 1996	Analysis of collected samples
September, 1996	Submission of report detailing samples and species collected
January, 1997	Submission of draft synthesis report
February, 1996	Submission of final synthesis report for Kenai/Alaskan Peninsula sites

D. Technical Support

The Environmental Conservation Division has most of the required equipment and facilities for performing this project. The only anticipated costs are for vessel support each year and nets to be purchased in the first year. The ECD has in-house facilities and personnel to carry out the field sampling and sample handling, all biochemical and chemical analyses, data compilation and analysis, and sample and data archival.

E. Location

The proposed project will be undertaken at several sites in Prince William Sound and along the Kenai and Alaskan Peninsulas. Possible sites within Prince William Sound include Olsen Bay, Snug Harbor, Sleepy Bay, and Squirrel Bay. Outside the Sound, sites may include Tonsina Bay, Hallo Bay, Resurrection Bay, and sites on Kodiak Island. To the extent that there is a desire on the part of native Alaskans to have additional sites sampled, attempts will be made within the budget confines to accommodate these requests.

PROJECT IMPLEMENTATION

It is proposed that this project be implemented by the Environmental Conservation Division (ECD) of the Northwest Fisheries Science Center of NOAA, NMFS. This group has been the lead agency on several similar projects in the past, and has all requisite technical expertise and equipment. This project is proposing to use state-of-the art techniques for determining oil exposure and determining ecotoxicological impacts of such exposure in nearshore subtidal species. These techniques have been largely developed, or optimized for use on oil-exposed organisms, by researchers in the ECD. The Division has demonstrated its ability to provide sound chemical, biochemical, and biological data on a timely basis, both under the NRDA process and for the Subsistence Science Project, following the EVOS. Moreover, this Division has considerable experience with sampling in and around Prince William Sound, and knowledge of the distribution of the species of interest. To our knowledge there are no other groups with the combination of chemical, biochemical, and biological expertise sufficient to conduct an ecotoxicological study of this magnitude in Alaskan waters.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The results from this project will be integrated into the overall ecosystem studies of Prince William Sound that will be conducted in FY95 and FY96. It is anticipated that an evaluation of any continuing ecotoxicological impacts in the nearshore benthic habitat will be available for the proposed annual ecosystem workshops, provisionally scheduled for winter 1995/1996 and 1996/1997. As appropriate, platforms and sampling gear will be shared with other projects that will be in the field at the same time as proposed in this study.

FY 95 BUDGET ($K)

Personnel	129.8
Travel	7.0
Contractual	25.0
Commodities	33.0
Equipment	15.0
Subtotal	209.8
Gen. Admin.	21.2
Total	231.0

Impact of Killer Whale Predation on Harbor Seals in Prince William Sound

Project Number:	95073
Restoration Category:	Research
Proposed By:	NOAA, Alaska Fisheries Science Center National Marine Mammal Laboratory, Seattle, WA
Lead Trustee Agency:	NOAA
Cost FY 95:	$228,200
Cost FY 96:	$208,900
Total Cost:	Unknown
Duration:	3 years (2 field + analysis and report)
Geographic Area:	Prince William Sound, Alaska
Injured Resource/Service:	Harbor seal

INTRODUCTION

Killer whales are classified as top predators of the marine ecosystem with diets that vary regionally and seasonally. Two life-history patterns, involving two forms of killer whales termed resident and transient, have been suggested for the whales occupying the waters of Puget Sound, Washington and British Columbia. One of the criterion used to differentiate the two forms is diet. Resident whales are thought to feed primarily on fish whereas transients are thought to feed primarily on marine mammals. Both forms of killer whales have been described from Prince William Sound. In Prince William Sound, predation by killer whales occurs on at least three injured resources: harbor seals, salmon, and herring. To predict the relative impact that killer whale predation may have on these injured resources, the level of predation and the relative proportion of each species consumed by killer whales must be quantified.

Current information on the dietary habits of killer whales are based on 1) observations of feeding events, and/or 2) stomach content analyses from stranded animals. Although both methods of determining food habits of killer whales are valid, each approach has significant limitations. Observations of feeding events may only represent the localized distribution of prey in an area. In many cases target prey consumed by the whales may be hard to determine. Since killer whales rarely strand, few stomach contents have been examined. Stomach contents represent a one time and fairly recent feeding event or series of events and this could

misrepresent the relative contribution of the prey item found in the stomach. Other problems associated with stomach content analysis are that the stomach contents may either represent something that the prey has eaten or a by-catch from an attempt to capture other prey.

The objective of the proposed project is to investigate the potential impact of killer whale predation on Prince William Sound harbor seal populations. We will collect biopsy samples from 40 killer whales from each of two putative populations (suspected resident and transient whale populations) from Prince William Sound. Killer whale skin and blubber samples will be examined through stable isotope and fatty acid analyses to determine the fraction of the Prince William Sound killer whale population that predates on marine mammals versus fish. In addition to obtaining dietary preferences of killer whales through biopsy sampling, our investigations will also include studies to determine population energetics of killer whales. Researchers working with killer whales and harbor seals will collaborate (Integrative Marine Mammal Ecosystem Program, to construct a model of killer whale predation on Prince William Sound harbor seal populations.

NEED FOR THE PROJECT

The effect of predation on the recovery rates of injured resources has been defined as a priority research issue by the EVOS Trustee Council. Information gathered during the killer whale study will be integrated with other studies (Marine Mammal Ecosystem Package) to provide a greater understanding of ecosystem processes in Prince William Sound and will enable us to predict the relative impact of whale predation on harbor seals. Additional insights regarding the relative impact of killer whale predation on herring and salmon will also be obtained during the course of these studies.

PROJECT DESIGN

A. Objectives

1. Determine short-term and long-term diets of Prince William Sound killer whales.

2. Compare dietary preferences of transient and resident killer whales in Prince William Sound.

3. Determine the potential impact that killer whale predation may have on Prince William Sound harbor seals and other injured resources, as appropriate.

B. Methods

Killer whale tissue samples will be collected using a biopsy dart. We plan to use an air pistol

powered by a CO_2 cartridge. We chose the CO_2 system because it allows the force of impact to be more precisely controlled. The dart size is 6mm by 25mm (diameter x depth) and the airgun dart is plastic to reduce the weight (less than 10 g) and improve flotation. The dart is collected free floating after sampling.

Samples will be subjected to stable isotope ratio analysis, fatty acid signatures and fatty acid isotope ratio analysis. Stable isotopes analysis has become a powerful tool in the studies of marine food webs. The ratio of heavy to light isotopes in a sample varies between organisms. An organism has an average of 1-2 ppt (parts per thousand) difference than it prey for carbon and 2-5 ppt for nitrogen. Using both carbon and nitrogen increases the resolution of the analysis. It may also be possible to rule out the presence of a certain species.

Analysis of fatty acid composition can be done from various tissues of an animal to determine the presence of fatty acids that are unique to potential prey. The lipids of the prey are hydrolyzed in the stomach and small intestine into fatty acids as well as glycerol and monoglyceride. Fatty acids remain intact during digestion. Therefore comparisons of the fatty acid composition of potential prey with blubber of the predator makes it possible to determine which prey was consumed. Many fatty acids can be attributed to a single phylogenetic group or species from a specific community. However, it may not always be possible to assign a species on the basis of one or two free-fatty acids. Thus it is necessary to consider an array of fatty acids present and then match the pattern present in the tissue with the pattern in the potential prey. This technique has the added advantage of enabling an assessment of the relative contribution of different prey types. Therefore, the presence of certain fatty acids can act as trophodynamic tracers. Analysis of carbon and nitrogen stable isotopes of a fatty acid will decrease noise and increase resolution in prey determination.

Longer term estimates of diet are required to more fully address food web dynamics. Although killer whales are considered top predators (defined as a species that is not eaten by any other species in the food web), this information alone does not allow for quantitative analysis or comparisons to be made between or within food webs. It is necessary to determine how many trophic levels or successive energy transfers occur between basal and top level species. This has important implications for the flow of energy and material through the ecosystem. The trophic level at which a predator feeds will determine the relative efficiency of that consumer and dictate much about the life history patterns and demographics of those animals. Further, the trophic level may change spatially as well as temporally, which affects the dynamics of resource utilization as well as the potential for concentration of environmental pollutants. Prey species consumed by predators may be the same over the course of the year, but could in fact represent different trophic levels depending upon the time of year and environmental conditions.

Trophic level can be determined on the basis of the isotopic analysis of the ratio of heavy to light nitrogen $^{15}N/^{13}N$, in the blubber and skin. Animals average from 3 to 5 parts per thousand (ppt) heavier in dietary nitrogen. In terms of food webs, nitrogen isotope values increase 10-15 ppt in many food webs due to the presence of 3-5 successive trophic transfers. Each transfer

increases the ^{15}N content by 3-4 ppt. Comparison of stable isotope ratios of tissue samples of predators (e.g., killer whales) with those of potential prey (e.g., harbor seals, salmon, herring, etc.) makes it possible to determine the diet of a species, as well as the trophic level at which they are feeding.

Of equal importance to the work being conducted on stable isotope and fatty acid analysis, we also propose to study foraging strategies and population energetics of killer whales. Information pertinent to these studies will be collected during field work and with captive killer whales. These data, in conjunction with the results obtained from analyses of skin and blubber samples, will be an integral part of a model we are developing to determine the impact of predation by whales on seals as well as other injured resources.

C. Schedule

This study will be conducted during 1995 and 1996, with either a recommendation for additional field studies or submission of a final report in 1997. The field season will operate from July to September each year. Data analysis will occur between October 1995 and February 1996. An annual report (summarizing 1995 research) will be submitted in April 1996 and in April 1997 (summarizing 1996 research). A final report will be submitted by 30 September 1997. Results will be prepared for publication in peer-reviewed journals.

D. Technical Support

Technical support will be provided by the research/administration staff of the Alaska Fisheries Science Center, National Marine Fisheries Service, National Marine Mammal Laboratory, Seattle, Washington. Laboratory analyses of killer whale tissues will be done by agencies or institutions other than NMFS/NMML. Research staff at Sea World (California and Florida) will assist with studies on captive killer whales.

E. Location

Field work conducted under this project will be restricted to Prince William Sound.

PROJECT IMPLEMENTATION

This study will be coordinated by staff at the National Marine Mammal Laboratory. NMML personnel have over 20 years experience conducting killer whale research in Alaska. NMML has designed and coordinated all previous killer whale NRDA and restoration monitoring and research studies (1989-91 and 1993). NMML will work closely with Alaska Department of Fish and Game biologists, scientists conducting laboratory studies on stable isotope and fatty acid analyses, biologists conducting captive killer whale studies, and other Principal Investigators, as appropriate.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is part of an integrated Marine Mammal Ecosystem package and as such is multi-disciplinary and would involve the collaborative efforts of many Federal and State Agencies, and includes the participation of Universities and private individuals. An integrated approach is absolutely critical to the overall success of this project and mandatory to obtain the desired results of this work. Studies in this package include this project (Impact of killer whale predation on harbor seals); Harbor Seal Monitoring, Habitat Use, and Trophic Interactions (ADF&G); Harbor Seal Condition and Health Status (UAF); and Confirming Food Web Dependencies in the PWS Ecosystem Using Stable Isotope Tracers (UAF). In addition, this study will be closely integrated with Herring (ADFG) and Oceanographic (UAF) studies being submitted under the SEA plan and with the Forage Fish study being developed.

FY 95 BUDGET ($K)

Personnel	23.0
Travel	6.0
Contractual	161.0
Commodities	23.5
Equipment	0.0
Subtotal	213.5
Gen. Admin.	14.7
Total	228.2

This page intentionally left blank.

Recreation Impacts In Prince William Sound: Human Impact As A Factor Constraining Long Term Ecosystem Recovery

Project Number:	95077
Restoration Category:	Research
Proposed By:	The National Outdoor Leadership School (NOLS)
Lead Trustee Agency:	ADNR
Cost FY 95:	$117,000
Cost FY 96:	Unknown
Total Cost:	Unknown
Geographic Area:	Prince William Sound
Duration:	5 years
Injured Resource/Service:	Recreation and tourism

INTRODUCTION

As a consequence of the *Exxon Valdez* oil spill, recreation in Prince William Sound (PWS) has been significantly affected. Recreationalists are now seeking areas that have not been disturbed by the spill and heretofore received little or no use. Moreover, areas that have been previously impacted by recreation are now seeing additional visitation. The National Outdoor Leadership School (NOLS), for example, has altered sea kayaking routes since the spill, resulting in a concentration of use. Since many other kayakers, fishermen, and hunters use these areas the potential for degradation of these sites is high. Little is currently known about the extent of use in these areas, or the resistance, resilience and tolerance of specific sites to recreation disturbance.

The proposed research addresses the issue of human impact in Prince William Sound. Is human impact a factor constraining long term ecosystem recovery? Results of this work will be provided to the Trustees, land management professionals and users to assist in appropriate utilization and management of the spill affected area.

NOLS Background: The National Outdoor Leadership School is a non-profit educational institution. Research, publications, outreach and training, and other programs are central to the school's mission to be a leader in wilderness education and research.

NOLS has been instructing expedition-length sea kayaking courses in the PWS area since 1971. As a consequence, we have extensive expertise on recreation areas, visitation, and user impact. This knowledge, combined with our research capacity, will contribute to an effective research process that results in usable and practical outcomes.

PROJECT DESIGN

We propose a three phase study with the following overall objectives:

1. Qualifying and quantifying use and impact from recreationalists.

2. Determining the tolerance of specific ecosystem types to user impact.

#. Examination of ecosystem processes altered as a consequence of user disturbance.

Phase I: Site Surveys and Assessment

Using monitoring and assessment techniques specifically designed for recreation sites, we would conduct an overall evaluation of recreation sites in the area. In addition, visitor, outfitter and land management surveys would be conducted to assay the numbers and demographics of area users. This would be a two year study and would consist of initial site identification and subsequent impact assessment and monitoring. Data from the initial identification and assessment would assist the development of Phases II and III.

Phase II: Site Tolerance to User Impact: Trampling and Experimental Camping

Although the information regarding the tolerance of specific sites to recreational disturbance is not extensive, accurate experimental methods have been developed and studies have been conducted in many backcountry areas. We propose to employ the techniques suggested by Cole and initiate a five year study on at least four distinct soil-plant associations impacted by recreational use. This study would involve both experimental campsites and applied trampling treatments and examine vegetation resistance, resilience and tolerance to user impacts. Changes in plant species composition, soil compaction and beach erosion would also be quantified. The first three years would involve applied trampling and camping treatments and assessment. Extensive follow-up measurements would be conducted the fourth year, and conclusionary data analysis and publication would be conducted in the fifth year.

Phase III: Recreation Impact: Process Level Research

To date, much of the research pertaining to user impacts on wilderness sites has focused on documenting intensity of use and its impact on vegetation ground covers. This research has greatly improved our knowledge of site durability and where, on a continuum of sensitive to durable, different vegetation types lie.

However, this type of research has been somewhat limited in scope, focusing primarily on site durability and response to impact. More comprehensive research would extend these studies to an examination of the time required for recovery on impacted sites and of the processes that are involved in controlling the rate and success of recovery. We therefore propose to examine a range of ecosystem processes that could be affected by disturbance in conjunction with phase II (above). This would be a two year study with measurements and analysis conducted in year two and four. A partial list of ecosystem processes to be examined is included (Table 1).

Table 1. Proposed soil and plant properties to be measured as an assessment of ecosystem health in sites disturbed by recreation. Not all properties would be appropriate measures at all sites.

Soil Properties	Plant Properties
Organic Matter Content	Biomass Production
Microbial Biomass	Nutrient Analysis
Physical Characteristics	Structural Compounds
C and N Mineralization Potential	Anatomical Damage/Response
	Mycorrhizal Response

NOLS currently has the internal capabilities to conduct all of Phases I and II of this proposal and are collaborating with the Natural Resource Ecology Lab at Colorado State University to conduct the analytical aspects of Phase III.

BUDGET ($K)

Phase I. Site Inventory
2 years x $28,080/yr. + overhead costs $70,200

Phase II. Trampling and Camping
4 years (field) x 28, 580/yr + overhead costs
1yr (analysis) x 12,500/yr + overhead costs $158,525

Phase III. Process Level Research
2 years (field and lab) x $59,260/yr + overhead costs $148,150

Total for all phases, 5 years **$376,875**

This page intentionally left blank.

Culture, History, and Ecosystems: An Assessment of Cultural/Historical Strategies to Building Long-term Understanding of Ecosystem Dynamics in the *Exxon Valdez* Oil Spill Area

Project Number:	95078
Restoration Category:	Research
Proposed By:	National Park Service
Lead Trustee Agency:	DOI
Cost FY 95:	$166,650
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	2 years
Geographic Area:	Project consists largely of library research with on-site consultation with Native Alaskan communities in the vicinity of the *Exxon Valdez* oil spill area.
Injured Resource/Service:	Multiple resources

INTRODUCTION

What is proposed here is an assessment of the potential value of archaeological, ethnographic, and historical research as sources of long-term comparative data for understanding the ecosystem processes that may be affecting the recovery of injured biological resources. Lack of a long-term perspective on ecosystem dynamics has made it difficult to identify which conditions or changes are related to natural fluctuations or shifts in the ecosystems in contrast to those that may be directly or indirectly linked to the *Exxon Valdez* oil spill event. In this study, archaeological sites, traditional Native Alaskan knowledge, and the historical record would all be evaluated for their specific ability to shed light on the causal factors that might explain current downturns in the health and populations of species that occur on the injured list. Three reports are envisioned, one for each discipline represented--archaeology, ethnography, and history.

NEED FOR THE PROJECT

If we are to understand how the *Exxon Valdez* oil spill event has altered or otherwise affected

present-day nearshore and upland ecosystems and their constituent subsystem components, it is imperative to have a basis for comparison, a point of reference from which to identify and measure changes that might be directly or indirectly attributed to the spill. Ecosystems are not static clockworks, but dynamic systems in a constant state of change and, as emphasized by the paleoecologist E. C. Pielou, they are always characterized by a greater or lesser degree of disequilibrium. Thus, the basis for informed comparison is a moving target, not time-bound portraits of the ecological systems of the Gulf of Alaska as these appeared in a brief snapshot of time on the eve of the oil spill.

How then can we obtain this historical perspective on the ecosystems of the region? One promising source of this long-term ecological data is the archeological record of the area. Archeological sites may be likened to a vast array of fortuitous environmental sampling stations extending back into time. For a period of at least 6000 years, humans along the coast launched out from their settlements and camps and sampled the world about them in their daily subsistence pursuits. The accumulated debris from this massive, but inadvertent environmental sampling effort has been conveniently concentrated in the archeological sites. This record, though often coarse-grained, may offer answers to some of the questions posed by contemporary ecosystem scientists who are trying to discriminate between changes that have links to the oil spill and those that represent fluctuations in natural systems over time.

Another source of long-term data may be found through ethnographic research. Native Alaskans over the past millennia have accumulated a rich storehouse of information about the local environment, and though much of this knowledge has been lost of late, much still survives. The survival of coastal Native peoples has always depended on accurate, empirical observations about the world and the challenges of the environment.

Historical archives may also offer valued information on the operation of the environment in the past. Old fisheries statistics and similar records have already been employed by biological scientists searching for answers in the past to inform the present. It is likely that there is much more to discover, particularly in the broader array of historical sources including personal diaries, official reports and correspondence by both industry and government, the observations of early scientists, etc. The newly-emerged fields of climate history and environmental history have already developed a solid track record in ecological research related to agricultural fluctuations and changes in plant cover over time in other areas (particularly northwest Europe). Based on this success, it is likely that the same approaches could be applied to the acquisition of a historical understanding of coastal ecosystems in the Gulf of Alaska.

The proposed project would explore and evaluate the potential of these archaeological, ethnographic, and historical sources to provide answers to key questions about long-term ecosystem change and stability in the region, that would in turn provide the understanding necessary to determining what current changes in the environment are either directly or indirectly attributable to the oil spill. If the findings demonstrate that this potential can be realized in a timely manner through reasonable outlays of funds and effort, then follow-up research programs to compile and analyze the data could be developed and implemented in subsequent years.

PROJECT DESIGN

A. Objectives

The purpose of the project is to provide professional evaluations of archaeological, ethnographic, and historical data as sources for understanding long-term ecosystem dynamics in the area of the *Exxon Valdez* oil spill. These assessments will help biological scientists and the Trustees decide whether or not the future acquisition and analysis of such data would have utility in discriminating between injured species recovery problems that are linked to the oil spill and those that are associated with natural fluctuations in natural systems. Separate evaluative reports, specifically designed for a biological scientist audience, would be produced for each of the three data sources.

B. Methods

In the case of the archaeological and historical assessments the studies would be limited to library research. First, the principal investigators would review the existing literature relevant to the topic of inquiry. Second, on the basis of this review, they would evaluate the specific potential of their discipline to address questions of interest to biological scientists that are attempting to add time depth to their descriptions and explanations of ecosystem operation and understand factors that influence the relative success of select component species (i.e., harbor seals, herring) over time (100+ years). Third, if the evaluations clearly demonstrate that significant contributions can be made through programs of reasonable and practical future research, the investigators will outline, recommend, and prioritize the lines of inquiry that are considered to be the most productive from the stand point of cost/benefits.

For the most part, the ethnographic assessment will follow the same basic steps and emphasize literature review and evaluation. However, because ethnographic research demands the active participation and cooperation of the Native Alaskan communities that will assist any future research as collaborative researchers, close consultation with Native communities in the area of the *Exxon Valdez* oil spill will be required. Contact with members of these communities will also be required to ascertain the level and kind of traditional knowledge that exists today. A large number of the Native elders that were keepers of traditional knowledge about the local environment only a few years ago have since passed away or have acquired health problems that could preclude their participation in collaborative research.

The draft reports that are generated by these inquiries would not only be subject to standard peer review, they would also be distributed to key biological scientists engaged in ecosystem and injured species research for their review. Finally, the participating researchers in the three fields would review each others' products. The final reports would incorporate appropriate recommendations and corrections that emerged in the course of the review process.

C. Schedule

8/94 Preparation of Research Plans/Scopes of Work

10/94	Start of Work Under Plan
Winter 95	Consultation With EVOS Scientists
8/95	Draft Reports Submitted
8/-10/95	Review of Draft Reports
1/96	Final Reports Submitted
3/96	Printing of Final Reports

No fieldwork is required for the archeological and historical assessments. Consultation with Native groups and communities, however, will be an ongoing process that will be designed into the ethnographic evaluation.

D. Technical Support

Other than printing and minor archiving of data, no special technical support to the research will be needed.

E. Location

The work will largely take place in an office setting with occasional travel to archives, libraries, and workshops. The ethnographic research will differ somewhat in that several trips to Native Alaskan communities will be required to consult with elders holding traditional knowledge.

PROJECT IMPLEMENTATION

The National Park Service has assumed a lead role for this project to assure that there is an agency sponsor for the work. However, the National Park Service has no proprietary interest in the project. We invite the involvement of other Federal agencies and the state if they wish to participate and assume responsibility for one or more components of the work. In fact, the National Park Service would be more than willing to transfer its project lead role to another agency as long as there was strong assurance that the research would not significantly deviate from what is proposed here and that it be done well.

In this project, the work of the lead agency would be limited to project design, administration, and technical oversight. The actual research would be carried out by scholars with a demonstrated background in environmentally-oriented research within their respective disciplines. The services of these scholars would be obtained by means of competitive contracts and/or cooperative agreements with recognized educational institutions.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The agency project manager will work closely with the Coordination Committee of the EVOS scientists and the EVOS Cultural Resource Working Group to insure that the work will properly address the need for archeological, ethnographic, and historical assessments of long-

term ecosystem stability and change as outlined on page A-9 of the Draft Restoration Objectives and Strategies by Resource and Service. In addition, the principal investigators of the three studies will meet together at the winter EVOS science workshop, report on their progress to the assembled scientists and interested public, and seek corrective feedback on their work. The review of the EVOS scientists will also be sought for the draft reports. Finally, the principal investigator for the ethnographic study will develop appropriate and effective mechanisms for frequent consultation with the Native Alaskan communities in the oil spill area as well as collaborative researchers from these groups.

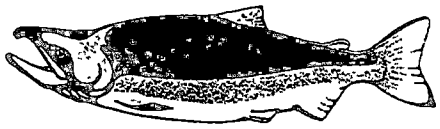
FY 95 BUDGET ($K)

Personnel	12.0
Travel	3.5
Contractual	138.0
Commodities	1.0
Equipment	0.0
Subtotal	154.5
Gen. Admin.	12.2
Total	166.7

This page intentionally left blank.

Doc#9506160 63

Project #95079



NERKA, Incorporated

A PROPOSAL TO THE *EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL

June 14, 1994

Pink Salmon Restoration through Small-Scale Hatchery Enhancement.

Principal Investigator: Jack M. Van Hyning, Ph.D.

Organizations: NERKA INC. and AQUABIONICS INC.

Suggested Funding:	FY 1995	$150,000
	96	75,000
	97	50,000
	98	50,000
	99	50,000
	2000	50,000

Start-up and Completion Dates: October 1, 1994 - December 31, 2000.

Duration: 6 years, 4 pink salmon cycles.

Area: South Bay, Perry Island, Prince William Sound.

Contact: Jack M. Van Hyning
PO Box 80165
Fairbanks, Alaska 99708
(907) 479-2476

/

INTRODUCTION

Pink salmon in Prince William Sound are considered an injured resource which is not recovering. We propose to utilize our aquaculture operation and expertise at South Bay, Perry Island to enhance and increase the local pink salmon runs.

In addition to a large shellfish farm at this site (Aquabionics Inc.), we have a permit for a non-profit salmon hatchery (Nerka Inc., ADFG PNP Permit No. 1). A small hatchery operated during the late 1970's and early 1980's, but has been inactive for a number of years because of financial and personnel issues which have been resolved. In addition to the direct contribution of additional salmon to the fishery and escapement, we will monitor the environment and return of fish and contribute to an understanding of the factors that influence the productivity of the pink salmon stocks. There have been concerns expressed about the very large salmon hatcheries depressing the natural runs through competition, genetic mixing, overharvesting, etc. We propose to supplement the wild runs, without overwhelming them, and study the effects of incrementally increasing production.

NEED FOR THE PROJECT

The pink salmon resource was apparently injured by the oil spill and is showing little or no signs of recovery. There is thus the need for both direct additional recruitment of juveniles into a healthy ecosystem and an understanding of the dynamics of the system. We propose to contribute to both these needs.

PROJECT DESIGN

Objectives (Tasks):

1. To produce 10 million pink salmon fry by 1999 in a small, environmentally compatible hatchery.

2. To understand the ecosystem into which the pink salmon are introduced and the factors controlling population return of both wild and hatchery fish.

Methods:

Due to the short time frame available for preparation of this proposal, only a conceptual methodology is presented. Complete details can be presented later if the Council finds the concept of interest.

Each returning run will be carefully enumerated. The spawning areas are small and a complete count can be made by boat and on foot. Some fish will be collected for hatchery incubation. Lambert Lagoon and South Bay will be regarded as a study ecosystem and environmental data will be gathered on water temperature, salinity, turbidity, zooplankton abundance, predators, etc. The company trawler "New Wave" will trawl for predator fishes for several days each spring and skiffs and an anchored barge will be utilized for sampling and data collection. A proportion of the hatchery-raised fingerlings will be coded-wire tagged, or otherwise identified, for later identification.

Schedule:

The 1994 escapement of pink salmon will be enumerated during August-September, prior to contract funding. Project planning will begin during the fall and winter of 1994-95 as well as the procurement of equipment and permits. The ADFG salmon hatchery permit is still valid, but permits for salmon hatchery operation from the U.S. Forest Service and Alaska Department of Natural Resources have expired and will need to be reapplied for.

Environmental monitoring will begin during March 1995 and continue through the contract period with emphasis on the spring and summer. Pinks are the only salmon spawning in the area and most are inter-tidal spawners. It is not possible to obtain any measure of downstream migration, but sampling of fry in the lagoon and bay for growth and survival will continue until they leave the area. Fry produced by the hatchery will be counted and sampled before release. Potential predators and competitors will also be sampled during the spring. Each summer's escapement will be counted during August and September and some eggs taken for
incubation. Data analysis will be conducted during the winter and a progress report submitted annually; a final report at the end of the contract.

Technical Support:

In addition to the Principal Investigator, the following will participate:
Dr. Steven Smith, biometrician with the University of Washington Center for Quantitative Studies in Fisheries, will be consulted for statistical analysis and computer programming.
Mr. Jeff Hetrick, manager of the Moose Pass Hatchery near Seward, will provide advice on hatchery design and operation.
Mr. Jon N. Van Hyning, a Prince William Sound commercial fishermen, will assist is sampling gear development, operation and maintenance.
Mr. Nate Hopkins, caretaker of the aquatic farm, with a few hired employees, will do the routine data collection and hatchery management.

Location:

All work except analysis and report preparation will be done at Perry Island, 25 miles southeast of Whittier. All fishermen and communities that are dependent on the pink salmon fishery, will benefit from the project. The outer areas of southern Perry Island had extensive oil deposition, but no oil penetrated into Lambert Lagoon, where the salmon spawning stream are located.

PROJECT IMPLEMENTATION

The project should be done by Nerka Incorporated, a private non-profit salmon hatchery corporation, and Aquabionics Incorporated, an Alaskan consulting and sea food company specializing in shrimp fishing and oyster farming.

COORDINATION

This project will be fully coordinated with other related projects conducted by the University of Alaska, Alaska Department of Fish & Game, National Marine Fisheries Service, and the Forest Service.

PUBLIC PROCESS

No specific plans have been made, but the Principal Investigator will participate in any desired forum.

PERSONNEL QUALIFICATIONS

Jack M. Van Hyning will be Principal Investigator. He has B.S., M.S. and Ph.D. degrees in fisheries from the University of Washington, University of Miami, and Oregon State University, respectively, with 40 years experience in fisheries research and management with a specialty in salmonid population ecology. He was Marine Research Supervisor for the Oregon Fisheries Department, Associate Professor of Fisheries at the University of Alaska Fairbanks, and a private consultant and fish farmer. He is familiar with hatchery programs in Oregon and Prince William Sound and is finishing a study on the factors affecting the return of chum salmon to Norton Sound. He has been invited to present the findings at an Arctic Science Conference in Anchorage and Vladivostok, Russia.

Dr. Steven Smith has undergraduate degrees in statistics from Utah State University and a Ph.D. from the University of Washington in biomathematics. He worked with Dr. Van Hyning on Norton Sound chum salmon and is heavily involved with the Columbia River salmon problem.

Jon Van Hyning has as an Associate Degree in Fisheries Technology and has been a commercial fisherman in Prince William Sound for 10 years, including the development of a new deep-water shrimp fishery.

#95079

BUDGET

Because of time constraints, the funding presented on the cover page is a very preliminary estimate. If the proposal is viewed with favor, we will submit a carefully drafted, realistic budget for further review. The 1995 budget covers the construction of a small, research hatchery. After that initial expense, annual expenses for time, travel, administration, etc. should be between $50,000 and $75,000. By the end of the contract period the project should be self-supporting in providing a continuing source of supplemental salmon to the fisheries of the Sound and an increased understanding of the possible benefits of small project salmon enhancement.

Project # 95080

DOC.#9506160070 A

RECREATION RESTORATION PROJECT PROPOSAL

PROJECT NAME: Fleming Spit Recreation Area Enhancements

SPONSOR: The Cordova Sporting Club

PROJECT DESCRIPTION: Fleming Spit is located within the Cordova City limits and is within the Prince William Sound Recreation Project area. Fleming Spit is already the site of a strong terminal Coho sport fishery and in the last 4 years a fledgling King fishery has been started. The area is popular and accessible. The Cordova Sporting Club, a non-profit organization dedicated to the promotion and development of outdoor opportunities in the Cordova area, along with many other interested local agencies and groups, would propose a project funded by the Exxon Valdez Oil Spill (EVOS) civil settlement monies to improve the Fleming Spit site for added recreational use, safer access, and an improved and enlarged fishing area.

The ongoing recreational fisheries at Fleming Spit have been developed through the cooperation of the Sporting Club (CSC), the Alaska Department of Fish and Game (ADF&G), and Prince William Sound Aquaculture Corporation. The smolt release areas and the surrounding tidelands and beach areas where the fish return to, however, need to be enhanced and upgraded to handle the ever increasing pressure from local recreational fishermen as well as a growing number of tourists. Our proposal includes acquision of critical lands and tidelands in the immediate Fleming Spit area, a dredge and fill project to improve the existing smolt release ponds, a general clean-up of the area including the removal of a derelict barge, and the addition of a variety of recreational facilities.

Our proposal is broken down into two phases. Phase I focuses upon work that is directly related to enhancing the sport fishery in the area. Phase II includes projects and facilities that take advantage of other recreational opportunities that exist in the area such as camping. Our specific proposal including work tasks, facilities, and projected costs follows:

Phase I:

Project/Task	Projected Cost
Acquire Parcel	$150,000
Dredge and Fill Operations/ (including engineering and permitting)	$150,000
Flood Plain Management (engineering)	$50,000
Surveying	$30,000
Barge Removal	$10,000
Composting Toilet Facilities	$30,000
Fishing Boardwalk (1,000 feet, 8 feet wide parallel to road with ramps and stairways.)	$300,000
Fish Cleaning Stations (two stations, 6 bays each)	$10,000
Off Street Parking (signs, curb stops, paving)	$20,000
Permanent Net Pens	$20,000
Total Cost/Phase I	$770,000

Phase II:

R.V. Campground (10-15 Units, electrical hookups, tables, fire pits)	$100,000
Sewerline Extension and R.V. Dumpstation	$450,000
Tent Platforms	$20,000
Covered Picnic Pavileon	$25,000
Total Cost/Phase II	$595,000
Total Cost/Project	$1,365,000.00

We would anticipate that the total project would take 2 to 3 years to complete. A preliminary site plan depicting the approximate location of all proposed facilities is attached.

POTENTIAL CONFLICTS: We do not anticipate any significant or major conflicts. Fleming Spit and the recreational fishery there are enjoyed by local Cordovans and visitors alike from early spring through the Silver season in the fall. The Cordova Chamber of Commerce holds a Silver Salmon derby each fall and many people fish the area during that time. The Chamber has been a strong supporter of recreational development at the spit for years. Groups such as the Cordova Fly Fishers and the Cordova Trap and Gun Club support our recreational goals for the area as well.

This proposal also enjoys the support of other important local agencies and organizations. For example, the Alaska Department of Fish and Game has been a long time supporter. ADF&G has proposed a demonstration hatchery at the site in the past and it started the salmon release program there. The Sport Fish Division is a strong supporter and has indicated that it would provide matching funds for this project. Prince William Sound Aquaculture has expended its own monies over the past few years to keep the Silver and King fisheries going. It has also submitted a proposal to improve the rearing ponds to insure a better smolt survival rate.

The Division of Parks and Outdoor Recreation has considered Fleming Spit as a possible addition to the State Park System. Development at Fleming Spit is currently listed as a priority in the Department's Statewide Recreation Plan. The U.S. Forest Service has also demonstrated its support. Its staff have helped in the development of this proposal. Finally, this project has the strong support of the City of Cordova. It appears as a goal in the City's Overall Economic Development Plan. The City has developed plans and sought funding for this type of project since 1985. The land is already zoned for conservation and recreational uses by the Cordova Coastal Managment Plan. We have a willing seller for the land we want to acquire.

There are two potential conflicts which will need to be worked out however, we believe they are easily resolved. First, the Eyak Corporation has leased adjacent tidelands from the state for use as a log transfer facility. The leased area is a very large tract which extends into the fishing area. This area is not needed for the transport of logs and the actual facility is a good distance from where people fish. We believe we can work out an acceptable arrangement. Log trucks moving through the area pose a potential threat to pedestrians however, traffic control signs should be sufficient to mitigate that problem.

Second, there are often transient workers and other visitors who illegally camp on private lands and State owned tidelands in the

area during the summer. We don't see this as a conflict because this project will enhance their camping experience by providing good clean places to camp complete with restroom facilities, dump stations, water, trash cans, and the like.

LINK TO EVOS INJURY: Since the oil spill in March, 1989, Prince William Sound commercial fisheries have declined drastically. A large majority of Cordova residents are involved in the fishing industry and because of the poor commercial seasons these residents have had increased free time and an increased need for sport caught fish. More and more of them have used the Fleming Spit area. The continued emotional impacts from the spill have also increased the need for recreational outlets and positive relationships with fishing for the people adversely affected. People have appeared to be hesitant and concerned about sport fishing in the oiled areas of the Sound and more and more of them have expressed an interest in and support for the enhanced fishery at Fleming Spit.

With the spill and the resultant media coverage, Prince William Sound has become an increasingly well known tourist destination. This is good for Cordova; with the decline in fishing since the spill, we need to concentrate on diversifying our economy. This area is an excellent location for facilities of this type because it is within walking distance of downtown and approximately 3,000 feet from the new Cordova Ferry Staging Area.

But there are also problems associated with the increase in visitors. These people need to have safe and accessible activities in the immediate area. Our desire would be to channel tourists to areas like Fleming Spit and relieve the recreational and fishing pressures on other fresh water spawning streams in the Copper River Delta area.

ECONOMIC FEASIBILITY: The enhancement of the Fleming Spit area and the recreational fishery would benefit an unlimited number of Cordova residents and visitors to Prince William Sound. The principal costs would be in land acquision and infrastructure inprovements. Maintenance of the facility/park could be financed through user fees on the campsites and the dump station, and user donations. As stated above, the City of Cordova, The Alaska Department of Fish and Game, the Division of Parks and Outdoor Recreation, the U.S. Forest Service, and Prince William Sound Aquaculture Corporation have all discussed and proposed enhancement projects for this area in the past. Following acquision of the land and construction of the facilities, the area could be turned over to one of these agencies. They would subsequesntly be responsible for the maintenance and upkeep of the improvements. PWSAC has been instrumental in obtaining the Coho and Chinook smolt and we see no reason why this won't continue.

CONSISTENCY WITH SURROUNDINGS: Fleming Spit is located on the edge of town directly on Orca Inlet. Because of the past efforts at

establishing the terminal Coho and Chinook runs, it has become a well known and heavily used "fishing hole". The area is accessible when weather prohibits boating and for those who don't have access to a boat suitable for the Inlet or one of the surrounding rivers or streams. Our project will increase the accessibility, the safety, and the appearance of the area. The existing smolt pond will be enlarged and improved to decrease the mortality rate among young salmon. The land is zoned for conservation and a recreation area is consistent with that designation.

NUMBER OF PEOPLE BENEFITTING: No established facilities are presently in place so accurate user counts are not available. However, it can be said that the improvement of the Fleming Spit area would benefit the entire population of Cordova. In addition, people using other parts of the Sound for recreation would be drawn to the enhanced fishery much as they are to the fisheries adjacent to the hatchery in Valdez. The Cordova Silver Salmon derby held in late August and easly September draws more and more entrants each year. The proposed improvements at Fleming Spit would allow more and more people access to the fish and would result in an expanded tourism industry for Cordova.

DISPLACEMENT OF CURRENT USERS: The only people being displaced would be transient campers who camp on private land and State owned tidelands during the summer months. These people would not really be displaced but rather, would be provided with a legitimate and significantly improved place to camp.

ADJACENT LAND MANAGEMENT: The tidelands immediately north of Fleming Spit are leased by the Eyak Corporation and used as a log transfer facility. We do not believe this presents a conflict with this project. Other surrounding tidelands are owned by the State of Alaska and the City of Cordova. Some of the uplands have private owners (including the parcel we hope to acquire). We would have to be sure that private landowners have legal access to their property. The rest of the uplands are owned by the State and the City. The area is zoned for Conservation; however, recreation projects are specifically permitted.

INFLUENCE ON OTHER PROJECTS: As stated above, the enhancement of the Fleming Spit area for recreation and sport fishing has been proposed and discussed by a number of agencies and other organizations over the years. Because legislation or budget allocations were not forthcoming, none of these proposals have come to fruition. No other use has been publically discussed for this area. All of the groups and agencies identified above would cooperate on the improvements proposed for Fleming Spit. It would be a community improvement and a project that everyone in Cordova could appreciate and use.

This page intentionally left blank.

DOC.#9506160 70 B

Project # 95082

RECREATION RESTORATION PROJECT PROPOSAL

PROJECT NAME: "Mor-Pac Hill" Campground Improvements

SPONSOR: The City of Cordova

PROJECT DESCRIPTION: Mor-Pac Hill is located directly across Railroad Avenue from the old Mor-Pac fish processing plant. It is less than a mile from downtown Cordova and a very short walk from the Cordova ferry dock. The Mor-Pac complex is under new ownership and is now known as Cannery Row Inc. Cannery Row Inc. owns the property that the campground is located on.

The existing campground contains 15 to 20 good campsites for tent campers. The site is located on a nine acre parcel and therefore, has the potential for a number of additional camp sites. The campground was constructed during the summer of 1989 as a direct result of the Exxon Valdez oil spill. During that period, the City was inundated with clean-up workers, people seeking work on the clean-up, and various other visitors. The City had no legitimate campground at that time and this one was quickly constructed under emergency conditions. The construction of this campground was a cooperative effort by the Chugach Alaska Corporation, owners of the Mor-Pac plant at that time, and the City of Cordova. Chugach provided the land and the City constructed a waterline and other basic improvements.

Since that time, the campground has fallen into disrepair. No one is currently responsible for managing and caretaking the area. The new owners do not have the resources nor the time to operate a campground and have posted no trespassing signs on the property. Campers have still been using it however, and this has resulted in periodic problems with litter, garbage, violence, trespass, and vandalism. The City is experiencing an increase in visitors every year and it still does not have a good tent campground. We desperately need to develop these types of facilities. This campground provides us with an opportunity to enhance an already existing facility.

This area has great potential because it already has 15 to 20 excellent camping sites, the potential for more sites, and an excellent location. It is less than a mile from both downtown Cordova and the Fleming Spit Recreation area. It is soon to be connected to downtown by a new bike trail. It is a very short walk from the Cordova ferry dock and it is close to trails that lead or will lead into the proposed Mt. Eyak State Park.

We propose to use EVOS recreation restoration funds to improve this campground so that it will be a safe and enjoyable experience for

tent campers. We would begin by purchasing the parcel from the owners who have expressed a willingness to sell. The improvements we envision include chain link fencing to improve safety and protect other unrelated facilities, a bathroom and shower facility, a short sewer line, and various site improvements such as gravel and tent platforms. Following is a projected budget for this project:

Projected Budget:

Facility/Work Task	Estimated Cost
Land Acquision	$150,000
Surveying	$20,000
Bathroom Facility (with showers)	$100,000
Sewer Line (300 ft.)	$40,000
Chain link Fence (8 ft. high, 400 ft. Installed)	$20,000
Tent Platforms	$20,000
Gravel, Wood misc. materials	$10,000
Total Project Cost	$360,000

POTENTIAL CONFLICTS: The current owners of the property have closed the campground and posted no trespassing signs. People still camp there without permission. The owners have indicated a willingness to sell this property and have stated that they believe a campground is a good use for the site. We propose to eliminate existing conflicts by giving campers a safe and clean place to camp.

There are no other conflicts with existing uses or adjacent landowners that we are aware of. The area is surrounded by woods and we believe that a campground is an appropriate use of the parcel.

LINK TO EVOS INJURY: There are two specific links to injuries suffered as a result of the oil spill. First, this campground was originally built in response to the influx of clean-up workers and job seekers. The City was overwhelmed by this in-migration and was unable to provide the services necessary to accomodate these people. As a result, the City was forced to build this campground under emergency conditions.

Second, the oil spill has created a heightened awareness about Prince William Sound in general and Cordova in particular. People have become increasingly aware that 1) Cordova suffered and continues to suffer great econonic and emotional damage due to the spill and 2) that there are outstanding recreational opportunities in and around Cordova (especially since this area of the Sound was

not oiled). The result is a marked increase in the number of visitors coming to this community. The City still does not have the capability to acomodate these visitors; especially those who want to travel by tent and backpack.

ECONOMIC FEASIBILITY: This project will not require any subsequent or incremental funding by the EVOS Trustees. After the campground is improved, it will be managed by the City of Cordova in a way that will make it self supporting. User fees will be implemented to pay for maintenance and upkeep.

CONSISTENCY WITH SURROUNDINGS: As noted above, we believe a campground is consistent with the character of the area. The campground is surrounded by forest for the most part. There are no residential areas close by. The nearest facilities are the Cannery Row complex and the Cordova Electric Copperative power plant. Both are far enough away from the campsites that we do not expect any adverse impacts or conflicts.

NUMBER OF PEOPLE BENEFITTING: There is only one legal place to pitch a tent within the City Limits at this time. We believe this campground would be used to capacity during the summer months. We estimate that this could translate into approximately 4,800 camper days. (20 sites, 2 people each, 120 day camping season).

It could also be argued that this facility would benefit the entire community. Since campground space is extremely limited in Cordova, campers are forced to camp wherever they can find a suitable piece of woods. This has resulted in a variety of problems for the community including trespassing, litter, sanitation problems, and violence. This effects everyone and the City would be better able to control these problems by directing campers into a safe and well equiped campground.

DISPLACEMENT OF CURRENT USERS: There would be no displacement of current users. The only people using the property now are campers who are camping there illegally. We propose to resolve this problem by providing these people with a legal and convenient place to camp.

ADJACENT LAND MANAGEMENT: Lands immediately to the North and South of this parcel are privately owned. They are undeveloped at present and are unlikely to be developed in any intensive way because of the extremely steep topography. The parcel is bounded by Railroad Ave. and the Cannery Row Complex to the east and by City and State land to the west.

INFLUENCE ON OTHER PROJECTS: This project will not have any influence upon any other projects that we are aware of. There are no other intended uses for this property.

This page intentionally left blank.

DOC. # 9506160 70 C

Project # 95084

RECREATION RESTORATION PROJECT PROPOSAL

PROJECT NAME: Odiak Camper Park Expansion

SPONSOR: The City of Cordova

PROJECT DESCRIPTION: Odiak Camper Park is located on Whitshed Road immediately adjacent to Orca Inlet. It is approximately one mile from the Center of Cordova. The camper park currently has 18 RV sites. All of the sites have electricity and water is available at six locations through hose bib type hydrants. A sewerage dump station is provided for R.V.s equiped with holding tanks. A shower/restroom facility is located in the middle of the campground for use by both R.V. campers and the few tent campers who use the area. While the camper park provides camping space with the basic utilities for up to 18 vehicles, it is badly in need of expansion and upgrading in order to meet an increasing demand.

The current facilities are marginal at best. The single restroom/shower facility is being used to its full capacity. Lines of R.V's waiting to dump holding tanks frequently form at the septic dump station; the only legal dump site in Cordova. Campers have to haul water from hydrants to their sites, a situation which is not always sanitary and certainly not convenient. Finally, the campground, in its current condition, is not aesthetically appealing to many campers. Landscaping is desperately needed so that we can take advantage of an otherwise ideal location for a campground.

Odiak Camper Park is currently the only legitimate camper park in Cordova. We are experiencing increases in the number of visitors each year and the demand for camping space has increased porportionately. Therefore, the need for expansion and basic improvements at the park are warranted. We propose to expand the park by an additional 40 R.V. spaces and to add basic utilities to each site. We also invision adding playground areas, additional tent sites, and landscaping. A proposed budget follows:

Work Task/Improvement	Estimated Cost
Water and Sewer line extensions to 40 spaces including fire hydrants	$140,000
Landscaping including materials and Labor	$30,000
Electrical Hookups to 40 new sites, trenches to be shared with T.V. and Tel.	$76,000

Tent Platforms	$10,000
Picnic Tables/Fire Grates	$10,000
TOTAL PROJECTED BUDGET:	$266,000.00

POTENTIAL CONFLICTS: The only potential conflict which exists is that the campground is located a short distance from the municipal landfill. We proposed to address the conflict be adding fencing and trees which will serve to mitigate the visual impacts. The landfill will be closed in 3-5 years and it has been suggested that that area could also be used for campground expansions.

LINK TO EVOS INJURY: The oil spill has created a heightened awareness about Prince William Sound in general and Cordova in particular. People have become increasingly aware that 1) Cordova suffered and continues to suffer great economic and emotional damage due to the spill and 2) that there are outstanding recreational opportunities in and around Cordova (especially since this area of the Sound was not oiled). The result is a marked increase in the number of visitors to this community. The City does not have the capability to adequately handle the increased demand for camping facilities. Improvements to this already existing campground would increase the City's ability to provide this service.

ECONOMIC FEASIBILITY: This project will not require any subsequest or incremental funding by the EVOS Trustees. After the campground is improved, it will be managed by the City in a way that will make it self supporting. The park is currently self supporting and is operated as an enterprise fund.

CONSISTENCY WITH SURROUNDINGS: The site is already used as a campground. It is surrounded on the North and East by water and on the south by woods. The landfill is located to the west. We believe campground expansion is consistent with the immediate surroundings.

NUMBER OF PEOPLE BENEFITTING: The City is desperately in need of campground facilities. This expansion and upgrade will provide suitable space for 58 R.V. campers and 10-15 tent campers.

It could also be argued that this facility would benefit the entire community. Since campground space is extremely limited in Cordova, campers are forced to park their R.V.s anywhere they can find space. This has resulted in a variety of problems for the community including trespassing, litter, sanitation problems, and blockage of public roads and alleys. The problem was so bad, particularly during the oil spill clean-up, that the City Council was forced to pass a trailer ordinance which strictly limited where motor homes could park. This forced many visitors outside of the City limits; a situation which is not good for either public relations or the local economy.

95084

DISPLACEMENT OF CURRENT USERS: There would be no displacement of current users. There are no users of this parcel other than campers. The City uses the expansion area for equipment storage.

ADJACENT LAND MANAGEMENT: All adjacent land and tidelands are owned by either the City of Cordova or the State of Alaska.

INFLUENCE ON OTHER PROJECTS: There are no other projects planned or in progress in the immediate area.

This page intentionally left blank.

DOC.# 9506160070 D

Project #95085

RECREATION RESTORATION PROJECT PROPOSAL

PROJECT NAME: Cordova Historical Marine Park

SPONSOR: The Cordova Planning and Harbor Commissions

PROJECT DESCRIPTION: The goal of this project is to acquire, restore and display vintage fishing vessels, which have been built and/or used by the Cordova fishing fleet during previous decades for commercial or subsistence harvest. Specific boats or boat types which have played an important part in Cordova's maritime and fishing history would be placed on display with interpretive signs describing what role the vessel played in Cordova's history, as well as design origins and how and where it was operated.

A potential site has been discussed by the City Planning, Harbor and Historical Commissions and found to be quite appropriate. In the plan for the new ferry terminal, there are several undesignated narrow strips of land surrounding the parking area. These open areas would be ideal for staging a variety of the historical vessels, offering maximum exposure and visibility to visitors, as well as local residents.

Six types of vessels have been identified as appropriate for the exhibit: (Specific boats that are available for those indicated *)

Charley Moore 24'*	Double Ender*
Tiedeman 22'	Plank Skiff
Cannery Boat (Seiner Style)*	Seine Skiff

It is anticipated that several of the vessels would be staged in a manner to allow boarding for closer observation, making this a "hands-on" exhibit.

It would be an outdoor museum, offering many benefits, such as:
- -the preservation of vessels otherwise soon to be lost
- -the actual lifesize examples displaying the development of the local fisheries
- -an educational presentation for future generations of residents and visitors
- -an attractive and interesting addition to Cordova's Ferry Terminal area, as well as great photo opportunities for tourists

PROJECT CURRENT STATUS

LAND to be donated by	City of Cordova	20,000.00
Vintage boat	City of Cordova	623.85
Transport of boats	Voluntary Equiment & labor	687.89
Restoration of Vessels	voluntary labor	3,600.00
Vintage Equiment donated		15,800.00
	Total Donations to date	40,711.74

95085

Projected Budget:

	Estimated Cost
Acquisition and Transport of Vessels	$35,000
Restoration to visual working condition (cosmetic repair, re-surfacing & painting)	
Charley Moore 24'	$ 5,000
Tiedeman 22'	$ 5,000
Cannery Boat (Seine Style)	$20,000
Double Ender	$ 9,000
Plank Skiff	$ 2,000
Seine Skiff	$ 3,500
Outfit with authentic or representational equipment	
Charley Moore 24'	$ 3,500
Tiedeman 22'	$ 3,500
Cannery Boat	$10,000
Double Ender	$ 5,000
Plank Skiff	$ 3,000
Seine Skiff	$ 3,000
Signs	
Overview of the historical diversity of the local fisheries (examples of shellfish, crab, salmon, herring, kelp)	$ 6,000
Vessel information delineating the era, usage, builders & operation	$18,000
Pavilions for Charley Moore, Tiedeman & Double Ender	$45,000
'Seascaping' and landscaping, finger docks, boarding gangways, lighting, various surrounding surface treatments.	$20,000
TOTAL PROJECT COST	$196,500

POTENTIAL CONFLICTS: There are no conflicts with land usage, the future staging area will largely be created by introducing fill into a current tidal zone. Other types of landscaping for visual aesthetics, or to create wind and weather breaks will be impossible with vegetation.

There is no better use for these vessels, which have become virtually obsolete. Subsequent maintenance and visitor safety issues will have to be addressed by a joint effort of the D.O.T., the City of Cordova and local non-profit organizations promoting tourism, however, no serious impediment is foreseen.

LINK TO EVOS INJURY: There are many links to injury resulting from the oil spill. Demand for response vessels for the cleanup attracted boats from both local and distant fisheries, including from out of state. The high dollar contracts affected boat values in two specific ways. A large number of fishermen used their capital gains to invest in newer, more modern hulls, which devalued the previous average gillnetter or seiner. In addition, once the contracts were completed, many of the relocated vessels were 'dumped' onto the local market further reducing the value of older local vessels. Consequently, the less competitive vessels have little value, while the older models have become useless to the present fishery.

In a recent article about Cordova in the Anchorage Daily news, it noted "More than any other town in South Central Alaska, Cordova's fortune has been tied to the sea. As long as the fishing was strong, Cordova did just fine." After three disastrous fishing seasons, diversifying Cordova's economy has become a primary concern for the community. It has long been recognized that tourism offers a sustainable growth industry for the State of Alaska and has great potential in Cordova.

Public awareness of the Prince William Sound has increased dramatically since the oil spill, national news, printed coverage of many varieties, even movies, have drawn significant attention to Cordova. This awareness has stimulated curiosity and has attracted travellers visiting the State, as well as Alaska residents to Cordova, and will no doubt continue to do so. Much of the history of our City can be preserved by saving these vessels, to entertain and instruct those interested in the early days and to the recent changes in our fishing industry.

ECONOMIC FEASIBILITY: This project is a one-time request to help establish a permanent physical historical representation of Cordova's fishing fleet with examples from the claming and canning days, up to early gillnetting and seining. Once completed, maintenance and management should be nominal and could be overseen by local groups in conjunction with D.O.T.

CONSISTENCY WITH SURROUNDINGS: As seen on the plans, included, the vessels will blend in very appropriately with Cordova's new Marine Highway Terminal. Being adjacent to the City's haul-out yard, this area in general has been used to store many vessels of this nature for layup for years. With this proposal, there is an opportunity to make these vessels available and safe for public study.

95085

NUMBER OF PEOPLE BENEFITING: The community as a whole will benefit. Newcomers will be able to understand the transitions experienced by the local industry and 'old-timers' will be able to reminisce and share their history with friends and visitors. Everyone waiting for the ferry will have an interesting variety of scenes to explore and appreciate.

DISPLACEMENT OF CURRENT USERS: There is no displacement, these strips are on the perimeter of the new parking area for the ferry terminal and are as yet undesignated.

ADJACENT LAND MANAGEMENT: As shown on the plan, the adjoining property is owned on one side by the City for a staging area and by the State Ferry System on the other.

INFLUENCE ON OTHER PROJECTS: This project will have only positive affects on all of the present and future recreational facilities in the area and can only enhance any other types of development in the area.

Population and Community Dynamics of Eelgrass and Associated Fauna

Project Number:	95086B
Restoration Category:	Research
Proposed By:	University of Alaska Fairbanks
Lead Trustee Agency:	ADFG
Cost FY 95:	$78,300
Cost FY 96:	$128,200
Total Cost:	Unknown
Duration:	3 years
Geographic Area:	Herring Bay, Prince William Sound
Injured Resource/Service:	Intertidal organisms

INTRODUCTION

Resources within eelgrass beds have clearly been injured by the *Exxon Valdez* oil spill. A reduction in eelgrass density, a reduction in the densities of associated sea stars (*Dermasterias)* and crabs (*Telmessus*), an increase in the density of mussels that live attached to eelgrass (*Musculus*), and an increase in juvenile cod were observed within oiled eelgrass beds. *Musculus* are at times very dense and may inhibit the growth and survival of eelgrass. The sea stars, crabs, and cod feed on the *Musculus*.

We suspect that recovery of eelgrass may be inhibited by their inability to quickly recolonize bare patches after injury, and that the recovery may be slowed by an increase in *Musculus* at oiled sites. Furthermore, *Musculus* densities may be higher at oiled sites because of a lack of predators (sea stars and crabs) at those sites.

This project examines factors that may inhibit the recovery of subtidal populations of eelgrass and invertebrates within the eelgrass community. This task would lead to the determination of the necessity for, and appropriate design of, restoration activities. This is a continuation of community dynamics studies within the coastal habitat.

NEED FOR THE PROJECT

This project would allow us to understand whether eelgrass resources should be restored, and if so, what methods may be appropriate for restoration.

PROJECT DESIGN

A. Objectives

1. Determine the recovery rates of damaged eelgrass populations, both by vegetative growth of rhizomes, and by seedlings.

2. Determine the importance of *Musculus* on the growth of eelgrass.

3. Determine factors that may be responsible for determining the distribution of *Musculus*.

4. Examine recruitment rates of sea stars and crabs and estimate their potential for recovery.

B. Methods

Experimental manipulations of eelgrass within Herring Bay will be conducted to determine the growth and recolonization rate of eelgrass. Experiments will evaluate the expansion rate of eelgrass into cleared patches along the edge of the bed, and to isolated patches of eelgrass transplanted just outside the bed. The growth rate of rhizomes will be documented. The growth of transplanted eelgrass rhizomes and shoots will be examined both in the presence and absence of *Musculus*.

Factors affecting the distribution of *Musculus* will be examined. The distribution of *Musculus* both within and among eelgrass beds in Herring Bay will be examined. Correlations between distribution of *Musculus* and physical factors will be examined in order to provide testable hypotheses regarding factors affecting *Musculus*. *Musculus* transplant experiments will be conducted to examine if the distribution of *Musculus* is limited by factors influencing recruitment or survival.

Manipulative experiments will be conducted to examine the relative impact of grazing by crabs, sea stars, and cod on *Musculus*.

We will also conduct sampling to determine the size distribution of sea stars and crabs within the eelgrass habitat, and to estimate the potential for recovery via recruitment.

C. Schedule

Experiments will be conducted during four cruises in 1995. A progress report will be submitted

in September of 1995 that summarizes field observations. A final report will be submitted in March 1996.

D. Technical Support

No technical support will be required.

E. Location

This project will be conducted within Herring Bay, Prince William Sound.

PROJECT IMPLEMENTATION

Principal investigators for this project have been conducting injury assessment studies in the shallow subtidal within Prince William Sound since 1989, and are submitting several proposals for continued monitoring and assessment of subtidal resources. The investigators involvement in other related projects makes them uniquely qualified to conduct cost effective studies on the interactions within the eelgrass community.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is to be conducted in concert with subtidal monitoring studies and with studies of population dynamics of intertidal populations within Herring Bay. The research platform used for this work will be shared with the team studying intertidal community dynamics within Herring Bay, and it is expected that information as well as logistical resources will be shared by these groups. For example, it is anticipated that an integrated subtidal and intertidal research effort will allow intertidal crews to examine the potential impacts of fish and crabs on populations within the lower intertidal during periods when these habitats are submerged.

FY 95 BUDGET ($K)

Personnel	7.2
Travel	0.0
Contractual	66.5
Commodities	0.0
Equipment	0.0
Subtotal	72.7
Gen. Admin.	5.7
Total	78.3

This page intentionally left blank.

Project # 95093 (revised)

I. EXXON VALDEZ OIL SPILL BRIEF PROJECT DESCRIPTION

Project Title:	Restoration of PWS Wild Stock Salmon Resources and Services: An Integrated Approach
Project Leader:	Howard Ferren, Special Projects Manager
Lead Agency:	AK. Dept. of Fish and Game (ADF&G)
Cost of Project	FY95: $1,690,331; FY96 $1,704,434
Start/Completion:	January, 1995 - September, 1995
Project Duration:	0.75 yr.
Geographic Area:	Prince William Sound
Contact Person:	Howard Ferren, Special Projects Manager PWSAC, P.O. Box 1110, Cordova, AK 99574 (907) 424-7511

II. Introduction

Prince William Sound Aquaculture Corporation (PWSAC) is the regional association for salmon enhancement in the PWS area. The corporation is authorized (Section 1 ch 111 SLA 1974) for the purpose of "contributing to the rehabilitation of the state's depleted and depressed salmon fishery", and is responsible (AS 29.03.020) for "providing salmon enhancement services."

Due to the Exxon Valdez Oil Spill (EVOS), wild stocks of salmon in PWS are recognized as injured. Pink salmon in particular are identified as injured and not recovering (EVOS Trustee Council). As a result of these injured resources, individuals and communities of PWS have suffered lost or reduced services.

The purpose of this project is to rehabilitate injured wild salmon stocks and restore services to subsistence, commercial, recreational and other users and communities of the PWS area. This will be accomplished by an integration of collaborative professional and local resident partners, and integration of objectives to actively rehabilitate injured stocks; relocate hatchery production to locations which will reduce harvest pressures on injured wild stocks; research and develop stock baseline genetic databases; determine stream escapements, and monitor both gene pools and returning adults.

This project will result in stock identification, enumeration, rehabilitation, monitoring, development and use of local expertise and evolvement in the restoration and monitoring process, and utilization of the restored and replacement resources

This project will contribute to the EVOS Trustee Council mission to "efficiently restore the environment injured by the *Exxon Valdez* oil spill to a healthy, productive ecosystem while taking into account the importance of quality of life and the need for viable opportunities to establish and sustain a reasonable standard of living." The restoration will be accomplished through natural recovery, resource and service restoration and enhancement, replacement of resources, research and monitoring. The project falls under EVOS TC Draft Guiding Principles including:

- "occur within the spill area";
- "support services necessary for the people who live in the area";
- include "meaningful public participation process";
- reflect "a reasonable balance between costs and benefits";
- provide a "cost-sharing opportunity";
- "have a sufficient relationship to an injured resource"; and,
- "state a clear, measurable and achievable endpoint".

III. Need for Project

Restoration funds must be used "...for the purposes of restoring, replacing, enhancing or acquiring the equivalent of natural resources injured as a result of the oil spill or the reduced or lost services provided by such resources". This project is needed to: restore and replace injured resources by increasing the rate and degree of recovery of wild pink salmon stocks; and, to restore/replace injured or lost services by wild stock enhancement and relocation of hatchery stocks which have "sufficient relationship to the injured resource...and will benefit the same user group(s) that was (were) injured."

IV. Objectives

A. **Restore wild stock salmon resources and services in PWS to pre-spill conditions.**

B. **Maximize fitness (both biologic and economic) of injured wild stocks through application of knowledge of salmon population biology, genetics and disease.**

C. **Reduce harvest of injured wild stocks by more specific management of wild and hatchery stocks.**

D. **Develop, integrate and coordinate collaborative participants in research, restoration and monitoring.**

E. **Develop, train and use resident expertise to establish the capability for continuing conservation and protection of PWS salmon resources.**

V. Methods

Four methods will be used to accomplish the immediate objectives of salmon stock restoration; a fifth will serve the longer-term objective of establishing expertise to practice sustained efforts in stock restoration. The restoration methods include direct restoration through use of available fish cultural facilities and talent in PWS; research into biological interactions, particularly genetic

effects of cultured salmon on wild salmon; integrated monitoring of the fitness of salmon stocks and their progress toward restoration; and, collaboration of partners to restore the Sound by integrating and coordinating activities. These methods, particularly the research and monitoring aspects, follow in concept a model for monitoring interactions of wild and hatchery salmon recently set forth by an international panel of salmon geneticists and conservation scientists convened by NINA (Norweg. Instit. Nature Res.). They emphasize the necessity of monitoring a baseline of genetic and fitness (phenotypic) data, of understanding the extent of gene flow between stocks, and of studying the biological effect of gene flow through quantitative genetic analysis.

The proposed methods anticipate the integrated cooperation of projects independently proposed by other agencies and groups; some of those projects are referenced here. Because of the schedule with which this revision has been undertaken there has not been formal communication and coordination with those agencies and groups. However, no impediments to integration of those projects into the restoration of wild stock resources are anticipated. A workshop is proposed to bring collaborators together to integrate and plan activities.

The work proposed will be carried out in part through the cooperation of several agencies active in salmon resource management in PWS (PWSAC, ADF&G). Portions of the genetic-interaction research will be carried out by the University of Alaska Fairbanks School of Fisheries and Ocean Sciences (SFOS) and will provide opportunity for graduate thesis research and professional development for junior biologists in PWS. PWS residents will participate in field restoration and monitoring activities.

A. **Directly restore injured stocks.**

1. **Assess and inventory hatchery capabilities:** water regimes, incubation capacity, stock isolation capability, etc. This will be completed to help match hatchery constraints or opportunities with specific injured or depleted wild salmon stocks identified as candidates for restoration which may benefit from hatchery/fish culture intervention.

2. **Incubate eggs taken from injured stocks, returning them as fry to the native site via net pen culture** (cf Draft EIS, Proposed Action, Comprehensive Restoration of Impacts on Fish, Action 3, Ch. 4, p. 124).

3. **Rear and release hatchery fish to divert harvest from injured wild stocks** (cf Draft EIS, Proposed Action, Comprehensive Restoration of Impacts on Fish, Action 4, Ch. 4, p. 124; See C.1. below).

B. **Maximize fitness of wild stocks.**

1. **Mark or tag hatchery stocks:** a research and monitoring tool.
   a. Coded micro wire tagging: Refer to Project Proposal 95137, 95320: Stock ID and Monitoring Studies.

b. Thermal manipulation of otolith microstructure Contained in Project Proposal 95320C, Otolith thermal mass marking.

2. **Monitor stock baselines:** a reference for assessment of progress; a basis for setting policy for restoration decisions.

a. Census: enumerate stocks of wild salmon by ground surveys in five districts of PWS to contribute to stock baseline information including species, stocks and stock size in oiled and unoiled areas.

b. Demography: fitness and life history traits of stocks: sample age, size, sex, timing, meristic/morphologic information from stocks. This information will aid in identifying injured and depleted stocks which will be targeted for further research, monitoring and possible restoration.

c. Gene frequencies: representative samples of tissues from stocks; contained in Project Proposal 95320D by Seeb & Seeb.

d. Pathogens and parasites: representative samples of tissues, fluids from stocks.

e. Marks and tags: recover marks and tags from representative samples of stocks.

3. **Research genetic interactions of wild with wild stocks; hatchery with wild stocks**

a. Straying/gene flow field experiment: (SFOS Division of Fisheries)
This research is modelled on earlier work on pink salmon at Auke Creek in Juneau by A.J. Gharrett and colleagues. Straying may be estimated by observing physically marked or tagged salmon; however, straying is only one component of gene flow--strays may well not breed successfully to contribute genetically. Our proposed protocol is to screen male returning salmon at a weir, allowing about 20%, those bearing a relatively rare presumably neutral gene, to spawn naturally. This procedure genetically tags the stock; applied with different marker genes to two stocks in the same region, a precise estimate of actual gene flow can be obtained by simple monitoring of the stocks over several generations. Integrates with Project Proposal 95076 by Wertheimer, et al.

b. Fitness phenotype laboratory experiment: quantitative genetic analysis of life history and fitness traits. (SFOS Division of Fisheries)
This research is developed from earlier work on pink salmon at Auke Creek and at Gastineau Hatchery by W.W. Smoker, P.A. Crandell, and colleagues. Gametes sampled from known parents in stocks under restoration will be taken to the incubation laboratory at Juneau and observed under a standard quantitative genetic experimental design. Analysis of observations of fitness-related developmental traits (rates of development, salinity tolerance, etc.) and developmental stability

(fluctuating asymmetry of meristic and morphologic traits) will provide estimates of genetic parameters, and from observations of hybrid families, direct estimates of the fitness effects of gene introgression.

c. Analysis of fitness effects on wild stocks of interactions with cultured fish based on observed PWS data. (SFOS Division of Fisheries) Recent biometrical simulations of hypothetical salmon production systems, modelled on PWS pink salmon, by AJ Gharrett have demonstrated a relationship between ecological productivity (carrying capacity) and the overall fitness benefit of homing or straying. These models will provide a basis for analyzing with biometrical rigor the straying, gene flow, population genetic structure, and quantitative fitness variation data collected by other components of this integrated project.

d. Incorporate genetic interaction insights in rehabilitation activities.

C. **Reduce harvest of injured wild stocks by more specific management of wild and hatchery stocks.**

1. **Relocate hatchery runs in space or season**(cf Draft EIS, Proposed Action, Comprehensive Restoration of Impacts on Fish, Action 4, 6 Ch. 4, p. 124)

a. Use appropriate remote releases (cf Phase Three Comprehensive Salmon Plan for Prince William Sound/Copper River). Based on site selection criteria and site evaluation, imprint and remote release hatchery fish to reduce possible harvest pressures on injured wild stocks which might migrate through fisheries conducted near hatcheries or targeting enhanced salmon migrating to the hatchery of incubation and rearing. For example, hatchery salmon could be released in the Eastern, Southeastern and/or Montague Districts, thereby distributing the commercial fleet and reducing harvest pressures on injured stocks in the Northwestern and Southwestern Districts.

b. Develop new hatchery stocks with inherent run timing different from injured wild stocks (cf Phase Three Comprehensive Salmon Plan for Prince William Sound/Copper River). Identify and select from the salmon stock census, stocks which have adult return run time different from that of injured or depleted wild stocks which may be currently harvested in fisheries targeting returning hatchery salmon. By culturing temporally isolated salmon stocks, fisheries can be managed without placing additional pressure on injured stocks. Consideration must be given to species in addition to pink salmon if those species provide the temporal and spatial isolation necessary to reduce pressures on injured pink stocks. Of particular potential are early run time chum and sockeye salmon.

2. **Identify hatchery stocks in season and manage harvests accordingly.** Otolith marking and CWT tag recovery and assessment (B.1. above).

D. **Project collaboration and activity integration.**

1. **Convene working group** of research and restoration collaborators. Agencies, organizations and groups which are identified by PWSAC as required within a collaborative network for salmon restoration to complete the objectives outlined within this proposal, will convene in Cordova to integrate objectives and activities including and in addition to those outlined within this proposal.

2. **Integrate projects** while formulating strategies and agreements towards implementation of activities. Establish project manager and management team, communication and decision making protocols, priorities and implementation plans.

E. **Employ resident sector-specific technical teams (5 sectors corresponding to major fishing districts, see Figure 1).** Teams responsible for surveys, sampling, egg takes, pen rearing, etc. Communications have been initiated with Eyak Tribal Council on project potentials and participation.

1. **Contract five vessels and crew** for field work including stream surveys, escapement enumeration, stock sampling, egg take, netpen and fry rearing support or other salmon restoration activities identified as appropriate. PWSAC will exercise standard contract procedures and employment options.

2. **Provide technical training** to crews in salmon escapement enumeration, and working with technical, academic and professional staff in genetic, disease and marked salmon recovery sampling, fish culture techniques, restoration methods and stock monitoring. Training will be provided survey, monitoring, sampling and fish culture crews by PWSAC, ADF&G and University of Alaska SFOS as required.

3. **Deploy vessels and teams** for stream surveying, stock assessment, sampling, restoration activities and monitoring. Historic observations indicate that early returning salmon stocks spawn in the Eastern and Southeastern Districts. Therefore, two vessels and technical teams are to be deployed to those sectors from June 23 to August 15. Beginning August 15, five vessels and crews are to be deployed, one to each sector of PWS, and remain in the field until September 25. The project leader and field technicians trained and assigned to each vessel and sector will survey, sample, monitor, compile data and report as required. Additional assignments may include, based on restoration requirements, taking eggs, managing net pens, rearing fry for imprinting, or other enhancement or rehabilitation activities.

#95093

V. Schedule for FY-95

NOTE: The schedule is presented for FY-95. Specific objectives and activities are intended to occur annually to encompass two (2) life cycles for both odd year and even year pink salmon. A schedule will be presented in the detailed project description (DPD) which delineates the workplan through the year 2002. A generalized listing of the extended workplan and timeline is presented in Figure 2.

Activity	Begin	End
Convene workshop		
Contact all collaborators	1/95	1/95
Convene workshop	2/95	2/95
Integrate objectives/activities	2/95	2/95
Finalize workplans	2/95	3/95
Evaluate hatchery capabilities		
Analyze facility temp and water flows	1/95	2/95
Review incubation and facility floor plans	2/95	3/95
Compute species/stock limitations	2/95	3/95
Report on recommendations	3/95	4/95
Develop five sector technical teams		
Contract vessels and crews	1/95	4/95
Contract technicians	3/95	4/95
Train field crews	4/95	5/95
Monitor stock baselines		
Stock surveys	6/95	10/95
Census/demographics	6/95	10/95
Marks/tags/tissue samples	6/95	10/95
Direct restoration		
Incubate injured-stock eggs	7/95	12/95
Survey injured stocks	6/95	10/95
Collect injured stock eggs	6/95	10/95
Incubate embryos	8/95	12/95
Pen rear & release fry	1996	
Evaluate & revise plan	1996	
Recover marks/tags	1997	
Plan next cycle	1997	
Realign hatchery stock releases		
Remote release hatchery fish	4/95	6/95
Survey sites	4/95	5/95

#95093

Activity	Begin	End
Pilot scale releases	4/95	5/95
Evaluate releases/returns	1996	
Production releases	(decision point)	
Develop new broodstocks	7/95	12/95
Survey stocks	7/95	10/95
Remote egg takes	7/95	10/95
Incubate and release	8/95	1996
Geneflow field experiment		
Establish genetic tag (2 camps/screen males)	7/95	9/95
Sample returns	1997	
Analyze gene flow	1997	
Report	1998	
Quantitative genetic analysis of fitness traits		
Sample gametes in field	7/95	10/95
Incubate embryos in lab and gather data	10/95	1996
Analyze	1996	
Report	1997	
Model fitness effects of genetic interactions: develop simulation models for:		
Gene flow and drift	2/95	11/95
Single locus selection	7/95	1996
Quantitative/fitness trait	12/95	1997
population dynamics	1996	1997
Incorporate PWS data	1998	
Report		

VI. Technical support

Technical support will include the services of:

- PWSAC planning, project management and fish culture staff
- ADF&G biologists and technicians
- University of Alaska geneticists and other experts in this field
- ADF&G pathologist
- permitting agencies including ADF&G, Department of Army, Corps of Engineers, Department of Natural Resources
- ADF&G otolith mark analysis lab

VII. Location

This project will take place in Prince William Sound. Field crew activities will take place within districts of PWS as divided into five sectors (Figure 1) including the Southeastern, Eastern, Northern-Coghill-Northwestern, Southwestern and Montague Districts. Hatchery incubation and rearing of wild stock salmon will occur at PWSAC hatchery facilities; specific facilities selected will be based on evaluation of site capabilities and wild stock biological requirements. PWSAC facilities include the Armin F Koernig Hatchery on Evans Island, the Main Bay Hatchery near Crafton Island, the Wally Noerenberg Hatchery on Esther Island, and the Cannery Creek Hatchery in Unakwik Inlet.

VIII. Project Implementation

PWSAC will implement the project in conjunction with ADF&G as the lead agency and other collaborating organizations. Restoration management will be based within PWSAC and PWSAC will be responsible for coordinating activities under this proposal including research, restoration and monitoring.

IX. Coordination of Integrated Research Effort

Activities of the salmon restoration program will be integrated with ongoing genetic investigations, stream analysis, stock identification and monitoring studies, and otolith marking (Figure 3).

X. Public Process

PWSAC is a regional association which by law (AS 16.05.380.) must include on their boards representatives of sport fishermen, municipalities, and Native organizations, in addition to commercial fishermen and processors. It is PWSAC's mission to optimally produce salmon for the benefit of all user groups.

As a mechanism to restore PWS salmon resources and services, the PWSAC salmon restoration project will incorporate existing research results achieved through projects previously and currently funded by the EVOS Trustee Council process. In addition, specific stock and stream restoration options may be recommended by users and villages within PWS. Local vessels, skippers and crews will be solicited from interested public and contracted for training and field work.

XI. Personnel Qualifications

Personnel: PWSAC

H.J. Ferren
Special Project Manager, Planner
M.S. Biological Oceanography, University of Alaska
Corporate strategic and tactical planning, regional salmon planning, team facilitation and project management.

#95093

Personnel: University of Alaska, SFOS

W.W. Smoker
Professor of Fisheries, SFOS.
PhD Fisheries, Oregon State Univ.
Research in salmon ocean ranching, quantitative genetics of Pacific salmon.

A.J. Gharrett
Professor of Genetics, SFOS
PhD Genetics, Oregon State Univ
Research on molecular genetics, population genetics of Pacific salmon.
Recognized expert on population genetics of Pacific salmon, Genetic Stock Identification, genetic tagging

Patricia A. Crandell
Postdoctoral Fellow and Research Associate, SFOS
PhD Aquaculture Genetics, Biometrics Univ. of Calif Davis
Research on quantitative genetics of pink salmon, ploidy manipulation in Pacific salmon
Expertise in experimental design and statistical analysis.

Andrew Gray
Research Associate, SFOS
MS Genetics, Washington State University
Molecular genetics techniques, Electrophoretic analysis of allozymes, DNA analysis

Budget FY95

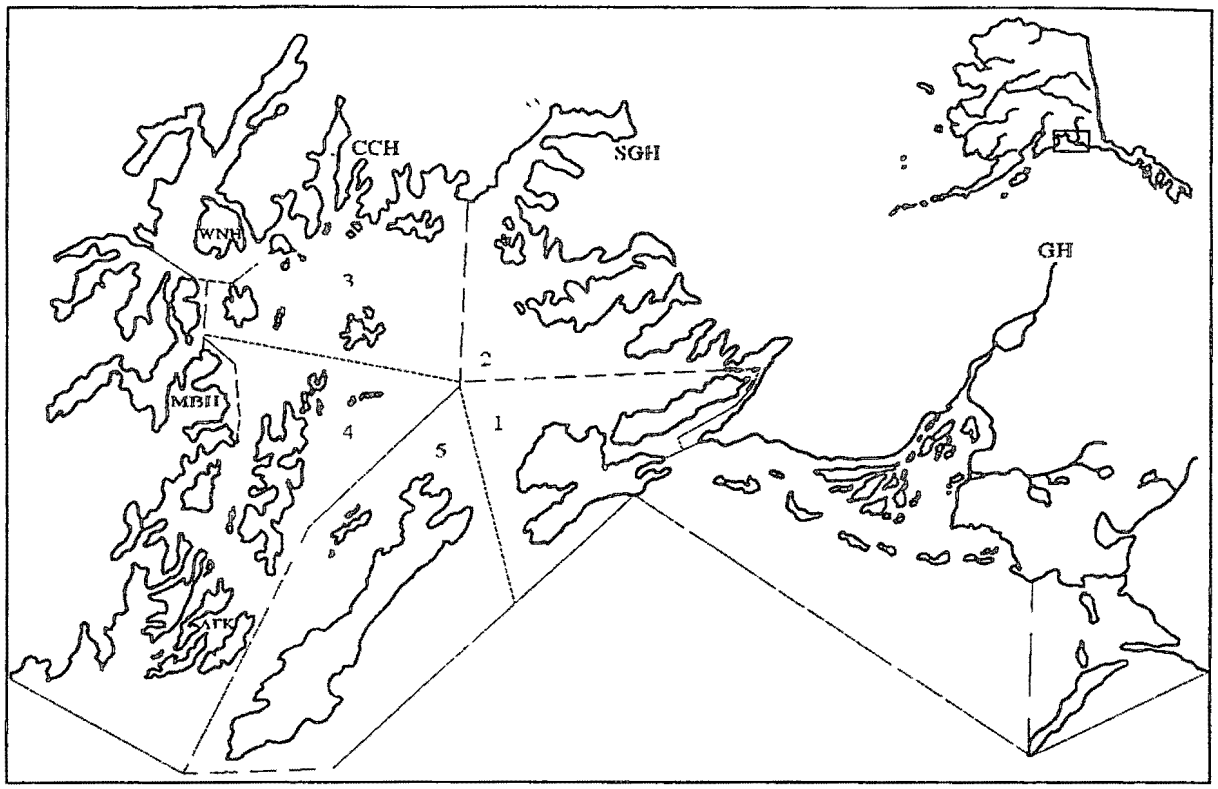
PWSAC		
100	Personnel	$135,120
200	Travel	$30,700
300	Contractual Services	$747,000
	Administration	$161,895
400	Commodities	$32,480
500	Equipment/capital	$134,000
	SUBTOTAL	$1,241,195
UAF SFOS (partner in genetics)		
100	Personnel	$231,080
200	Travel	$7,200
300	Contractual Services	$16,000
	Administration	$74,856
400	Commodities	$20,000
500	Equipment/capital	$100,000
	SUBTOTAL	$449,136
TOTAL PROJECT BUDGET		**$1,690,331.**

#95093

Figure 1

Prince William Sound

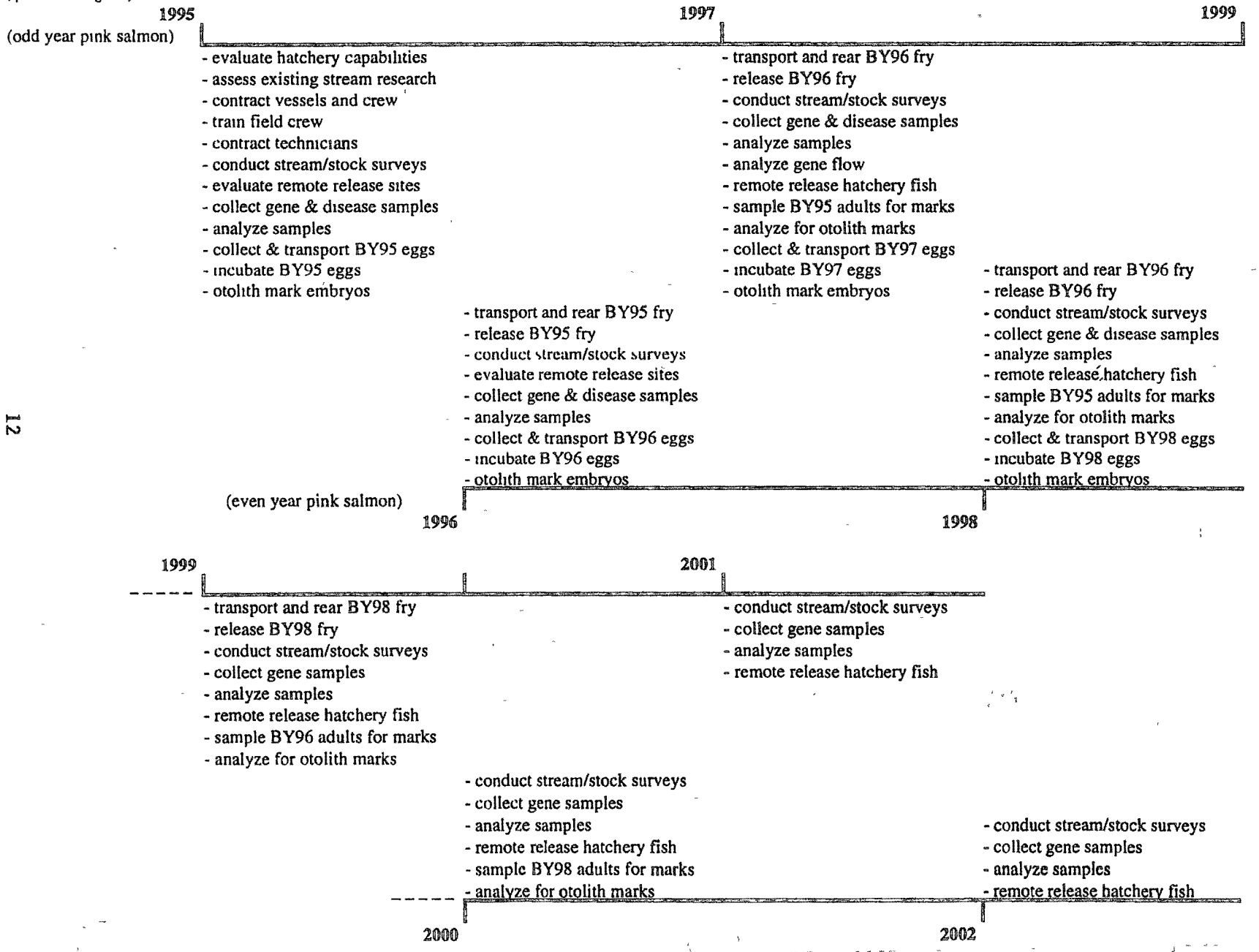
Sectors for Research, Restoration and Monitoring



Sectors	Hatcheries
1: Southeastern District	_____
2: Eastern District	Solomon Gulch
3: Northern-Northwestern-Coghill Districts	Cannery Creek Wally Noerenberg
4: Southwestern-Eshamy Districts	Main Bay Armin F. Koernig
5: Montague District	_____

Figure 2: Time-line and activities

(\pwsac\evos\fig95-2)



#4596

#95093

EVOS Trustee Council: Project Description
Restoration of PWS Wild Stock Salmon Resources and Services
(pwsac\evos\fig95-3)

Figure 3: Integration of Research, Restoration and Monitoring

COMPONENT	ACTIVITY	INTEGRATION
Research	Stream - stock identification	ADF&G USFS PWS resource users
Research	Stream - stock surveys and escapement enumeration	PWSAC ADF&G Trained technicians and vessel crews
Research	Genetic and disease sampling	Technicians ADF&G
Research	Gene analysis, gene flow simulation	ADF&G University of Alaska, SFOS NMFS: Auke Bay Lab
Research	Disease analysis	ADF&G
Research	Evaluate remote release sites for hatchery fish	PWSAC ADF&G
Restoration	Egg-take from wild stock system(s)	PWSAC ADF&G technicians Vessel crews
Restoration	Incubation and rearing wild stock	PWSAC
Restoration	Imprint and release wild stock	PWSAC Vessel crews
Restoration	Remote release hatchery fish	PWSAC ADF&G
Research	Otolith marking	ADF&G PWSAC
Research and monitoring	Adult return, enumeration and otolith mark sampling	PWSAC ADF&G technicians Vessel crews
Research and monitoring	Otolith analysis	ADF&G

This page intentionally left blank.

Quantification of Stream Habitat for Harlequin Ducks and Anadromous Fish Species from Remotely Sensed Data

Project Number:	95095
Restoration Category:	Habitat Protection
Proposed By:	Richard Podolsky, PhD. Avian Systems, Inc. 1275 15th St. #15G Fort Lee, NJ 07024-1929 Tel: (201) 224-2025; FAX: (201) 224-2566
Lead Trustee Agency:	NOAA
Cost FY 95:	$88,000
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Oil spill area
Injured Resource/Service:	Harlequin duck

INTRODUCTION

Harlequin ducks (*Histrionicus histrionicus*), feed in the shallowest water of all the seaducks in Alaska. Consequently, they were heavily impacted by the *Exxon Valdez* oil spill. Furthermore, because of the persistence of oil in certain estuaries, harlequins appear to be suffering from continued, chronic exposure to oil. Nearly total nesting failure of harlequins apparently has ocurred in the spill area. Identification and protection of nesting habitat through land acquisition, therefore, is critical to the recovery of this species.

PROJECT DESCRIPTION

Harlequins congregate at the mouths of fast streams where they nest. The goal of this study is to analyze aerial photographs and satellite imagery in order to identify and map all potential nesting streams in the spill area. With the aid of a geographic information system the distribution of historical or current harlequin nests will be incorporated.

The goal will be to prioritize sites in terms of their potential to support harlequins and make this information available to those charged with land acquisitions. Any land acquisitions made as a result of this study will also benefit the species of anadromous fish that co-occur in these streams.

Methods

1. Analyze satellite or aerial photos identifying all major and minor streams. This can be accomplished with GIS software such as GAIA, that allows the coregistration and overlay of hydrography vectors to the raster imagery.

2. Catalogue all major and minor streams and rank them according to their value as potential harlequin nesting habitat.

3. Build a GIS that includes the following data layers: imagery, historical harlequin nest sites, current harlequin nest sites, stream stretch ranking in terms of water motion, vegetation cover etc., vectorized hydrography, and proximity to shallow estuaries for feeding.

4. Recommend specific sites to be acquired to maximize the number of harlequins and their reproductive output.

Restoration of Murres by way of Social Attraction and Predator Removal

Project Number:	95096
Restoration Category:	General Restoration
Proposed By:	Dr. Richard Podolsky Dr. Stephen Kress National Audubon Society 1275 15th St. #15G Fort Lee, NJ 07024-1929 Tel: (201) 224-2025; FAX: (201) 224-2566
Lead Trustee Agency:	DOI
Cost FY 95:	$167,000
Cost FY 96:	$167,000
Total Cost:	$668,000
Duration:	4 years
Geographic Area:	Oil spill area
Injured Resource/Service:	Common murre

INTRODUCTION

Common Murres (*Uria aalge inornata*) were the most heavily affected bird species as a result of the Exxon Valdez Spill. Restoration of selected populations and enhancement of habitat by way of auditory and visual attraction of pre-breeders in combination with removal of predatory mammals such as Arctic Fox, could be an important technique for reducing the recovery time of murre population.

PROJECT DESCRIPTION

Pre-breeding seabirds are known to wander widely in the years before breeding. During this prospecting phase it has been shown that behavioral attraction (sound playback and presentation of decoys or models) is an effective means of luring seabirds to new or extirpated habitat especially when done in conjunction with predator removal. The result could be a reduction in the recovery time, especially for Murres. Work by National Audubon with murres

and other seabirds in the Gulf of Maine has shown that they are lured to habitat where predators have been eradicated.

Murres accounted for 61% of the dead birds recovered after the spill (22,000 of 36,000). But because many oiled birds were lost at sea or along the shores, the number of recovered murres represents perhaps only 5-10% of the total number of murres killed by the spill. It is therefore likely that in excess of one hundred thousand murres were killed as a result of the spill. This translates into a major mortality event that will affect the reproductive performance and population stability of murres in Alaska for years to come. It is known already that this mortality event has caused complete reproductive failure in some large colonies in each year since the spill, and this loss represents the cumulative lost production of some 300,000 young. Reasons for this "echo" of lost production into subsequent years is complex, but may have to do with the fact that many surviving adults have had to find new mates, a process that can be followed by several years of failed reproduction.

Methods

1. Conduct appropriate attraction trials at extirpated habitat within the spill area.

2. Conduct appropriate attraction trials at predator infested colonies within and/or outside the spill area (such as Walrus Island in the Aleutian Islands).

Restoration of Murres by Way of Transplantation of Chicks: A Feasibility Study

Project Number:	95097
Restoration Category:	General Restoration
Proposed By:	Dr. Richard Podolsky Dr. Stephen Kress National Audubon Society 1275 15th St. #15G Fort Lee, NJ 07024-1929 Tel: (201) 224-2025; FAX: (201) 224-2566
Lead Trustee Agency:	DOI
Cost FY 95:	$176,000
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Oil spill area
Injured Resource/Service:	Common murre

INTRODUCTION

Common murres (*Uria aalge inornata*) were the most heavily affected bird species as a result of the *Exxon Valdez* Spill. Restoration of selected populations by way of transplantation and hand-rearing of chicks could be an important technique to reduce the recovery time of the murre population.

PROJECT DESCRIPTION

Translocation and hand-rearing of alcids has been successful in reestablishing Atlantic Puffins to former breeding sites in the Gulf of Maine. Similar methodologies might be adaptable to Common murres and result in the re-establishment or enhancement of colonies impacted by the spill. Thus, the goal of this project is to conduct the background research necessary to ascertain whether this approach is adaptable and feasible with Common murres and whether any

significant restoration potential might be realized through this methodology.

Murres accounted for 61% of the dead birds recovered after the spill (22,000 of 36,000). But because many oiled birds were lost at sea or along the shores, the number of recovered murres represents perhaps only 5-10% of the total number of murres killed by the spill. It is therefore likely that in excess of one hundred thousand murres were killed as a result of the spill. This translates into a major mortality event that will affect the reproductive performance and population stability of murres in Alaska for years to come. It is known already that this mortality event has caused complete reproductive failure in some large colonies in each year since the spill, and this loss represents the cumulative lost production of some 300,000 young.

Reasons for this "echo" of lost production into subsequent years is complex, but may have to do with the fact that many surviving adults have had to find new mates, a process that can be followed by several years of failed reproduction.

Methods

1. Conduct appropriate experiments in such places as the Barren Islands to ascertain the feasibility for translocations of Common Murre chicks from large colonies outside the spill area.

2. Conduct the appropriate trials to establish a methodology for human-rearingof murre chicks.

Identification of Seabird Feeding Areas from Remotely Sensed Data (AVHRR and/or Landsat MSS) and Its Impact on Restoration Efforts

Project Number:	95098
Restoration Category:	General Restoration
Proposed By:	Dr. Richard Podolsky Dr. Stephen Kress National Audubon Society 1275 15th St. #15G Fort Lee, NJ 07024-1929 Tel: (201) 224-2025; FAX: (201) 224-2566
Lead Trustee Agency:	DOI
Cost FY 95:	$74,000
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Oil spill area
Injured Resource/Service:	Multiple resources

INTRODUCTION

Restoration efforts for seabirds should be focused on areas with the greatest likelihood of maximizing reproductive output and minimizing risk from human activities.

PROJECT DESCRIPTION

The two factors that are most important to the distribution and abundance of seabirds are: 1) the proximity to rich feeding areas, and 2) disturbance-free (especially predator-free) island habitat. Assessing the quality of seabird habitat entails measuring at least these two variables. These data can then be used to identify seabird "hot-spots", and 1) focus the restoration efforts in these areas and 2) identify hot-spots to be avoided by any shipping activities that pose the risk of spilling hazardous materials.

When abundant island habitat exists in close proximity to rich feeding grounds than seabird colonies typically attain impressive concentrations. These concentrations are at significant risk, however, when they co-occur with certain types of human activities, most notably the shipping of hazardous substances.

Methods

1. Collect and summarize existing information on the distribution and abundance of seabirds within foraging distance (@200 km) of the islands and shores impacted by the Exxon Valdez Spill.

2. Measure the productivity of the ocean within foraging distance (@200 km) of the islands and shores impacted by the Exxon Valdez Spill by analyzing ocean fronts, algae blooms, chlorophyll concentrations and related phenomenon from AVHRR (Advanced Very High Resolution Radiometer) and/or Landsat MSS (Multispectral Scanner) data.

3. Examine the degree to which seabird distribution correlates with ocean productivity. Prioritize coasts and islands as a function of the overall quality of their seabird habitat and make logical recommendations to all appropriate agencies.

Marbled Murrelet Vocalizations in Conjunction with Artificial Nests: A Possible Means of Attraction to Restored or Acquired Habitat

Project Number:	95099
Restoration Category:	General Restoration
Proposed By:	Richard Podolsky, PhD. Avian Systems, Inc. 1275 15th St. #15G Fort Lee, NJ 07024-1929 Tel: (201) 224-2025; FAX: (201) 224-2566
Lead Trustee Agency:	DOI
Cost FY 95:	$77,000
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Oil spill area
Injured Resource/Service:	Marbled murrelet

INTRODUCTION

Marbled murrelets (*Brachyramphus marmoratus*) were among the most heavily affected bird species as a result of the *Exxon Valdez* Spill. Restoration of selected populations by way of auditory and visual attraction of pre-breeders in conjunction with artificial nests could be an important technique to reduce the recovery time of the murrelet population.

PROJECT DESCRIPTION

Playback of vocalizations has been shown to be an effective method of attracting many seabirds including: alcids, terns, albatrosses, storm-petrels and gadfly petrels. Both storm-petrels and gadfly petrels have been successfully lured to artificial nests augmented with playback of vocalizations. Because this method has not been attempted with murrelets, the goal of this project is to ascertain whether murrelets are attracted to playbacks or other relevant sounds and whether there is any significant management potential to be realized through combining these

stimuli with the presentation of artificial nests.

Methods

1. Conduct appropriate experiments on Knight and Naked Islands in order to ascertain whether murrelets are attracted to playback of vocalizations or other relevant sounds.

2. Conduct appropriate experiments on Knight and Naked Islands in order to ascertain whether the number of murrelets observed, during dawn watches or through other population assessment methods, can be increased by broadcasting various sounds.

3. Ascertain whether murrelets are attracted to, or will use, artificial nests with or without vocalization playback.

Closeout: Murrelet Prey and Foraging Habitat in Prince William Sound

Project Number:	95102-CLO
Restoration Category:	Research (closeout)
Proposed By:	DOI
Cost FY 95:	$63,800
Cost FY 96:	$0
Total Cost:	$63,800
Duration:	1 year
Geographic Area:	Not applicable
Injured Resource/Service:	Marbled murrelet

INTRODUCTION

This project is the closeout of 94102 - Murrelet Prey and Foraging Habitat in Prince William Sound. The purpose of the project was to identify prey species, locate foraging areas, determine foraging patterns from known nesting areas, and characterize important feeding habitat for marbled murrelets.

NEED FOR THE PROJECT

To complete data analysis and write report for FY 94 field work.

PROJECT DESIGN

A. Objectives

The purpose is to analyze 1994 project data and prepare a final report. The report will be prepared for the peer-review process and presentation to the Trustee Council.

B. Methods

Not applicable.

C. **Schedule**

October - December:	Data analysis
December - January:	Report writing
February 15:	Draft report
March 31:	Final report

D. **Technical Support**

Not applicable.

E. **Location**

Report preparation will occur at the Fish and Wildlife Service Regional Office in Anchorage, Alaska.

PROJECT IMPLEMENTATION

The USFWS is the most appropriate entity to analyze the data and write the report.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Not applicable.

FY 95 BUDGET ($K)

Personnel	55.5
Travel	0.0
Contractual	0.0
Commodities	0.0
Equipment	0.0
Subtotal	55.5
Gen. Admin.	8.3
Total	63.8

Subtidal Site Verification

Project Number:	95107
Restoration Category:	Monitoring
Proposed By:	University of Alaska Fairbanks.
Lead Agency:	Alaska Department of Fish & Game
Cost FY 95:	$56,200
Cost FY 96:	$42,000 (data analysis and report writing only)
Total Cost:	$98,200
Duration:	2 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Subtidal organisms

INTRODUCTION

The optimal design for environmental impact monitoring includes sampling both before and after a disturbance event, at pairs of impacted and control sites. This is referred to as the BACIP (Before-After, Control -Impact Pairs) design. Very few of the current studies of the effects of the EVOS have been able to use this design because of the lack of pre-spill data. Instead, we have relied on sampling at pairs of oiled and control sites after the spill to infer injury to biological resources in coastal habitats. This is the ACIP (After Control-Impact Pairs) design. Correct interpretation of the results produced from this design are based on the assumption that oiled and control sites would not have differed if there were not an oil spill.

There are resources within the subtidal habitats that have shown consistent differences among oiled and control sites using the ACIP design. For example, *Musculus* density on eelgrass in Prince William Sound has been consistently higher at oiled sites. Without pre-spill data, it is difficult to establish whether these differences represent long-term impacts of the spill, or whether they represent inherent differences among sites that resulted from bias in the site selection process. For example, it may be that predominant wind and current conditions within the Sound that were responsible for bringing oil to specific beaches, are also responsible for bringing higher concentrations of *Musculus* larvae to those same beaches.

There are essentially two ways to help address this issue. First, long-term monitoring of

resources could be conducted and evaluated to determine if the resources at oiled and control sites "converge" after some period of time. This approach suffers from the fact that convergence may take very long to occur, or may never occur if some alternate stable state has been achieved after the spill. In the shorter term, agencies are faced with making decisions regarding possible restoration of supposedly injured resources. A second approach is to conduct an independent test of our ability to match oiled and control sites, and to demonstrate that the site selection process produced no biases that may have resulted in inherent differences among oiled and control pairs.

The verification of the process by which matched pairs are selected also has much larger implications with respect to monitoring programs that may be used to evaluate impacts of future oil spills as well as other disturbances. Because of the uncertain time and location of impact of oil spills, it is extremely difficult to obtain the appropriate "pre-spill" data at both impacted and control sites. Costly "baseline" monitoring programs often result in data that is largely unusable for evaluating injuries, and evaluation of injuries from spills almost always relies on sampling conducted only after the spill. The establishment of *a priori* criteria for the selection of oiled and control sites, and the *a priori* verification that this selection process does not produce biases in oiled-control comparisons, would be very useful in supporting inferences made from post-spill surveys in future spills. In addition, establishment and verification of *a priori* site selection criteria, could prove much more useful, and much more cost effective, than baseline monitoring studies. Establishing *a priori* criteria for selection of matched pairs could prove to be a useful monitoring tool in Prince William Sound as well as elsewhere.

NEED FOR THE PROJECT

A study is needed to test of our ability to match oiled and control sites, and to demonstrate that the site selection process produced no biases that may have resulted in inherent differences among oiled and control pairs.

PROJECT DESIGN

A. Objectives

1. Determine if previously used site selection criteria may have resulted in biases that could lead to inherent differences among oiled and control sites that were unrelated to oiling.

2. Establish criteria for the unbiased selection of oiled and control site pairs to be used in assessing injury from future oil spills or other disturbances.

B. Methods

We will test our ability to select appropriate matched pairs of sites by sampling at "simulated oiled" sites and their matched controls. An oil spill simulation model will be used to define a potential universe of "simulated oiled" sites. (Work on oil spill simulation will be the same as used in intertidal studies, and will be funded under that project). We will select a set of "simulated oiled" sites from this universe and select matched control sites using procedures used in earlier injury assessment studies. We will then sample at both simulated oiled and control sites and test for significant differences among sites. Variates measured and sampling methods will be similar to that described for the monitoring program. These studies will be conducted only within one depth strata, within eelgrass beds (< 3 m). A total of four pairs of sites will be visited.

C. Schedule

The field work for this project will begin in June 1995 and conclude in July 1995. Data analysis and draft report preparation will be completed in May 1996. Deliverables will consist of a FY 95 progress report to be submitted in September 1995, and a final report to be completed by May 1996.

D. Technical Support

Technical support includes a small float plane and small (< 32 ′) vessel for site selection verifications in June. The bulk of the site selection verifications will occur during subtidal eelgrass habitat sampling in July.

E. Location

The project will be undertaken in Prince William Sound.

PROJECT IMPLEMENTATION

The principal investigators have been conducting damage assessment/monitoring studies in the shallow subtidal regions of Prince William Sound since 1989. Since these studies have mainly been implemented through Alaska Department of Fish & Game (ADFG), and since this project will overlap with the ongoing work in the subtidal eelgrass habitat, it is appropriate for this project to also be implemented through ADFG.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will integrate with the subtidal eelgrass habitat investigation, as well a similar

project for Coastal Habitat Intertidal Site Verification.

FY 95 BUDGET ($K)

Personnel	3.0
Travel	0.0
Contractual	49.3
Commodities	0.0
Equipment	0.0
Subtotal	52.3
Gen. Admin.	3.9
Total	56.2

Habitat Protection - Data Acquisition and Support

Project Number:	95110-CLO
Restoration Category:	Habitat Protection (closeout)
Proposed By:	Habitat Work Group
Lead Agency:	ADNR
Cooperating Agencies:	ADFG, DOI, USFS
Cost FY 95:	$144,000
Cost FY 96:	$0
Total Cost:	$144,000
Duration:	1 year
Geographic Area:	Prince William Sound, Kenai Peninsula, Alaska Peninsula, and Kodiak Archipelago
Injured Resource/Service:	Multiple resources

INTRODUCTION

This project is designed to support habitat protection activities of the Trustee Council and is a close-out of project 94110. In 1993 Habitat Protection Work Group conducted a survey and assessment of selected parcels of private land within the oil spill zone. The lands were scored, ranked and mapped using the Trustee Council approved Evaluation Process to determine the value of these areas to injured resources and services and the benefits that could be achieved through habitat protection. The evaluation was done using a variety of available data and information gathered from various agencies and technical experts, data collected during The Nature Conservancy Workshop, Natural Resource Damage Assessment reports, and site reconnaissance field visits.

In 1994, a method was developed for nominating, processing, evaluating and ranking parcels of private land less than 1000 acres, i.e., *The Small Parcel Process*. Responses to the solicitation for nominations of small parcels are currently being processed and evaluated. Evaluations, starting with field surveys, of large and small parcels submitted this Spring will also continue into the Fall.

NEED FOR THE PROJECT

The need for the close-out work on project 94110 is to complete evaluations of lands nominated during this summer and fall and to prepare reports. Results of large parcel evaluations will be submitted to the Trustee Council as a supplement to Volume I of the Comprehensive Habitat Protection Process document. The results of the Small Parcel Process will be submitted to the Trustee Council as a separate volume of the Process.

PROJECT DESIGN

A. Objectives

1. Evaluation, restoration unit design, scoring and ranking of selected private parcels.

2. Mapping of evaluation units.

3. Preparation of supplement to Volume I of the Comprehensive Habitat Protection Process document for Trustee Council review and negotiations with landowners.

4. Preparation of Volume III *Small Parcel Evaluation and Ranking Comprehensive Habitat Protection Process* for Trustee Council review and negotiations with landowners.

B. Methods

Existing data and data obtained by HPWG in 1993 and 1994 will be analyzed to fill data gaps to the maximum extent possible. This will include some additional programming, data base management, and GIS work to sort data and to map resource information where appropriate.

Primary and secondary evaluations, for large and small parcels, will be conducted by the HWG using evaluation formats developed by the group.

Volume III and the supplement to Volume I will be prepared in a format consistent with Volumes I and II.

C. Schedule

Evaluation and ranking of small parcels will occur during this summer and fall. It is anticipated that negotiations for small parcels will commence in January 1995. Field surveys of recently nominated large parcels will occur this summer. Evaluation results, including scoring and ranking, of both large and small parcels will be submitted to the Trustee Council in the fall.

D. Technical Support

The Alaska Department of Natural Resources LRIS group will produce all maps. The HWG will

produce all documents.

E. Location

The analysis will cover all selected lands within the oil spill zone. Lands are located within Prince William Sound, Kenai Peninsula, Kodiak/Afognak Archipelago and on the Alaska Peninsula.

PROJECT IMPLEMENTATION

The proposed project is a continuation of 94110. Habitat protection projects were started in 1992 by the Restoration Planning Work Group and outlined in concept in Volume I of the *Restoration Framework*. Implementation of this project would be by the Habitat Work Group. This group includes four members representing ADNR, USFS, ADFG and USFWS. The HWG includes three individuals who have been working on the spill since early 1989 and who participated in the genesis and development of habitat protection as a restoration strategy. All four members are authors of the *Comprehensive Habitat Protection Process* report and participated in the development of the *Small Parcel Process*.

COORDINATION OF INTEGRATED RESEARCH EFFORT

All habitat protection efforts including this project are dependent upon the results of on-going research and monitoring projects. For example, the Large Parcel Element used information from the anadromous fish stream catalog, colonial seabird catalog, bald eagle nesting maps, and data from Trustee Council funded studies on black oystercatchers, marbled murrelets and pigeon guillemots.

FY 95 BUDGET ($K)

Personnel	73.2
Travel	6.0
Contractual	48.0
Commodities	2.4
Equipment	0.0
Subtotal	129.6
Gen. Admin.	14.4
Total	144.0

This page intentionally left blank.

Sustainable Rockfish Yield

Project Number:	95111
Restoration Category:	General Restoration
Proposed By:	ADFG
Cost FY 95:	$222,600
Cost FY 96:	$334,000
Total Cost:	Unknown
Duration:	3 years
Geographic Area:	Prince William Sound, outer Kenai Peninsula
Injured Resource/Service:	Rockfish

INTRODUCTION

Rockfish include species in the genera *Sebastes* and *Sebastolobus*. Commercial rockfish harvests increased four-fold due to closures of the commercial salmon and shellfish fisheries following the EVOS. Recreational rockfish harvests have also increased, particularly in response to an increasing number charter operators. Rockfish harvest rates have remained high. In addition, rockfish mortalities attributable to oil ingestion were observed immediately after the EVOS. Subsequent histopathological sampling indicated continuing population injury. Because rockfish exhibit extreme longevity, slow growth, and late maturity, depressed populations recover very slowly. Due to concerns over the sustainability and yield from the rockfish resources, regulations have been implemented in recent years to reduce commercial and sport fishing harvest. Even with the curtailment of human use, the impacts and rebuilding of a severely depleted rockfish population may continue through several human generations.

Little information is available on rockfish abundance and composition in the EVOS-impacted area. Lacking data on population abundance, composition, and production, an estimate of maximum sustainable yield is unknown. The Alaska Department of Fish and Game (ADFG) has attempted to increase the assessment of rockfish resources in recent years. However, both surveys and follow-up analyses have suffered from a lack of available funding. This project would compile and analyze existing data and conduct surveys to estimate relative rockfish population size and composition. The goal is to develop a management plan that assures recovery of damaged stocks and long-term sustainable yield.

NEED FOR THE PROJECT

Relative to many other marine species, rockfish exhibit extreme longevity (>50 yrs), slow growth, and late maturity (7-20 yrs). Many rockfish species also have localized distributions. These characteristics reflect the relatively low annual productivity of rockfish, making these species highly susceptible to overfishing. Once depressed, populations recover very slowly.

Rockfish populations suffered direct mortalities and sublethal effects from the oil spill. Indirect spill impacts included an increase in effort directed at groundfish resources in general and rockfish in particular as traditional fishing opportunities such as salmon and shellfish declined or were curtailed to prevent product contamination by petroleum products. Rockfish are an integral, resident component of the spill area ecosystem. The loss of rockfish resources through direct and indirect effects following the spill may severely alter energy transfer within the spill area. While ADFG has authority to curtail commercial and recreational fishing, that authority is dependent upon a meaningful and defensible biological justification.

Rockfish are difficult to study because of their unique habitat and physiological characteristics. Despite the importance of rockfish to the ecosystem and the potential for long-term damage from overfishing, there have been few studies to directly assess rockfish resources in the spill area. Because commercial rockfish fisheries typically generate a relatively low economic value, rockfish have a low institutional priority. Although limited rockfish sampling has provided some biological data, this low priority has left much data unprocessed.

This project is severely needed to compile and analyze data previously collected, to conduct fishery independent surveys to better assess the role that rockfish fill in the ecosystem, and to develop a management plan which modifies human use patterns to allow damaged stocks to recover and assure for the long-term yield of the rockfish resource.

PROJECT DESIGN

A. Objectives

The goal of this project is to develop a plan that modifies human use to provide for restoration of rockfish resources in the area impacted by the EVOS. Initial objectives of this study are to:

1. Describe biological characteristics of the rockfish resources. Through port sampling and fisheries-independent test fishing: describe stock composition, mortality, growth, relative abundance, and relative recruitment.

2. Clarify rockfish stock definition. Tagging studies will further identify stock movements and potential recruitment.

B. Methods

1. Species, sex, size, and age data will be collected from commercial landings at ports and processors where rockfish are delivered from the EVOS impacted area. Observers placed aboard a sample of commercial vessels will quantify the magnitude and composition of discards. Test fishing will produce fisheries-independent stock composition data.

2. Relative, species-specific productivity will be estimated using: i) age composition of lightly exploited stocks; and ii) empirical relationships based on related biological characteristics.

3. Biological data from current and historical landings (ADFG fish ticket system) will be analyzed over time and area to describe temporal and spatial patterns in human use.

C. Schedule

Feb 95-Sep 95	Sample collection
Jan 95-Sep 95	Otolith reading
Mar 95-Jul 95	Data analysis
Aug 95-Sep 95	Report writing. An interim progress report will be available October 1, 1995.

D. Technical Support

Determination of stock composition relies upon rockfish otolith ageing by the ADFG ageing laboratory. ADFG biometrics staff will provide input into sampling strategies and direct stock structure modeling.

E. Location

The project will be conducted in Prince William Sound and the outer Kenai Peninsula. The public utilizing rockfish resources for commercial, recreational, or subsistence purposes, particularly Southcentral Alaska communities, will benefit from this project.

PROJECT IMPLEMENTATION

ADFG is ideally suited to implement this project. Having historically monitored the sport and commercial harvests in Prince William Sound and the outer Kenai Peninsula, ADFG staff are uniquely familiar with the rockfish fishing fleet characteristics and areas fished, currently process all rockfish harvest data and conduct limited annual surveys in the study area.

COORDINATION OF INTEGRATED RESEARCH EFFORT

An understanding of stock composition and rockfish productivity will contribute significantly to the Sound Ecosystem Assessment (SEA) Plan.

FY 95 BUDGET ($K)

Personnel	133.3
Travel	2.8
Contractual	35.1
Commodities	3.2
Equipment	25.7
Subtotal	200.1
Gen. Admin.	22.5
Total	222.6

Rockfish Restoration Objective

Project Number:	95112
Restoration Category:	General Restoration
Proposed By:	ADFG
Cost FY 95:	$53,700
Cost FY 96:	$0
Total Cost:	$53,700
Duration:	1 year
Geographic Area:	Prince William Sound, outer Kenai Peninsula
Injured Resource/Service:	Rockfish

INTRODUCTION

Rockfish include species in the genera *Sebastes* and *Sebastolobus*. Commercial rockfish harvests increased four-fold following the EVOS due to closures of the commercial salmon and shellfish fisheries. In addition, recreational rockfish harvests also increased. Both commercial and recreational rockfish harvests remain high. In addition, rockfish mortalities attributable to oil ingestion were observed immediately after the EVOS. Subsequent histopathological sampling indicated continuing population injury.

Because rockfish exhibit extreme longevity, slow growth, and late maturity, depressed populations recover very slowly. Due to concerns over the sustainability and yield from impacted rockfish resources and evidence of local depletions, regulations have been implemented since the EVOS to reduce commercial and sport fishing harvests. At the Department's request the Alaska Board of Fisheries adopted a management plan for North Gulf of Alaska commercial rockfish fisheries. This plan establishes seasonal and trip limits as well as bycatch provisions. In addition, bag and possession limits in area sport fisheries have been reduced. Even with these measures, the impacts and rebuilding of depleted rockfish populations are likely to continue through several human generations.

Information is available on rockfish relative abundance and species composition in the EVOS-impacted area. The Alaska Department of Fish and Game (ADFG) has attempted to increase the assessment of the rockfish resource in recent years. However, surveys, follow-up analyses, and a synthesis with existing EVOS data have suffered from a lack of funding. This project would synthesize existing data on rockfish. The goal is to develop a recovery objective and

make recommendations on whether monitoring or restoration activities (such as marine reserves/refuges) are needed to meet the defined objective.

NEED FOR THE PROJECT

The *Exxon Valdez* Oil Spill Trustee Council has acknowledged that rockfish is an injured resource and has an obligation to determine if the resource has recovered or is recovering. A recovery objective needs to be defined and a framework created under which the trustees can decide on subsequent monitoring or restoration activities. Rockfish populations suffered direct mortalities and sublethal effects from the oil spill. Indirect spill impacts included an increase in effort directed at groundfish resources in general and rockfish in particular as traditional fishing opportunities such as salmon, herring, and shellfish declined. Rockfish are an integral, resident component of the spill area ecosystem. The loss of rockfish resources through direct and indirect effects following the spill may alter energy transfer within the spill area. While ADFG has authority to curtail commercial and recreational fishing, that authority is dependent upon a meaningful and defensible biological justification.

Relative to many other marine species, rockfish exhibit extreme longevity (>50 yrs), slow growth, and late maturity (7-20 yrs). Many rockfish species also have localized distributions. These characteristics reflect the relatively low annual productivity of rockfish, making these species highly susceptible to overfishing. Once depressed, populations recover very slowly.

Rockfish are difficult to study because of their unique habitat and physiological characteristics. Despite the importance of rockfish to the ecosystem and the potential for long-term damage from overfishing, there have been few studies to directly assess rockfish resources in the spill area. Because commercial rockfish fisheries typically generate a relatively low economic value, rockfish have a low institutional priority. Although limited rockfish sampling has provided some biological data, this low priority has left much data unprocessed.

PROJECT DESIGN

A. Objectives

The goal of this project is to develop a recovery objective following the synthesis of existing rockfish data. Initial objectives of this study are to:

1. Describe biological characteristics of the rockfish resource. Using port sampling, fishery performance, and EVOS study data describe stock composition, relative mortality, growth, relative abundance, and relative recruitment.

2. Describe the stock status of the rockfish resource. Using survey and fishery performance data describe stock distribution, habitat preference, and potential level of disturbance for rockfish in the EVOS affected area.

3. Review and recommend recovery monitoring and restoration activities. Possibilities include habitat based assessment and marine reserves/refuges.

B. Methods

1. Species, sex, size, and age data collected from commercial and sport landings at ports and processors where rockfish have been delivered from the EVOS impacted area will be analyzed.

2. Relative species-specific productivity will be estimated using: i) age composition of lightly exploited stocks; and ii) empirical relationships based on related biological characteristics.

3. Biological data from current and historical landings (ADFG fish ticket system) will be analyzed over time and area to describe temporal and spatial patterns in human use.

4. An expert in rockfish biology will be contracted to review existing data and help define the level of damage, its possible causes, and restoration options

C. Schedule

Oct 94-Feb 95	Review literature and coalesce data
Oct 94-Dec 94	Otolith reading
Mar 95-Jul 95	Data analysis an interim progress report will be available October 1, 1995

D. Technical Support

Rockfish otoliths will be aged by the ADFG otolith laboratory in Juneau. ADFG biometrics staff in Anchorage will direct stock structure modeling. An expert on rockfish biology will be contracted to help direct the synthesis of existing commercial, sport, and EVOS data and develop conclusions on stock status, restoration objectives, and monitoring and restoration options

E. Location

The project will be conducted in Prince William Sound and the outer Kenai Peninsula. The public utilizing rockfish resources for commercial, recreational, or subsistence purposes, particularly Southcentral Alaska communities, will benefit from this project.

PROJECT IMPLEMENTATION

ADFG is ideally suited to implement this project. Having historically monitored the sport and commercial harvests in Prince William Sound and the outer Kenai Peninsula ADFG staff are uniquely familiar with the rockfish fishing fleet characteristics, areas historically fished, currently

process all rockfish harvest data and conduct limited annual surveys in the study area. Additional expertise will be contracted to help direct the synthesis of existing commercial, sport, and EVOS data and develop conclusions on stock status, restoration objectives, and monitoring and restoration options.

COORDINATION OF INTEGRATED RESEARCH EFFORT

An understanding of rockfish stock composition, distribution, and productivity will contribute significantly to the Sound Ecosystem Assessment (SEA) Plan. Data collected on rockfish distribution, habitat, or food habits from such SEA studies as *Salmon Predators* will be used. A thorough review of other marine studies funded by the EVOS will lead to a very efficient use of all rockfish data.

FY 95 BUDGET ($K)

Personnel	25.8
Travel	3.0
Contractual	15.0
Commodities	3.0
Equipment	2.0
Subtotal	48.8
Gen. Admin.	4.9
Total	53.7

Project 95113
SFOS 94-179

ENERGETICS OF INTERTIDAL FISH:

THE CONNECTION BETWEEN LOWER AND UPPER TROPHIC LEVELS

Project Leader:	W. E. Barber, Associate Professor School of Fisheries and Ocean Sciences University of Alaska Fairbanks Fairbanks, AK 99775-7220
Cost:	FY 95 - $140,284 FY 96 - $147,580 FY 97 - $108,688
Start-up/Completion:	1 January 1995 to 1 June 1997
Duration:	3.5 years
Geographic Area:	Prince William Sound and Cook Inlet
Contact:	W. E. Barber, Ph. D. School of Fisheries and Ocean Sciences University of Alaska Fairbanks Fairbanks, AK 99775-7220 (907) 474-7177; FAX 474-7204

Introduction:

The recent emphasis on understanding ecosystem processes to interpret the influenced of the Exxon Valdez oil spill on the numerous impacted species, and their recovery, has brought to the forefront the interaction between forage species and their predators. A number of the impacted birds and mammals prey not only on subtidal and pelagic organisms fishes but also those inhabiting the intertidal area. This is particularly true of the pigeon guillemot and river otter. The intertidal area bore the brunt of the spill, impacting plants, invertebrates, and fishes. To understand the influence of the spill on species such as these and their recovery, from an ecosystem perspective, intertidal fishes must be considered and incorporated into models developed. This study proposes to study the bioenergetic aspects of the three fish species inhabiting the intertidal area of Prince William Sound utilized by pigeon guillemot and river otter.

Objectives:

1. Determine the seasonal changes in energy content of the high cockscomb prickleback ((Anoplarchus purpurescens), the cresent gunnel (Pholis ornata), and the tidepool sculpin (Oligocottus maculosus).
2. Determine prey organisms of these three fish species.
3. Determine the energy content of major prey species of these three intertidal fish species.

Methods and Materials:

Energy content (kJ/g), percent water, total energy (kJ), will be determined for the major body components (gonads, body, gastrointestinal tract, and liver) will be determined. This will be done for four size groups of each species and four seasons. For the four seasons foods will be determined and for the major prey species energy content determined for each species. Samples will be dried and energy determined using a Parr adiabatic bomb calorimeter following standard methods.

Budget:	FY95	FY96	FY97
SALARIES	103.8	109.9	80.7
TRAVEL	6.6	6.6	5.3
CONTRACTUAL	2.5	2.5	3.2
COMMODITIES	4.0	4.0	1.4
EQUIPMENT	0.0	0.0	0.0
SUBTOTAL	116.9	122.9	90.6
ADMINISTRATIVE COSTS	23.4	24.7	18.1
TOTAL	140.3	147.6	108.7

Eelgrass Community Structure Restoration Assessment Using Stable Isotope Tracers

Project Number:	95114
Restoration Category:	Research
Proposed By:	Prince William Sound Science Center
Lead Trustee Agency:	ADFG
Cost FY 95:	$145,100
Cost FY 96:	$60,700
Total Cost:	$205,800
Duration:	2 years
Geographic Area:	Western Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

Stable isotope ratios of carbon ($^{13}C/^{12}C$) can serve as effective tracers of energy supply in the study area due to conservative transfer of carbon isotope ratios between the lower tropic levels (primary producers such as eelgrass, invertebrates, and forage fishes, etc.) of Prince William Sound waters up to the top consumers. Isotope ratio analysis of harmed species, their prey and their predators can provide insight into both habitat usage and assist in quantifying amounts of food derived from various areas. Nitrogen stable isotope ratios ($^{15}N/^{14}N$), in turn, provide excellent definition of relative trophic level. The heavy isotope of nitrogen is enriched by about 0.34 % with each feeding process and thus can accurately indicate the relative trophic status of species within an ecosystem. The combined use of $^{15}N/^{14}N$ and $^{13}C/^{12}C$ measurements can be used to reconstruct food web structure. The data obtained from these measurements are unique in that they trace material actually assimilated and thus can be used for more accurate ecosystem modeling.

It can be postulated that natural stable isotope abundance of Prince William Sound (PWS) biota will shift because of changes in trophic level, food web structure, and primary producer in the context of species and community recovery following the Exxon Valdez Oil Spill (EVOS), thus providing an independent tool to verify, quantify and model ecosystem processes during ecosystem recovery and restoration. The tracer nature of the approach will enable the integration of ecosystem components. It will enable us to monitor both "top down" (predatory)

and "bottom up" shifts (food supply) during recovery and restoration of harmed species and habitats.

This project is part of an interdisciplinary effort focused on the food web dynamics of eelgrass beds in PWS. The study is providing an integrating function to projects focusing on several levels in the food chains and will employ the stable isotope ratios of carbon and nitrogen to trace trophic transfers of carbon and nitrogen between levels. One focus will concern building the data base regarding eelgrass communities whereas the remaining work will seek to build a comprehensive base of isotopic data for the PWS region. In cases where regional gradients in isotope ratios exist, it may also be possible to identify critical habitats used by marine biota.

This project is designed to supplement the on-going EVOS eelgrass community monitoring project that is under the direction of Stephen C. Jewett (UAF), the FY95 BPD is already submitted. The stable isotope analysis in this project is anticipated to provide that project an added dimension for use in collaborative data interpretation.

NEED FOR THE PROJECT

The eelgrass community is a significant habitat for the production of terrestrial and aquatic species harmed by EVOS. In addition to the flora, harmed species include epi- and infauna of eelgrass beds as well as transient terrestrial and aquatic organisms that use the habitat or feed there. The restoration strategy has been to allow the natural recruitment processes re-establish the eelgrass communities. However, the eelgrass and other intertidal to subtidal communities contain organisms that are recovering from EVOS as well as species that are not recovering. In a holistic sense, these communities are not at their pre-spill status. Thus, there is a need to assess the recovery of community structure within eelgrass communities. In particular, there is a need to compare epifauna (e.g. amphipods) in control and oiled areas because of their role as forage for higher trophic levels. The rebound and then return to damaged state by several community species, including amphipods, suggests that although populations may appear to temporally recover, the ecological balance in terms of interorganismic relationships has not. Thus techniques such as natural stable isotope abundance that reveal ecological relationships must supplement studies that focus on assessing population size and structure. This will enable an assessment of restoration not otherwise possible. This assessment could then lead to modifications or development of new restoration strategies based re-establishing normal ecological roles of different species.

A further benefit of this project is that it will provide the needed littoral isotopic signatures for use in conjunction with concurrent pelagic studies to assess the roles of different communities in the recovery of motile species, e.g herring and salmon. This project will also provide an isotopic signature database of forage biota for projects concerned with higher trophic levels (birds and mammals) enabling then to interpret their data.

PROJECT DESIGN

A. Objectives

Hypothesis 1. Carbon and nitrogen stable isotope ratios of biota from Prince William Sound can be used to identify major food sources to top trophic levels and to assign trophic positions to specific consumers of given age classes and habitat.

Hypothesis 2. Isotope ratios in consumers provide a means to validate conceptual food web structures, identify trophic variability by individuals within species, and to validate quantified energy flows in ecosystem models.

Specific objectives of this project are:

1. To determine the $^{15}N/^{14}N$ and $^{13}C/^{12}C$ of species collected from oiled and unoiled sites in the stratified sampling design specified in the proposal "Subtidal Monitoring: Eelgrass Communities", Principal Investigator Stephen C. Jewett. These paired site comparisons will be used to assess recovery from the EVOS by comparing food web structure as determined by stable isotope abundance in conjunction with the approach specified in the Jewett proposal.

2. Synthesize the data obtained in context with conceptual food webs to validate feeding models and expand to other isotope studies being conducted in PWS by Kline and others.

B. Methods

Because this project will be done in collaboration with Jewett, sampling will follow his strategy. Briefly, sampling will be conducted at four oiled and four control eelgrass sites. This will enable comparison of site effects and oil effects on community structure. Obtaining isotopic signatures of biota from several littoral sites will also be useful in synthesis of this projects results with those of projects form the adjacent pelagic habitats (PWS system investigations)

The methodology involved in the isotopic analyses and the interpretation of the data are well-established and documented in several publications resulting from prior work of the Principal Investigator. The UAF Stable Isotope Facility has three isotope ratio mass spectrometers including a new automated system which facilitates faster sample processing and allows more replication in small samples.

Field sampling protocols are well established and will be used. Predator isotopic data will be compared with values obtained from prey species in the same habitats. Where samples of prey species are missing or few, we will try to select proxy samples from the same area (zooplankton, benthos) which will enable a similar comparison. After the isotopic values are in hand, we will synthesize the data with past unpublished data and with other literature isotope ratio values to establish a trophic model.

C. Schedule

Field activities will take place during a two-week cruise in July 1995 as planned by Jewett. Preliminary sample preparation will take place during the cruise followed by laboratory preparation for mass spectrometry at the Prince William Sound Science Center. Mass spectrometric analysis will take place at the UAF stable isotope facility with completion anticipated in December, 1995. The completion of the draft final report is anticipated during February 1996.

D. Technical Support

Technical support (field logistics) is being provided for this project through the Jewett project. Additional support will come from the University of Alaska Stable Isotope facility: N. Haubenstock will receive prepared samples from Dr. Kline and will report the data to Dr. Kline.

E. Location

A total of 4 oiled (O) and 4 control (C) sites will be sampled per the Jewett proposal. The paired sites are as follows: Bay of Isles (O) / Drier Bay (C); Herring Bay (O) / Lower Herring Bay (C); Sleepy Bay (O)/ Moose Lips Bay (C); and Clammy bay (O)/ Puffin Bay (C). Analytical work will be carried out using the stable isotope facility at UAF. Sample preparation for stable isotope analysis and data interpretation will take place at the Prince William Sound Science Center.

PROJECT IMPLEMENTATION

This project is derived from the Jewett project that has been implemented by ADFG for the past three years.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will coordinate via Jewett with the monitoring of oil in subtidal (<20 m) sediments (conducted by NOAA). These projects have several sites in common. This project will also coordinate with other stable isotope projects in the EVOS studies.

FY 95 BUDGET ($K)

Personnel	3.0
Travel	0.0
Contractual	132.4
Commodities	0.0
Equipment	0.0
Subtotal	135.4
Gen. Admin.	9.7
Total	145.1

This page intentionally left blank.

Project 95116

A. COVER PAGE

1 Project Title	Restoration of Intertidal Oiled Mussel Beds by Non-Destructive Manipulation/Flushing with PES-51®	
2 Project Leader	Mr Stephen R Rog	
3 Lead Organization	PES Services AK, Inc 552 W 58th, Unit E Anchorage, AK 99518 Phone (907) 562-8881 Fax (907) 562-8883	
4 Cost of Project:	Cost Estimate - $453,186 for FY95	
5 Project Startup/Completion Dates:	Startup Completion	July, 1995 July, 1996
6 Project Duration	One (1) Year	
7 Geographic Area:	Chenega Island area	
8 Contact Person:	Dennis C. Owens PES Services, Inc P O. Box 680488 San Antonio, TX 78268-0488 Phone (210) 680-2950 Fax (210) 523-5700	

B. INTRODUCTION

This project will focus on restoration of the mussel beds in the Chenega area, and as a result contribute to the recovery of injured resources that use these mussels as a food source, e g harlequin ducks, sea otters and black oystercatchers In addition, these mussels are an integral component of the subsistence of humans residing in the Prince William Sound area These mussel beds were impacted by the 1989 Exxon Valdez oil spill The Chenega area remains as one of the sites of the most persistent heavy and medium oil residue concentrations (1993 Shoreline Assessment sponsored by the Exxon Valdez Trustee Council) A team of companies and universities to be led by PES Services proposes to work with the Trustees Council and the Alaskan Department of Environmental Conservation (ADEC) on this project The project will be conducted to demonstrate the efficacy of a non-destructive manipulation/flushing method using PES-51® to remove the oil found in mussel beds and to demonstrate that this method is not toxic to the mussels or other resident fauna This project builds on the successful demonstration of PES-51® for the removal of persistent oil from a rocky shoreline in Prince William Sound as was funded by the Hazardous Substance Spill Technology Review Council (HSSTRC) in 1993 The shoreline project also demonstrated that there were no observable acute toxic effects from PES-51® on the mussels and other invertebrate fauna observed near the treatment site It is reasonable to propose, therefore, that PES-51® application to oiled mussel beds will be effective while not being toxic to the mussels and other resident fauna

Dense clusters of the blue mussel, *Mytilus edulis*, occur on rocky shores throughout the region impacted by the Exxon Valdez oil spill that began in March of 1989 Mussels secrete byssal threads which enable them to attach to the substrate In addition to providing stability, the matrix of threads extending from a bed of mussels, forms an environment that offers shelter for a diverse mix of marine invertebrates These other fauna find shelter from wind, waves and sunlight within the mussel threads

It is documented that liquid oil persists in the sediments and organic materials that compose the mussel beds in the Chenega area (Piper,E and Gibeaut,J.,1993) These oiled mussel beds offer the opportunity to evaluate the efficacy of new shoreline treatment technology, like PES-51®, to restore these beds and to establish baseline information for future oil spills Currently, there is no established best method for removal of the oil from within oiled mussel beds. It is, therefore, important to take this opportunity to develop a method of effectively and efficiently removing the oil while not damaging the mussel bed

C. NEED FOR THE PROJECT

This project is being undertaken to demonstrate the efficacy of a non-destructive/flushing methodology utilizing PES-51® to remove oil persisting in mussel beds in the Chenega Island area The impact of these oiled mussel beds is evident from information provided in the "Invitation to Submit Restoration Projects for Fiscal Year 1995" in response to which this proposal is submitted

> "Oil trapped in the sediments beneath certain mussel beds has degraded slowly and has retained toxic components since the spill The protected beds are one of the few sources of unweathered oil remaining from the oil spill This oil may be a route for continued exposure and contamination to higher trophic levels such as harlequin ducks that feed on the mussels "

This project will demonstrate that this new shoreline cleaning technology is a minimally intrusive manipulative technique that will remove oil from beneath oiled mussel beds and accelerate natural attenuation processes without harming the mussels and other resident fauna Restoration of the mussel beds to their pristine condition will enable ADEC to determine whether removal of the persistent oil in the mussel beds is a critical factor in speeding up the recovery of harlequin ducks sea otters and black oystercatchers

Project 95116

D. PROJECT DESIGN

1 **Objective** To evaluate the effectiveness of a new shoreline cleaning technology, using PES-51®, to remove oil from an impacted mussel bed and to demonstrate the potential impact of this removal methodology on the mussels and the fauna residing in the nearshore/shoreline

2 **Methods** The overall design and performance of the project is shown in Table 1 The project site design will depend in part on the size of oiled mussel beds available for the project The candidate mussel bed will be selected by the Trustees Council in conjunction with regulatory and recovery agencies, e g ADEC, NOAA, etc If the area is relatively limited, the design will include two mussel bed areas; one oiled bed and another nearby that has no evidence of retained oil (control area) Each of these beds will be divided into three plots, one to be treated with the PES-51® methodology, one that will be treated, but without PES-51®, while the third is left untreated These six plots will enable us to evaluate the efficacy of the PES-51® on oiled mussel beds as well as the potential for toxicity on mussels and other resident fauna in oiled and non-oiled beds. Measures will be undertaken to minimize the possibility of PES-51® migrating from treated plots to untreated ones The second approach to be used, if the beds are large enough, will have a randomized block design and include test and control blocks Choice between these two designs will be made during an initial visit by representatives of the project team and the Trustees Council With either design, mussel bed, water column and lower and middle tidal zone sediment samples will be obtained for analyses prior to and after treatment with the PES-51® methodology

Post treatment samples will be obtained at least at one and seven days with other sample times to be determined by the UAF and UCSC associate investigators One day samples will be analyzed for the potential toxicity on mussels and other resident fauna, whereas the seven day sample will also be analyzed for impact on microbial populations Subsequent samples are likely to be proposed for the last possible date that access is permitted to the site due to winter weather and then the following spring

Mussel bed samples will be obtained from the proposed oiled and control areas using the NRDA methods and prepared for hydrocarbon and biological analyses Hydrocarbon analyses will be conducted on these samples by the Zymax Environtechnology, Inc of San Luis Obispo, CA using gas chromatography/mass spectrometry techniques (EPA 8240/8270) to establish baseline levels present in these beds Biological analyses of the mussels will be conducted by Dr Highsmith at the UAF and will establish the pretreatment characteristics of the mussel beds in the oiled and control areas Note that the project design also includes administration of PES-51® to control areas This is necessary to fully analyze the potential impact of this methodology on mussel beds because a) mussels and other resident fauna exposed to chronic oiling for four years may be highly susceptible to injury by the treatment, b) conversely, those organisms remaining may be extraordinarily hardy or resistant, and c) the other faunas may be different (samples collected during the initial visit may answer this question prior to the experiment) Additionally, biological analyses will include determination of potential toxicity of the PES-51® treatment on other aquatic life, i e the other resident fauna This phase of the project will be conducted by Dr. Tjeerdema at UCSC Potential impact of PES-51® treatment on total heterotrophs and hydrocarbon degrading microbes in the lower and middle intertidal zones will be determined by Dr Braddock at UAF from water column and sediment samples

3 **Schedule** Timelines for all critical aspects of the project are also shown Table 1 with all times represented as month and year when the activity will be accomplished

Project 95116

Table 1: Restoration of Intertidal Oiled Mussel Beds - Project Methodology and Timelines

Activities	PES	UAF	Chenega Corp	UCSC	Foss	Time (mo/yr)
Project Lead	X					
Initial Visit - Project Site Design and Baseline Mussel Bed, Water Column and Sediment Samples	X	X	X		X	6/95
Project Site Preparation	X		X		X	7-8/95
Logistics and Support			X			
PES-51® Application	X		X			9/95
Obtain Post Treatment Mussel, Water and Sediment Samples	X	X				9-10/95, 9/96
Hydrocarbon Analyses	X					7-10/95, 9/96
Analyses of Mussel Bed Samples for Potential Toxicity of Mussels		X				7-10/95, 9/96
Analyses of Mussel Bed Samples for Potential Toxicity of Other Resident Fauna		X		X		7-10/95, 9/96
Microbial Analyses of Water Columns, and Lower and Middle Tidal Zone Sediment Samples		X				7-10/95, 9/96
Hydrocarbon Waste Collection and Disposal	X				X	10/96
Interim and Final Reports	X					11/95, 10/96

4. **Technical Support:** The selected mussel beds will be double boomed and contained prior to the PES-51® treatment. Sea water deluge and flush pumps, air compressors, recovered oil storage tank and equipment and supplies will be staged on a sixty (60) foot landing craft, moored adjacent to or "beached" at the treatment site Crew support will be provided using a berthing vessel. Foss Environmental Services, Inc will provide qualified spill response equipment and services including booms, pumps, etc

Methodology to be employed in this project involves application of PES-51® using a modified version of the air knife, pneumo-hydrodynamic system used at Sleepy Bay in 1993 that was sponsored by HSSTRC. For mussel bed application, the air knives will be regulated for a low pressure fracturing (or dilation) so that PES-51®, via an aerosol infusion, can reduce the interfacial tensions and move through the vertical sections of the oiled mussel beds During the PES-51® infusion, sea water will follow the route of the PES-51® induced subsurface pathway In addition, sea water deluge and flushing (low pressure, large quantities) using 6 inch pumps and fire monitors, will be used to move the oil to the double boomed area for collection and recovery Oil recovered during the project will be contained and collected for disposal in accordance with standard spill techniques, e g containment booms, skimmers and absorbents This oil will be pumped

to the storage tank, excess water will be decanted and the volume of oil recorded At the completion of the project, the recovered oil will be disposed of or recycled at a permitted facility, e g. Alaska Pollution Control, Inc., in accordance with state and federal laws and guidelines. Application of PES-51®, operation of the flushing equipment, and recovery of the oil will be handled by Chenega Corporation

Samples obtained from the mussel beds, water column and lower and middle tidal zone sediments will undergo biological and chemical analyses as described in Section D.2 The work will be performed by Zymax Envirotechnology, Inc (hydrocarbon analyses), UAF (potential toxicity on mussels and impact on the microbial populations) and UCSC (potential toxicity on other resident fauna) Results of the analytical activities will be provided to PES for evaluation, coordination and archiving Each associate investigator will generate interim and final reports that will be integrated into the overall project reports that will be developed by PES.

5 **Location:** As was stated earlier, the Chenega areas is known to have some of the most persistent, heavy- and medium oil residue concentrations. For this reason the Chenega area is proposed as the site for this project Additionally, involvement of the Chenega Corporation throughout the project is likely to serve a secondary purpose, i e. involving local residents in critical resource restoration activities (1993 Trustee Council sponsored Assessment Survey). ADEC and the National Oceanographic and Atmospheric Administration have surveyed and sampled mussels and sediments from these oiled sites One of the locations monitored during this survey is proposed for the proposed project.

E. PROJECT IMPLEMENTATION

PES Services is proposed as the lead organization for this project. PES Services, Inc is well qualified to lead a multidisciplinary team of companies and universities having led the effort that was sponsored by HSSTRC at Sleepy Bay in 1993 The only portion of the project that could be implemented through a competitive contract process is the logistics support of the environmental contractor services Foss Environmental Services, Inc. is listed as the contractor of choice due to their expertise in oil spills and the use of PES-51® under these conditions The UAF and UCSC have both established marine science programs dealing with highly specialized testing for marine toxicology of selected species found in the Prince William Sound area. Chenega Corporation is well qualified and experienced in conducting projects as the one described in this proposal having performed similar duties during the 1993 HSSTRC sponsored project Zymax Envirotechnology, Inc. is recognized for its capabilities in the types of chemical analyses and conducted analyses for PES on previous projects.

F. COORDINATION OF INTEGRATED RESEARCH EFFORT

This project involves collaborative partnerships among three companies and two universities and will involve oversight by a number of state and federal agencies, e.g ADEC and NOAA, as well as community advisory groups Depending on the outcome of the competition for funding from the Trustee Council, collaborative efforts may be undertaken with other groups having projects with related objectives and activities

G. PUBLIC PROCESS

PES Services will make every possible effort to participate in workshops, public meetings, document reviews, etc that are needed to insure understanding of the objectives and results of the proposed project so as to fulfill the requirements of the Trustee Council PES Services has taken an aggressive approach to publishing its research and has presented results of the 1993 HSSTRC sponsored project at several national and international oil spill conferences National Geographic will carry an article about this project in the August, 1994 issue

Project 95116

H. PERSONNEL QUALIFICATIONS

1 Mr Steve R Rog, VP of Oil Spill Response and Industrial Cleaning for PES Services AK, Inc., will be the Project Leader Mr Rog has twenty years experience as an environmental geologist, served on an Oil Spill Response Team as the Environmental Coordinator for Tesoro Alaska Petroleum Company, has an extensive working knowledge of the proposed application technology, has been at every major oil spill in 1994 representing PES Services, and also was the manager for the 1993 HSSTRC sponsored project

2 Dr Raymond Highsmith is to be an Associate Investigator on this project He is a Professor at UAF and a lead investigator in the Institute Of Marine Science He is recognized as a worldwide expert on bivalves found in Alaskan waters

3 Dr Ron Tjeerdema is to be an Associate Investigator on this project He is an Associate Professor at UCSC and a researcher in the Institute of Marine Science and recognized as a worldwide expert on aquatic toxicity testing procedures and protocols His research team has developed dispersant toxicity testing protocols that have been adopted as industry standards

4 Dr Joan Braddock is to be an Associate Investigator on this project She is a Assistant Professor of Microbiology and is associated with the Institute for Arctic Biology at UAF and has extensive experience in studies of the impact of hydrocarbons on shoreline microbiology and was a participant in the 1993 HSSTRC sponsored project

5 Mr Dennis Owens, VP for R&D of PES Services, will be the Project Coordinator responsible for all contract matters relating to the sponsor and subcontracts to the team members He has twenty years experience as a corrosion oilfield chemist and microbiologist and is one of the developers of PES-51® Most recently, he was the technical project coordinator for the 1993 HSSTRC sponsored project

6 Dr William Alter III, Director of Research and Technology Development for PES Services, will be responsible for coordinating the analyses of data and for integrating the team's reports into those that will be delivered to the Trustees Council He is an Environmental Physiologist with over 25 years experience in research and development for the Air Force and academia and most recently was a Space Grant Fellow for the National Aeronautics and Space Administration

7 Gail Evanoff and Chuck Totemoff of the Chenega Corporation and will be responsible for organizing the work crews that will participate in this project The Chenega Corporation participated in the 1993 HSSTRC sponsored project at Sleepy Bay.

I. BUDGET

The budget was developed on the basis of an initial visit to the Chenega area for selection of the field site, project site design and acquisition of baseline samples, and a proposed 10 day field effort that includes travel to/from project site and one weather day. The costs for efforts in the field by PES and its team members are estimates which are subject to revision after finalizing the field aspects in discussions with the Trustees Council, regulatory and recovery agencies A more detailed description of the budget appears as an appendix

1	Personnel - PES Services, Inc (only)	48,900
2	Travel	6,300
3	Contractual Services	
	a UAF - Environmental Technology Laboratory	66,297

Project 95116

	b UCSC	95,940
	c Chenega Corporation	31,800
	d Foss Environmental Services	21,000
	e Zymax Envirotechnology, Inc.	8,000
	f. Alaska Pollution Control, Inc	2,000
	g Videography services	7,500
4	Commodities	0
5	Equipment	122,750
6	Capital Outlay	0
7	General Administration	1,500
8	Subtotal Direct	411,987
9	Indirect (10% MTD)	41,199
10	Total Estimated Cost	453,186

This page intentionally left blank.

A PROPOSAL TO NOAA PROCUREMENT DIVISION AND
EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

EXXON VALDEZ OIL SPILL RESTORATION WORK

Response to Broad Agency Announcement 52ABNF400104

TITLE: Food Limitation on Recovery of Injured Marine Bird Populations

Principal Investigator:	William J. Sydeman
Co-Principal Investigator:	Nadav Nur
Lead Agency:	Point Reyes Bird Observatory Stinson Beach, CA 94970

Date: 30 June 1994

Total Cost of Project:	$275,815
Fiscal Year 1995:	$124,883
Requested Start Date/Completion Date:	January 1995/December 1996
Project Duration:	Two years
Geographic Area:	Central California
Contact Person:	William J. Sydeman
Address:	Point Reyes Bird Observatory 4990 Shoreline Highway Stinson Beach, CA 94970
Telephone No.	(415) 868-1221 FAX: 868-1946

Project 95119-BAA

INTRODUCTION: PROJECT NEED

In response to NOAA BAA 52ABNF400104 we propose to investigate the role of food limitation on the recovery of injured marine wildlife resources, with a focus on marine birds of the family Alcidae. Alcids, the group of marine birds most seriously impacted by oil spills (c.f. Page et al. 1990, Piatt et al. 1990), include the Common Murre (Uria aalge), Pigeon Guillemot (Cepphus columba), Marbled Murrelet (Brachyramphus marmoratus), Rhinoceros Auklet (Cerorhinca moncerata) and Cassin's Auklet (Ptychramphus aleuticus). These species were killed or debilitated during the 1989 Exxon Valdez oil spill (Piatt et al. 1990), as well as other oil spills along the west coast of North America (e.g. Page et al. 1990).

An investigation of the relationship between forage availability, diet, and effects of diet on demographic factors is needed to explain marine bird population dynamics, forecast the growth and recovery of affected marine bird populations, and guide oil-spill related restoration options for marine birds. Predicting the growth potential and recovery time of affected populations and species requires information on the balance between recruitment rate and adult mortality, immigration and emigration characteristics of a population, and the availability of other, less affected stock to repopulate affected resources and populations (Burgman, Ferson, and Akackaya 1993). Many of these parameters are unknown for alcids (Hudson 1985), although some parameters have been recently estimated (e.g. Emslie, Sydeman, and Pyle 1992; Sydeman 1993; Nur 1993; Beissinger and Nur in prep.).

With extended periods of time, injured alcid populations may recover from catastrophic mortality associated with oil spills. However, the population recovery process may, in some cases, be enhanced with proactive restoration efforts. Restoration projects using decoys and playback of vocalizations (e.g. Podolsky and Kress 1989) have been proposed to restore Common Murre colonies affected by oil spills, such as the Exxon Valdez. However, restoration efforts of this type will meet with limited success if ecological resources, such as prey availability, are insufficient to sustain growing or recovering populations. The answers to basic ecological questions, e.g. how food controls or limits marine bird populations and the relationship between resource availability and critical population parameters (reproduction, survival, and recruitment), are thus required to predict the success of proposed restoration projects (see Birkhead and Furness 1985; Croxall and Rothery 1991; Cairns 1992).

Moreover, restoration of injured resources should be guided by knowledge of sensitive demographic traits. Yet, for most seabirds, the sensitivity of the intrinsic rate of population increase or the annual rate of population growth (lambda) to variation in specific demographic traits and/or variation in food supply has not been determined (Nur, Ford and Ainley 1994). Without this type of understanding, restoration may focus upon demographic parameters which have little or no effect on population growth.

To further our understanding of food limits on population growth and seabird demography, we propose a two part investigation involving (1) a retrospective analysis of alcid diet and at-sea foraging ecology in relation to demographic parameters, and (2) development and application of stochastic population models (Caswell 1989; Burgman, et al. 1993) to predict population recovery and estimate the sensitivity of population growth to specific demographic and prey availability parameters. The second part of the study includes application of findings and models developed to Alaskan alcid populations. The core of the proposed work exploits a unique 24-year time-series of alcid ecology, including year-round information on diet, age-specific diet composition, breeding ecology, and oceanic habitat use, collected by Point Reyes Bird Observatory (PRBO) on the Farallon Islands and in the Gulf of the Farallones in central California, 1971-1994 (see Table 1). In conjunction with

Project 95119-BAA

Table 1. Available PRBO data on diet composition, demographic parameters, and foraging ecology of 4 species of alcids in the Gulf of the Farallones, California. na=not available.

Parameter	Common Murre	Pigeon Guillemot	Cassin's Auklet	Rhinoceros Auklet
chick diet	1973-1994	1971-1994	1977-1994[1]	1987-1994
feeding rate	1973-1994	1988-1994	1977-1994	1987-1994
adult diet	1985-1988	na	1985-1988	na
offspring production	1972-1994	1971-1994	1969-1994	1986-1994
chick growth	na	1971-1994[1]	1970-1994[1]	1987-1994
adult condition index	na	na	1978-1994	1987-1994
adult survival	1985-1994	1979-1994	1978-1994	1986-1994
juvenile survival	1992-1994	1979-1994[1]	1978-1994[1]	1987-1994
population size/index	1972-1994	1971-1994	1971-1994	1971-1994
oceanic habitat use	1985-1994	1985-1994	1985-1994	1985-1994

[1] Annual data for these parameters are intermittent.

NOAA/NMFS and CDFG fish and zooplankton stock assessments, these data provide a powerful tool for relating resource availability and marine bird population dynamics.

STUDY DESIGN AND OBJECTIVES

We will investigate the hypothesis that food limits population growth, hence the recovery of injured marine bird populations, through its effects on demographic traits: growth, mortality, reproduction, and recruitment. Our principle goal is to determine the functional relationship between variation in food supplies and demographic parameters for the alcids: Common Murre, Pigeon Guillemot, Rhinoceros Auklet, and Cassin's Auklet. To accomplish this goal, we will:

(1) Investigate temporal (annual, seasonal, and inter-decadal) and spatial variation in the diet of alcids in central California,

(2) Analyze available demographic data (growth, reproduction, survival, and recruitment) for alcids of the Farallon Islands,

(3) Investigate and establish relationships between diet composition and demographic parameters for Farallon Island alcids,

(4) Evaluate the energetic value of different alcid prey using bomb calorimetry (of previously collected samples) and estimate annual prey consumption based on observations of feeding rates and diet composition of chicks,

(5) Develop stochastic population models for 4 species to predict population trajectories and growth,

Project 95119-BA

(6) Incorporate variation in food availability in population models and project population growth and recovery under varying scenarios of resource availability,

(7) Apply models developed in (5) and (6) to Alaskan populations, utilizing available demographic information (e.g., reproductive success), and

(8) Conduct sensitivity analyses on population growth to guide restoration activities in Alaska under varying scenarios of resource availability, diet composition, and demographic parameters.

In addition, the project will involve the integration of diet and demographic results with NOAA/NMFS fish and zooplankton stock assessments. NMFS, Tiburon Laboratory, has conducted standardized mid-water trawls each year from 1983 to the present on the availability of rockfish (Sebastes spp.) and krill (Euphausidae) in the Gulf of the Farallones (Adams 1993). Farallon Island alcids feed extensively on these prey throughout the year (Ainley and Boekelheide 1990). Thus, the NMFS data provides a unique opportunity to relate an independent measure of resource availability with alcid diet and demographic parameters. Finally, in conjunction with the NMFS cruises, we have conducted censuses of alcids at sea during the breeding and pre-breeding seasons. These data are critical to understanding the relationship between productivity and diet. Birds forage at different locations depending upon the type of prey sought. The distance between the colony and feeding locations varies, hence diet selection may influence feeding rates, chick growth and, ultimately, reproductive success. For this aspect of the project, we will map foraging locations using GIS software and correlate oceanic habitat characteristics with diet and demography. This effort will provide habitat-specific understandings of the relationship between ocean resources and alcid population dynamics.

PRODUCTS

Our investigation will provide the Trustee Council with a comprehensive ecological understanding of the importance of food limitation on the recovery of injured marine bird populations, with a focus on the group of birds most often injured by oil spills. The investigation will help to explain why marine bird resources have not recovered more rapidly following the Exxon Valdez oil spill and why, for some colonies, long-term problems persist. The importance of determining the relationship between ocean resources, diet and population dynamics cannot be understated; the successful restoration of affected marine bird populations is wholly dependent upon resource variability and its effect on alcid demography. These relationships have, in general, been inadequately studied. Thus, the project will contribute to the restoration of injured resources through an understanding of basic ecological relationships. Furthermore, our modeling efforts will predict population growth under realistic ecological constraints. Lastly, sensitivity analyses will provide information on which demographic traits strongly influence population growth and which have minimal effects. For example, given the longevity of alcids, we may discover that maximizing adult survival, rather than attempting to increase productivity is more important to the population recovery process. These analysis should guide future restoration programs. Overall, the project will help NOAA and other agencies prioritize management goals and restoration options, given ecological constraints associated with food resources.

PROJECT IMPLEMENTATION AND COORDINATION

PRBO will be the lead organization in the project; our qualifications are listed below. Because of the unique nature of the data available to us, we feel that competitive

Project 95119-BAA

procurement process is not necessary. The project is collaborative with UC Davis, NOAA's NMFS, NSF's GLOBEC program (through James Quinn, UC Davis), USFWS Farallons National Wildlife Refuge, and California Department of Fish & Game.

PUBLIC PROCESS

In addition to public involvement through the usual channels appropriate to activities of the Exxon Valdez Oil Spill Trustee Council (e.g., review by the Public Advisory Group), results of the project will be presented at major scientific conferences to which the public is invited.

STATEMENT OF QUALIFICATIONS

PRBO and its key personnel (PI Sydeman, co-PI Nur; together with D. Ainley and L. Spear) are uniquely qualified to meet the goals of this research program. In addition, Dr. James Quinn (UC Davis) will make an important contribution to research efforts, especially in relation to analysis and modeling of spatial variation in prey distribution. PRBO biologists on the proposed project have over six decades of direct field experience with marine birds and have been involved with oil spill damage assessments in California and elsewhere in the world for the past 25 years. We have investigated and published upon many aspects of seabird ecology over the past decade, including over 20 peer-reviewed scientific contributions specifically concerning alcid demography, population dynamics, and food web interactions (curriculum vitae provided upon request).

William Sydeman is Director of Farallon Island Research at PRBO. He has published extensively on seabird demography including relationship to the environment. He is PI or co-PI on several relevant seabird projects currently being conducted on the Farallon Islands, including two for the Gulf of the Farallones National Marine Sanctuary and the California Department of Fish & Game (Oil Spill Response Program). The latter is a project investigating the long-term effects of chronic oiling on Common Murres of Central California and is being carried out with Nadav Nur and David Ainley, among others.

Nadav Nur is Theoretical Ecologist at PRBO. He has expertise in state-of-the-art analysis of demographic parameters and recently organized a workshop on this subject. He has carried out demographic modeling of Common Murres, Brandt's Cormorants, Western Gulls (this work done with David Ainley; see Nur et al. 1994) and Marbled Murrelets (Nur 1993), as well as terrestrial species, e.g., Osprey (Nur & Geupel 1994). Together with David Ainley he carried out a literature review of marine bird population recovery potential for the Exxon Valdez Restoration Working Group (Nur and Ainley 1992).

David Ainley is Director of Marine Research at PRBO. He has been working on prey diet of seabirds for decades, first at the Farallon Islands (summarized in Ainley & Boekelheide 1990), and more recently in the Pacific and the Antarctic (these results summarized in numerous scientific publications in peer-reviewed ecological journals). Since 1985 he has been collaborating with National Marine Fisheries Service regarding habitat characteristics of pelagic seabirds in the Gulf of the Farallones. Current work includes demography of endangered shearwaters on Kauai island (together with Nadav Nur).

Larry Spear is seabird biologist at PRBO. He has extensive experience with calorimetry analyses (see Spear 1993) and with studies of at-sea seabirds in the Gulf of the Farallones and elsewhere in the Pacific Ocean, conducted over the past 15 years. He has published 31 peer-reviewed articles on seabirds in scientific journals.

James Quinn is Professor of Environmental Studies at University of California, Davis. He has worked extensively on spatial modeling of planktonic populations in relation to

Project 95119-BA.1

oceanographic factors, work currently supported by the NSF GLOBEC program and Sea Grant. This work would contribute directly to the proposed project, as would the Geographic Information System (GIS) laboratory that Quinn has established at UC Davis.
PRBO has demonstrated its ability to successfully administer large contracts and grants in the past. The institution has administered over $2M in grants and contracts in the past 5 years.

LITERATURE CITED

Ainley, D.G. and R.J. Boekelheide (Eds). 1990. Seabirds of the Farallon Islands. Stanford University Press, Palo Alto.

Birkhead, T.R. and R.H. Furness. 1985. Regulation of seabird populations. In Behavioral Ecology (R.M. Sibly and E.H. Smith, Eds), Blackwell Press, Oxford.

Burgman, M.A., S. Ferson, and H.R. Akcakaya. 1993. Risk Assessment in Conservation Biology. Chapman and Hall, London.

Cairns, D.K. 1992. Population regulation of seabird colonies. In Current Ornithology, (D.M. Power, Ed). Plenum Press, New York.

Caswell, H. 1989. Matrix Population Models. Sinauer Press, New York.

Croxall, J.P. and P. Rothery. 1991. Population regulation of seabirds and implications for their demography and conservation. In Bird population Studies: Their Relevance to Conservation and Management. (C.M. Perrins, J.D. Lebreton, and G.M. Hirons, Eds), Oxford Univ. Press, Oxford.

Emslie, S.D., W.J. Sydeman, and P. Pyle. 1992. The importance of mate retention and experience on breeding success of the Cassin's Auklet (Ptychoramphus aleuticus). Behav. Ecol. 3:189-195.

Hudson, P.J. 1985. Population parameters for the Atlantic Alcidae. In The Atlantic Alcidae (D.N. Nettleship and T.R. Birkhead, Eds.). Academic Press, London.

Nur, N. 1993. Estimating demographic parameters of the Marbled Murrelet. Final Report to Marbled Murrelet Recovery Team, USFWS.

Nur, N., and D.G. Ainley. 1992. Comprehensive Review and Critical Synthesis of the Literature on Recovery of Marine Bird Populations from Environmental Perturbations. PRBO Report To Restoration & Planning Work Group, Contract COOP-91-039.

Nur, N., and G.R. Geupel. 1994. Analysis of 1993 Cantara Osprey surveys. Final Report to Calif. Department of Fish & Game.

Nur. N., R.G. Ford, and D.G. Ainley. 1994. Computer model of Farallon seabird populations. Final Report contract CX-8140-1-0019, NOAA, Gulf of the Farallones National Marine Sanctuary.

Page, G.W., H.R. Carter, and R.G. Ford. 1990. Numbers of seabirds killed or debilitated in the 1986 "Apex Houston" oil spill in central California. Studies in Avian Biology 14: 164-173.

Piatt, J. F., C. J. Lensink, W. Butler, M. Kendziorek, and D. R. Nysewander. 1990. Immediate impact of the "Exxon Valdez" oil spill on marine birds. Auk 107:387-397.

Podolsky, R.H. and S.W. Kress. 1989. Colony formation in Leach's Storm-Petrel. Auk 106:332-336.

Spear, L.B. 1993. Dynamics and effect of Western Gulls feeding in a colony of guillemots and Brandt's Cormorants. J. Animal Ecology 62:399-414.

Sydeman, W.J. 1993. Survival of Common Murres (Uria aalge on Southeast Farallo Island, California. Ornis Scand. 24:135-141.

Project 95119-BAA

BUDGET SUMMARY

			Total Project	Fiscal Year
1995				
1.	Personnel		175600.00	75600.00
	Wm. Sydeman	1600 Hours		
	D. Ainley	1200 Hours		
	N. Nur	1040 Hours		
	L. Spear	400 Hours		
	Other	1520 Hours		
	Benefits @ 15%		26340.00	11340.00
2.	Travel/Per Diem		12948.00	4316.00
3.	Contractual Services		3000.00	1500.00
4.	Commodities/Supplies, etc.		1000.00	500.00
5.	Equipment		4000.00	4000.00
6.	Capital Outlay		8500.00	8500.00
7.	General Administration		44427.00	19127.00
8.	Fixed Fee		.00	.00
		TOTAL:	275815.00	124883.00

BUDGET SUMMARY BY TASK

		Personnel	Total Hours
(A)	RETROSPECTIVE DATA ANALYSES:		
1.	Analysis of Annual, Seasonal and Spatial Diet Composition:	4 FTE	800.00
2.	Analysis of Demographic Parameters:	4 FTE	720.00
3.	Relationships Between Diet Composition and Demography, Growth and Condition:	5 FTE	720.00
4.	Consumption of Prey and Prey Bioenergetics:	5 FTE	720.00
5.	Ocean Habitat Use in Relation to Diet:	2 FTE	880.00
(B)	MODEL DEVELOPMENT AND SENSITIVITY ANALYSIS:		
1.	Compilation of published/unpublished Alaskan data	2 FTE	320.00
2.	Model development and application	2 FTE	480.00
(C)	SUMMARY, INTERPRETATION AND REPORT PREPARATION:	5 FTE	1120.00

This page intentionally left blank.

Mapping Potential Nesting Habitat of the Marbled Murrelet in Prince William Sound Using Habitat Models Linked to Geographic Databases

Project Number:	95122
Restoration Category:	Habitat Protection
Proposed By:	USFS
Cost FY 95:	$169,200
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	2 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Marbled murrelet

INTRODUCTION

Marbled murrelets were injured by oil contamination from the *Exxon Valdez* oil spill. Between 9,500 and 14,000 marbled murrelets died from the direct effects of oiling. This estimated mortality represents approximately 10% of the present total population size within the spill area. Presently, there is no known evidence of population recovery within the spill area.

Habitat modifications (such as logging) both within and outside the spill area may pose additional threats to the area's marbled murrelet populations. Protection of nesting habitat areas through acquisition and stewardship may reduce the extent of future disturbance so that population recovery may proceed.

This study represents an extension of previous work conducted by the USFWS the USFS as Restoration Project 93051 Part B. These studies characterize the nesting habitat of marbled murrelets throughout the spill area. The currently proposed work would be an operational application of the conceptual and quantitative models described in DeVelice et al. (1994) and Kuletz et al. (1994). The models would be linked to geographic databases of vegetation and physical site characteristics in the identification of potential nesting habitat of the marbled murrelet in Prince William Sound. The map outputs from this project will provide a state-of-science means for evaluating habitat protection or acquisition options in reference to marbled murrelets (or other species whose potential habitat can be specified based on vegetation and landscape features).

NEED FOR THE PROJECT

Marbled murrelet populations in Prince William Sound are reportedly not yet recovering from the spill and from the pre-spill population decline. However, protection of habitat is thought to be an important strategy for assisting in population recovery. Using the best available scientific information, the proposed work would provide a digital map of potential nesting habitat of the marbled murrelet. Land protection/acquisition personnel could directly use this map product in selecting alternative sites with the greatest potential towards ensuring population recovery.

PROJECT DESIGN

A. Objectives

Potential habitat of the marbled murrelet in Prince William Sound would be mapped by linking models described in DeVelice et al. (1994) and Kuletz et al. (1994) to spatial databases of vegetation and physical site characteristics. To meet this objective, a spatial database of vegetation types based on satellite imagery would need to be completed as part of this project. A draft version of this digital map (developed by USGS EROS Alaska Field Office and USFS Forest Sciences Laboratory personnel, in cooperation with the Chugach National Forest) is currently available for Prince William Sound. This project would verify and refine this vegetation database.

B. Methods

DeVelice et al. (1994) and Kuletz et al. (1994) describe both conceptual and statistical models that relate marbled murrelet occurrences to vegetation and physical site attributes. For example, both reports highlight a preference of marbled murrelets for forested habitats, particularly older forests with numerous mossy platforms (potential nest sites) in the trees. Additionally, DeVelice et al indicates that marbled murrelet sightings increase with the proportion of coniferous forest in an area. Both reports show a higher occurrence of marbled murrelets in more sheltered landscape positions (e.g., heads of bays, aspects protected from major storms). Models described in these and other studies relating marbled murrelet occurrences to vegetation type and landscape features would be applied in queries of the digital vegetation type and digital elevation model databases. Ultimately, this process will result in a digital map of potential marbled murrelet habitat in Prince William Sound. The proposed steps involved in this process are as follows:

1. The Chugach National Forests draft digital vegetation type map (based on satellite imagery) must be verified and refined before the habitat models can be effectively applied. Existing survey data will be used for initial refinement. Currently, almost 800 detailed sample plots spanning the range of vegetation types are available in the Chugach National Forest vegetation ecology database for Prince William Sound. These plots, 40 randomly-located 1-km radius digital vegetation maps from Prince William Sound, and a digital vegetation map covering Naked, Storey, and Peak islands will be

the primary input to the initial supervised classification of the digital vegetation map. All of these plot and polygon coverages reside in digital databases on the Chugach National Forest.

2. The marble murrelet habitat models based on vegetation type and landscape features will be linked (via GIS technology) to the digital vegetation map and digital elevation model (basically, a computerized topographical map) covering Prince William Sound.

3. During the summer of 1995, field surveys throughout Prince William Sound will be conducted to fill in gaps in the database of vegetation and physical sites for use in verification and refinement of the digital vegetation type map. The survey crews will be directed to sites that, in the aggregate, represent the full range of vegetation and physical site combinations present within Prince William Sound (however, ice fields will not be surveyed). These sample sites will be complementary to those sites already in the Chugach National Forest databases. The vegetation type classification developed by DeVelice et al will be used in the identification of vegetation types at each verification site. The precise location of each site will be quantified using a geographical positioning system (GPS).

4. Use the data from the summer of 1995 for the supervised classification of the digital vegetation map of Prince William Sound. The marbled murrelet habitat models would then be reapplied to this database (and the digital elevation model) to produce a digital map of potential marbled murrelet habitat. Although the digital vegetation map will initially by applied towards mapping potential habitat of the marbled murrelet, the potential applications of the digital map are vast. Among these applications are: mapping potential habitat for brown bear; assessing biodiversity patterns at the landscape level; assessing the ecological representativeness of alternative networks of nature preserves.

C. Schedule

1994 October	Provide GIS/remote sensing analyst with vegetation plot and polygon data for initial verification of digital vegetation map based on satellite imagery
Nov.- Dec.	Revise vegetation map based on plot and polygon data
1995 January	Create models of marbled murrelet potential habitat that can be linked to the digital vegetation map and the digital elevation model
Feb.-April	Apply the models to the digital vegetation and elevation coverages and make initial assessments of their validity
March	Secure charter vessel for use in vegetation map verification and advertise for field personnel
April	Hire field personnel (two biotechnicians) prepare for field work (e.g., organize training for field crew; acquire maps and aerial photographs; order necessary equipment; generate sufficient copies of field forms)
May	Safety training vegetation/characterization training and identification of locations of field verification sites

June-Aug.	Prince William Sound vegetation map verification surveys
Sept.-Oct.	Data entry and refinement of digital vegetation map
Nov.-Dec.	Final analysis and report writing
Dec. 31	Final report submitted

D. Technical Support

This project will require 18.5 person months of effort. Ecological support will be provided by R.L. DeVelice (six months; Chugach NF) and C. Hubbard (two months; Chugach NF). Habitat capability modeling support will be provided by L. Suring (one month; Chugach NF). GIS/remote sensing analysis will provided by K. Winterberger (three months; Forest Sciences Laboratory). Field work will largely be accomplished by two biotechnicians (total of six months).

Computational, analytic, and data archiving support will be provided by the USDA Chugach National Forest and Forest Sciences Laboratory, and USGS EROS Alaska Field Office (including the extensive use of personal computers and GIS workstations that will be required).

E. Location

The study area includes all of Prince William Sound.

PROJECT IMPLEMENTATION

This project would be conducted by ecology and GIS personnel of the USFS, Chugach National Forest and Forest Sciences Laboratory, and USGS EROS Alaska Field Office. These personnel have been actively developing geographic databases of vegetation and physical site characteristics in Pws over the past eight years. Extensive ecological survey in the area has provided the personnel with unparalleled familiarity with the ecological characteristics present. This experience is necessary for efficient verification of the map products generated by this study. Additionally, Chugach National Forest personnel (in cooperation with the USFWS) have developed models relating vegetation and physical site characteristics to marbled murrelet occurrences in PWS ("Characterization of Upland Nesting Habitat of the Marbled Murrelet in the *Exxon Valdez* Oil Spill Area (Project 93051B)". The personnel involved in developing these models would be best qualified towards applying them operationally, as proposed.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will be independent of other known restoration projects proposed for FY 1995.

FY 95 BUDGET ($K)

Personnel	83.5
Travel	1.5
Contractual	60.0
Commodities	4.5
Equipment	3.0
Subtotal	152.5
Gen. Admin.	16.7
Total	169.2

This page intentionally left blank.

Project Number
95123

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
SUBSISTENCE RESTORATION PROJECT DESCRIPTION

Project Title: Native Village of Tatitlek Community Store
Project Leader: Tatitlek Village IRA Council
Lead Agency: Alaska Department of Community and Regional Affairs
Cost of Project: FY 95 $300.0
Start-up/Completion Dates: June 1, 1995 through November 1, 1995
Project Duration: Ongoing
Geographic Area: Native Village of Tatitlek
Contact Person:

Gary P. Kompkoff, President
Tatitlek Village IRA Council
P.O. Box 171
Tatitlek, Alaska 99677
Phone: (907) 325-2311
Fax: (907) 325-2298

INTRODUCTION

" The disruption in the lives of the people in the subsistence based villages was one of the most drastic and damaging of the entire oil spill. The effects are probably among the most lingering--and measurable of the spill".

The Exxon Valdez Oil Spill
Final Report, State of Alaska Response

For many generations, the residents of the Native Village of Tatitlek have been able to rely on the subsistence resources from the land and sea for their sustenence and lifestyles; for many generations the residents have been able to harvest adequate subsistence resources to provide for their families and elders. Because of the dramatic effects that the Exxon Valdez oil spill has had on subsistence resources, the availability of subsistence resources has declined continuously since March 24, 1989 to a point where Tatitlek residents are not able to sustain adequate harvest levels to fill the needs of their families and elders and are forced to rely, to a much higher degree, on "store bought" goods for their sustenence.

The residents of the Native Village of Tatitlek are very aware of the strain that the oil spill has put on the subsistence resources and proposes a community store to alleviate the continual decline of those resources. This project would provide an avenue for replacing resources no longer available in sufficient numbers to meet the needs of the residents of the Native Village of Tatitlek, and more importantly, will lessen the impact that continued subsistence harvests at the present level may have on the already depleted resource base, until it becomes feasible to resume pre-oil spill harvest levels.

NEED FOR THE PROJECT

Most subsistence resources were severely damaged as a result of the EVOS. Availability of subsistence resources in th spill impacted areas continue to decline much more noticeably with each passing yeat. The percentages of normal harvests for the last year (1993) were down drastically.

Harbor Seals	25% of normal harvest levels
Sea Lions	10% of normal harvest levels
Salmon	30% of normal harvest levels
Ducks	10% of normal harvest levels
Shellfish	20% of normal harvest levels
Herring	0% of normal harvest levels
Herring Spawn	0% of normal harvest levels

The community store would contribute greatly to the restoration of subsistence resources by providing an avenue for lessening the impacts that continued subsistence harvests may have on an already depleted resource base. Tatitlek residents are very sensitive to the status of the resources that have provided for their lifestyles for thousands of years and are aware that decreased harvest levels may be necessary in order for the resources to respond favorably. The EVOS also created a much greater awareness of Prince William Sound, making visitors to the village a much greater issue, the store would provide access to supplies for the visitors.

PROJECT DESIGN

I Objectives

a) Develop a long-range business plan for the development of a small, rural general store that will ensure continued operational success.

b) Design and construct a building for utilization as a community store

c) Develop, purchase and maintain an inventory suitable to the needs of the residents of Tatitlek.

d) Provide a community store capable of meeting the needs of visitors and guests.

e) Provide employment and educational opportunities for residents of Tatitlek.

II. Methods

a) A long rang business plan will be developed with assistance from recognized consulting firms specializing in small business development (primarily Community Enterprise Development Corporation), to ensure the long term operational success of the store. This plan will include construction, design, inventory development, and long term operational plans.

b) A new building will be constructed at a centralized location, on lands owned by the Tatitlek Village IRA Council.

c) An inventory list will be developed with input from village residents and consultants.

d) Store Inventory goods will be shipped in conjuntion with Mariculture Project products in order to limit freight costs.

e) Local residents will be trained to operate the store in all aspects of business administration.

III. Schedule

June 1,1995	Develope contract with Community Enterprise Development Corporation to provide technical assistance for store design and inventory listing, Begin traing manager and employees in business administration.
July 1,1995	Complete store design, order building materials.
August,1995	Begin construction of store building, under store inventory.
October,1995	Complete store construction, recieve store inventory.
Nov. 1,1995	Open Native Village of Tatitlek Community Store to public for business.

IV. Technical Support

Community Enterprise Development Corporation, which has much experience and expertise in rural business development will provide technical assistance for the development of building design and inventory.

Alaska Department of Community & Regional Affairs will assist in development of grant agreement.

Alaska Department of Fish & Game, Subsistence will provide assistance in developing grant application and follow through.

V. Location

The Community Store will be constructed on a centralized location within the Native Village of Tatitlek on lands owned by the Tatitlek Village IRA Council and serve residents of Tatitlek, Ellamar and visitors and guests.

PROJECT IMPLEMENTATION

The Native Village of Tatitlek Community Store should be implemented by the Alaska Department of Community & Regional Affairs, in conjunction with the Alaska Department of Fish and Game, Subsistence Restoration Planning and Implementation Project which has been funded by the criminal settlement agreement.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project could be integrated with the Mariculture Enhancement Project that the Native Village of Tatitlek intends to submit for consideration under the Subsistence Restoration Planning and Implementation Project. Materials and supplies for both projects could be integrated very well to limit freight costs, which are a major expense for rural projects. Supplies for the Community Store could be shipped on the return trip of the vehicle which will be used for transporting mariculture products to market on the Alaska State Ferry System, which is to be constructed this year.

PUBLIC PROCESS

Public meetings by the Tatitlek Village IRA Council have been held periodically since 1990 addressing the restoration of subsistence resources. It has been determined by the residents and government of the Native Village of Tatitlek that the resources affected by the oil spill will not soon recover unless efforts are made to assist that recovery. Limiting harvests until it has been determined that it is safe to resume pre-oil spill harvest levels is an effort that would benefit the resources greatly, provided that the residents have an alternative means to provide for their sustenance.

PERSONNEL QUALIFICATIONS

The Tatitlek Village IRA Council has much experience in administering grant rpojects and has an excellent working relationship with the Departments of Community and Regional Affairs and Fish and Game Subsistence Division

BUDGET ($K)

Store Construction:	
Materials	75.0
Freight	20.0
Labor	65.0
Store Equipment	
Freezers	7.5
Coolers	7.5
Display Cases	5.0
Store Inventory	
Supplies	85.0
Freight	15.0
Consultants	
Fees	10.0
SUBTOTAL	290.0
General Administration	10 0
PROJECT TOTAL	300.0

Project Number
95124A

Project Title: Tatitlek Mariculture Development Project

Project Leader: Gary Kompkoff

Lead Agency: Tatitlek IRA Council

Cost of Project: FY 95 - $109.5K; FY 96 - $122.0K; FY 97 - $156.1

Project Start-up/Completion Dates: October, 1994 to September, 1997

Project Duration: 3 years

Geographic Area: Tatitlek, Prince William Sound

Contact Person: David Daisy, 3936 Westwood Drive, Anchorage, AK 99517; phone 243-8544, fax 243-1183

Introduction

This project is intended to provide a long term source of subsistence food and income for the residents of Tatitlek. 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. This funding is being sought to help the mariculture project through the development stage and achieve self sufficiency. The development stage will continue through the next three years and will consist of continued training of local mariculture workers, cost of operations and setting up the project management structure in the village.

Project Need

This project is needed to replace lost subsistence resources and economic opportunities and provide the village with a means to develop a local bivalve resource in a manner that provides some level of protection against future man-made disasters such as EVOS. The oil spill amply demonstrated how vulnerable the local marine resource 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.

Project Design

Objectives:

By September 30, 1995 a village management structure will be in place that will provide total oversight and accountability for the mariculture project.
By September 30, 1996 the mariculture will be making a substantial contribution to the subsistence needs of the village.
By September 30, 1997 the Tatitlek Mariculture Project will become self sustaining through the sale of shellfish produced by the project.

Methods:

The project will continue under the guidance of a mariculture expert. A business development company will be contracted to set up the project management system in the village.

Schedule:

The project will operate year round. Site health certification will take place in early summer, PSP sampling will be on a weekly basis, product will be available for subsistence use and sale year round, activity reports will be submitted quarterly.

Technical Support:

Mariculture expert, lab analysis for certification and PSP samples.

Location:

The project will take place near the village of Tatitlek.

Project Implementation

The Tatitlek IRA Council will be primarily responsible for the project with assistance from the Chugach Regional Resources Commission (CRRC).

Personnel Qualifications

The Tatitlek IRA Council has been involved with the mariculture project since it began in 1991. CRRC has been providing administrative assistance. Jeff Hetrick of Alaska Aquafarms, Inc. will continue to provide training and technical guidance. Mr. Hetrick has extensive experience in mariculture development in Alaska.

Budget

This project will fund only a portion of the total mariculture budget. The following are those items from the budget that will be funded by this project,

Item	Estimated Cost		
	FY 95	FY 96	FY 97
Personnel	$59.5	$59.5	81.1
Contractual	$15.0	$15.0	$15.0
Comodities	$25.0	$37.5	$50.0
Administration	$10.0	$10.0	$10.0
Total	$ 109.5	$ 122.0	$ 156.1

This page intentionally left blank.

Project Number
95124B

Project Title: Tatitlek Mariculture Development Project; Capital Outlay

Project Leader: Gary Kompkoff

Lead Agency: Tatitlek IRA Council

Cost of Project: FY 95 - $405.0K; FY 96 - 201.0K

Project Start-up/Completion Dates: November, 1994 to September, 1996

Project Duration: 2 years

Geographic Area: Tatitlek, Prince William Sound

Contact Person: David Daisy, 3936 Westwood Drive, Anchorage, AK 99517; Phone 243-8544, fax 243-1183

Introduction

The village of Tatitlek has been engaged in a shellfish mariculture development project as a way of restoring and/or replacing lost shellfish subsistence and economic development opportunities near the village as a result of the Exxon Valdez oil spill. Shellfish resources in the oil spill-affected area suffered double jeopardy. 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 damage.

Because of the possible shellfish contamination from the oil spill village confidence in the healthfulness of the local wild shellfish stocks has been badly eroded. This is why the Tatitlek village council chose to undertake the mariculture development project. Mariculture is a feasible and cost effective means to conserve, repair and enhance the natural productivity of the natural resource base.

The project was initiated in 1991 and has now reached the point where a major capital outlay is needed to enable it to become self sufficient

Project Need

This project will provide a certified clean bivalve resource on a self sustaining basis that can meet local subsistence needs as well as provide an economic base for the village. The local marine environment, as well as being the primary source for subsistence foods, offers one of the very few opportunities available to Tatitlek for economic development. EVOS amply demonstrated how vulnerable the marine environment is to disasters such as an oil spill. Unlike the wild bivalve resource, steps can be taken with shellfish raised under mariculture to protect them should another disaster such as EVOS ever occur.

Project Design

Objectives:

By September 30, 1995 the concrete foundation and floor for the processing building will be installed and the prefabed building itself put on order.
By September 30, 1995 the shellfish holding facility will be completed.
By September 30, 1995 the mariculture workboat will be purchased.
By September 30, 1995 the mariculture transport truck will be purchased.
By August 31, 1996 the processing building will be completely set up and all processing equipment purchased and installed.

Methods:
The processing building will be professionally designed and construction overseen by a reputable contractor. Workboat, transport truck and processing equipment specifications have already been developed.

Technical Support:
The project will require engineering, construction and mariculture expertise.

Location:
The project will take place in the village of Tatitlek.

Project Implementation

The Tatitlek IRA Council will implement project. The council will have oversight over all engineering, building and construction contracts and equipment ordering.

Personnel Qualifications

The Tatitlek IRA Council has extensive experience in involvement and oversight of capital projects conducted in their village.

Budget

The budget will consist entirely of capital outlay. The following is a list of the separate pieces that make up the capital budget with an estimated cost for each by fiscal year

Item	Estimated Cost FY 95	FY 96
Holding Facility	$122.0	$0.0
Processing Building	$185.0	$144.0
Processing Equipment	$0.0	$57.0
Workboat	$53.0	$0.0
Transport Truck	$45.0	$0.0
Totals	$ 405.0	$ 201.0

This page intentionally left blank.

Project Number
95125

EXXON VALDEZ OIL SPILL PROJECT PROPOSAL

Title:	Tatitlek Sockeye Salmon Release Program
Project Leaders:	Gary Kompkoff
Agency:	Tatitlek Traditional Council Alaska Department of Fish and Game Prince William Sound Aquaculture Corporation
Cost of Project:	$39,000 (FY95)
Dates of Project	1 October 1994 to 30 September 1995
Project Area:	Prince William Sound, Tatitlek vicinity
Contact Person:	Gary Kompkoff, President Tatitlek Village IRA Council P.O. Box 171 Tatitlek, Alaska 99677 (907) 325-2298

B. Introduction

Subsistence, as well as commercial and sport fisheries were drastically disrupted by the *Exxon Valdez* Oil Spill. Traditional usage of fish and fishing grounds by residents of the Village of Tatitlek was greatly reduced. The Tatitlek Sockeye Salmon Release Project will assist in the restoration for lost subsistence fishing opportunities and establish alternative subsistence fishing opportunities.

C. Needs for the Project

Many subsistence resources were impacted by the *EVOS* and Tatitlek residents have been forced to substitute commercially obtained processed foods for their traditional subsistence food resources. Subsistence uses have not returned to pre-spill levels and will not until subsistence resources return to pre-spill levels. In addition, resources will have to appear to be free of tainting by hydrocarbons. This project is designed to provide sockeye salmon for substitution for lost subsistence resources, until those resources reach pre-spill levels. The project will use Tatitlek Village laborers to the maximum extent possible.

The project will provide for the restoration and improvement of subsistence salmon harvests that were disrupted as a direct result of the *Exxon Valdez* Oil Spill.

D. Project Design

1. Objectives

Enhance sockeye salmon stocks in the vicinity of Tatitlek to provide subsistence foods needed for maintenance of the Villagers subsistence life style. The goal is to enhance subsistence resources by permitted releases of sockeye salmon at designated locations near the Village of Tatitlek in northeastern Prince William Sound. The objective would be a harvest of approximately 2000 adult sockeye salmon.

2. Methods

a. Sockeye salmon eggs will be taken from an ADF&G approved site. The incubation of the eggs and raising to smolt stage will occur at a salmon hatchery in Prince William Sound . Possible stocks would be Eyak Lake stock, or possibly one close to the Village

b. Smolts would be transported by boat to a permitted site for remote release.

c. Smolts will be held and fed in net pens for approximately two weeks before releasing to improve survival rates and provide imprinting to the designated site

d. Adults will be harvested for subsistence use in a terminal fishery designated for the village of Tatitlek

3. Schedule

Date	Action
Jan 1995	Plans are reviewed by the NEPA Process
Feb. 1995	Plans reviewed by the Prince William Sound Planning Team. and run through the Fish Transport Permit process. Compliance with the Alaska Genetics policy will also occur at this time.
June 1995	Sockeye salmon smolt transported, pen fed and released
June 1996	First adult "jack" returns of sockeye salmon.
June 1997	First complete complement of all sockeye salmon age classes return to remote release site.

4. **Technical Support**
The project will require support from the Alaska Department of Fish and Game, Commercial Fish Development and Enhancement Division, as well as the Prince William Sound Aquaculture Division.

5. **Location**
Northeastern Prince William Sound, around the Village of Tatitlek.

E. Project Implementation

ADF&G will evaluate candidate remote release sites for the sockeye salmon. They will determine the appropriateness of the candidate sites. It is expected that the Village of Tatitlek will be employed for the work at the net pen remote release sites. Private non-profit corporations will provide the hatchery service.

F. Coordination of Integrated Research

This project will be coordinated with other 1995 salmon and subsistence restoration projects.

G. Public Process

This project will be reviewed through the NEPA process, the Prince William Sound Regional Planning Team, and the Alaska Department of Fish and Game fish transport permitting process.

H. Personnel Qualifications

Area and regional ADF&G biologists with many years of fish culture experience will provide the technical support.

I. Budget ($K)

Personnel	2.5
Travel	0 0
Contractural	21.5
Commodities	0.0
Equipment	0.0
Capital Outlay	10.0
SUB-TOTAL	34 0
General Administration	3.0
NEPA Compliance	2.0
Total	39.0

This page intentionally left blank.

Project Number
95127

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
SUBSISTENCE RESTORATION PROJECT DESCRIPTION

Project Title: Tatitlek Coho Salmon Release Program
Project Leader: Tatitlek Village IRA Council
Lead Agency: Alaska Department of Fish & Game
Cost of Project: FY 95 $39.0
Start-Up/ Completion Dates: January, 1995 - June 1997
Project Duration: Ongoing
Geographic Area: Prince William Sound, Tatitlek Narrows
Contact Person: Gary P. Kompkoff, President
Tatitlek Village IRA Council
P.O. Box 171
Tatitlek, AK. 99677
Phone: (907) 325-2311
Fax: (907) 325-2298

#95127

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
RESTORATION PROJECT DESCRIPTION

Project Title: Tatitlek Coho Salmon Release Program

B. INTRODUCTION

Subsistence as well as commercial and sport fisheries were severely disrupted by the oil spill. This project is intended to enhance subsistence resources by permitted releases of coho salmon at designated locations near the Native Village of Tatitlek in order to provide a long term subsistence resource for the residents of Tatitlek. Valdez Fisheries Development Corporation presently maintains an enhancement project near the Village of Tatitlek, at Boulder Bay. This project would ensure the continuation of that project.

C. NEED FOR THE PROJECT

Subsistence harvests of all salmon resources have declined considerably since the oil spill, and continue to be affected by it. This project would enhance the recovery of the salmon resources and provide a means for lessening the impacts of continued harvests on resources affected by the spill.

D. PROJECT DESIGN

I. Objectives:

-provide for the continued production of 50,000 coho salmon smolt at the Solomon Gulch Hatchery in Valdez for transport and release near the Native Village of Tatitlek (Boulder Bay).
-hold and feed coho salmon smolt at net pens at the release site for two weeks prior to release.
-harvest approximately 2,000 coho salmon annually upon their return to imprinting site.

II. Methods:

-Coho salmon will be taken from an ADF&G approved site for incubation and care and raised to smolt stage at the Solomon Gulch Hatchery in Valdez
-Smolt will be transported by boat in designated imprinting sites
-Smolt will be held and fed at net pens for approximately two weeks before releasing to improve survival rates and imprinting.

III. Schedule:

January 1995	Plans reviewed by the NEPA Process, salmon hatcheries
June, 1995	Eggs taken from salmon near the Native Village of Tatitlek
June, 1995	First salmon smolt transported, penned, fed and released
June, 1996	First adult salmon returns of coho salmon
June, 1997	First complete complement of all coho salmon age groups.

Each year smolts will he released in late May or early June

IV. Technical Support:

Utilization of experience and technical support of Alaska Department of Fish & Fame is necessary for this project. Valdez Fisheries Development Corporation expertise will also be utilized.

V. Location:

The project will occur near the Native Village of Tatitlek. Salmon will be raised to smolt stage at the Solomon Gulch Hatchery at Valdez and released, after imprinting at Boulder Bay.

E. PROJECT IMPLEMENTATION

Valdez Fisheries Development Corporation, who have extensive experience in salmon enhancement activities, will continue their present enhancement of coho salmon near the village. ADF&G expertise will also be utilized.

F. COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is intended to provide funds for the continuance of a salmon enhancement project presently undertaken by Valdez Fisheries Development Corporation and could be accomplished in conjunction with a Sockeye Salmon Release Project being proposed by the Tatitlek Village IRA Council.

G. PUBLIC PROCESS

Public meeting in the Native Village of Tatitlek have been held periodically by the Tatitlek Village IRA Council addressing the prioritizing of restoration work.

H. PERSONAL QUALIFICATIONS

Valdez Fisheries Development Corporation personnel leave much experience and expertise in this field, they would work in cooperation with ADF&G personnel in accomplishing the goals of this project.

I. Budget ($K)

ADF&G

Personnel	$2.5
Travel	0.0
Contractual	21.5
Capital Outlay	10.0
SUB-TOTAL	34.0
Gen. Administration	3.0
NEPA Compliance	2.0
PROJECT TOTAL	$39.0

Project Number
95128

Project Title: Teaching Subsistence Practices and Values

Project Leaders: Martha Vlasoff and Gary Kompkoff

Lead Agency: Subsistence Divisions of ADF&G and NPS.

Cost of Project: FY 95 $69,000 FY 96 $52,000 FY 97 $52,000

Start/Completion Dates: 10/95 - 9/98

Project Duration: Three Years

Geographic Area: Tatitlek and environs

Contact Person:

Don Callaway
National Park Service, Subsistence Division
2525 Gambell, Suite 102
Anchorage, AK
(907) 257-2408

B. Introduction -Project Overview:

Many of the harvest areas used by residents of Tatitlek for subsistence were impacted by the Exxon Valdez oil spill. As documented by the Alaska Department of Fish and Game, Division of Subsistence subsistence harvests in Tatitlek declined from 652 pounds per capita between April 1988 and March 1989 to 207 pounds per capita between April 1989 and March 1990, 68.3 percent decline; the largest decline of any of the impacted communities. Five years after the spill, harvests have rebounded somewhat, but subsistence users in Tatitlek continue to report the scarcity of some resources and a distrust of the wholesomeness of resources in the oiled areas. As a result of the interruption of subsistence activities by the EVOS, there has been less opportunity to teach subsistence skills to young people in Tatitlek.

This project will provide funding for a spirit camp where young people from the community of Tatitlek will learn how to harvest, prepare and distribute a variety subsistence resources. Elders and other experienced individuals from the community will guide these activities. Young people will learn the practical aspects of harvesting, be introduced to the preparation and taste of traditional resources. They will also learn the spiritual, ethical and cultural importance of these resources for their community. The camp will be established in Galena Bay, which was not oiled in the EVOS, on land owned by the Tatitlek Corporation.

The camp will help restore a subsistence service currently unavailable in the community. It will provide a continuity in subsistence harvesting activities until the resources can be reestablished and confidence in their safety restored in the traditional harvest areas which were oiled.

C. Need for the Project:

Subsistence resources, and the activities associated with the harvest of these resources, provide more than food. Participation in family and community subsistence activities helps to teach young people basic cultural values. These activities define and establish the sense of family and community. It is through such activities that a person learns to identify, harvest, efficiently process and prepare resources.

The distribution of these resources establishes and promotes the basic ethical values in a culture, including generosity, respect for the knowledge and guidance of elders, self-esteem. No other set of activities provide a similar moral foundation for continuity between generations.

Food preferences are the most conservative behaviors in any culture. The unique preparation and special taste of foods encountered by children as they grow up stays with them forever. Years later the taste and smell of certain foods evoke memories of family and belonging.

The interruption of these harvest activities, to the service provided by subsistence resources, is key to the restoration concerns elicited in Tatitlek, Chenega Bay, Port Graham and other small Native communities affected by the Exxon Valdez Oil Spill.

D. Project Design:

1. Objectives:

To establish a camp site in Galena Bay, and provide training and experience in subsistence activities for youth of Tatitlek

2. Methods:

A group of locally hired workers from Tatitlek will clear the campsite and construct tent platforms as well as cooking and sanitation facilities. Tents, skiffs, fuel and other supplies will be purchased. The Tatitlek Village IRA Council will select and hire local elders and other experienced individuals to provide guidance and training in subsistence harvest activities. Camp support personnel will also be hired locally. The support personnel will be expected to document the educational program conducted at the camp, so it may be evaluated as an model for other such programs. It will be necessary to contract a vessel to transport the participants to the camp. Skiffs will be needed to travel to beaches within Galena Bay for harvest activities.

3. Schedule:

Four to six camp sessions of approximately two weeks each will be conducted during the appropriate seasons for harvest activities.

4. Technical Support:

Assistance may be required from various state and federal agencies to identify and obtain any permits necessary to establish and operate the camp.

5. Location:

The proposed site of the camp will be in Galena Bay, on land owned by the Tatitlek Corporation. The use of the land for this purpose will be contributed by the corporation.

E. Project Implementation:

The project should be implemented through a cooperative agreement between the Tatitlek Village IRA Council, the National Park Service (NPS) with a subsidiary cooperative agreement between the NPS and the Subsistence Division of the ADF&G. Section 809 under Title VIII of ANILCA empowers the Secretary to enter into cooperative agreements with other Federal agencies, the State, Native Corporations and other persons and organizations to oeffectuate the purposes and policies of this title".

F. Coordination of Integrated Research Effort.

This project will reinforce the efforts of the Subsistence Foods Testing Project (95279) in restoring subsistence services impacted by the EVOS. It will also further some of the goals of the Elder/Youth conference proposed by the Division of Subsistence of ADF&G and the impacted communities, by promoting communication between the generations. This project may also help the recovery of some resources in the oiled areas, by redirecting some harvest activities to an unoiled area.

G. Public Process:

The Subsistence Restoration Planning and Implementation Project composed of state representatives from the Subsistence Division of ADF&G and the Municipal and Regional Assistance Division of DCRA, along with representatives of the Forest Service and NPS have met in public meeting with the community of Tatitlek to solicit their recommendations for oil spill restoration projects. This project description is a product of that public meeting. The public at large will have an opportunity to comment during the public process associated with dissemination of FY 95 Draft Work Plan.

H. Personnel Qualifications:

Federal and state participants in the planned cooperative agreement have all had extensive experience in subsistence related research and regulatory programs. In addition both entities have conducted and monitored numerous cooperative agreements. Who knows better the values and activities associated with Tatitlek subsistence harvests than the members of the community themselves?

#95128

I. Budget

PERSONNEL	35.0
TRAVEL	1.5
CONTRACTUAL	14.0
COMMODITIES	4.5
EQUIPMENT	0
CAPITAL OUTLAYS	9.0
GENERAL ADMINISTRATION	5.0
TOTAL	69.0

This page intentionally left blank.

Project Number
95129

A. EXXON VALDEZ OIL SPILL PROJECT DESCRIPTION

1. Project Title: Tatitlek Fish and Game Processing Center/Smokery
2. Project Leader: Gary Kompkoff, President, Tatitlek I.R.A. Council
3. Lead Agency: Alaska Department of Fish & Game
4. Cost: $515,500
5. Project Start Up/Completion dates: Spring 1994 - 2000
6. Project Duration: Facility built in increments
7. Location: Tatitlek, AK
8. Contact Person: Gary Kompkoff, Tatitlek I.R.A. Council, PO BOX 171 Tatitlek, AK 99677 ph. (907) 325-2311

B. Introduction: Tatitlek proposes to build a fish and game processing/storage/smokery facility. The purpose of this center will be to enhance the injured services of participation in subsistence activities and increase the amount of subsistence food available to the community while providing year-round employment for Tatitlek residents.

C. Need for the Project: Tatitlek's traditional subsistence harvests have not yet recovered to the pre-1989 oil spill level. Subsistence activities take more time than they did before the spill because residents have to travel farther and wait longer to find subsistence resources. The residents have also had to use fish to compensate for the decline in shellfish harvesting, which showed a more serious decline than salmon. As an example from Chenega Bay, a subsistence community similarly impacted by the spill, in 1984/85, fish represented only 29 percent of the total harvest; in 1985/86 fish represented 38 percent of the harvest, but in 1991, fish made up 74 percent of the harvest (AK Dept. of Fish and Game Household Survey.)

A processing center will permit residents to better process the resources they are still able to harvest. An improved storage facility/freezer will improve the quality of stored resources. The commercial part of this facility would also replace unrecovered subsistence activity with economic development.

D. Project Design:

1. Objectives: The community will be able to clean, process, and store their subsistence food more efficiently than they are currently able. Operating and maintenance costs of the facility will be paid through the sale of smoked oysters and salmon.

2. Method: Tatitlek IRA council will select an architecture/engineering firm to design the facility this Fall. Construction will begin in Spring of 1995. A contractor will also be selected using a bid type process. The council will hire someone to operate the facility. Once a year a technician from a refrigeration service will come to Tatitlek to check the facility and do preventative maintenance.

The design will be complete by early spring 1995 and will be submitted for public review. Construction will begin later that season. Local hire will be encouraged. After construction, the

council will oversee the operation of the facility. The council plans to start out the project on small scale with basic equipment, then further develop the facility as they establish its successfully and find other sources of funding. The council will hire a staff to operate, maintain and monitor the facility.

A marketing consultant will assist the council in selling the oysters. If the state ferry stops at Tatitlek, which is a strong possibility as an oil spill response/ferry dock is scheduled to be built by the Dept. of Transportation in Fall 1994, the fish and oysters will be sold to tourists.

Technical support will be available from the equipment supplier and the council will contract with a local refrigeration specialist to do yearly inspections and preventative maintenance as well as repairs as the need occurs.

The project will be located in Tatitlek, AK at the staging area of the ferry/oil spill response dock which will be built in the Fall of 1994.

E. Project Implementation: The village council will manage the construction and operation of the facility. They will hire staff to clean the facility, monitor the freezer temperature and check that sanitation regulations are followed. They will also contract with a refrigeration services specialist for preventative and emergency maintenance.

F. Coordination of Integrated Research Effort: This project has the potential to also meet the needs of the mariculture project which is submitted for FY 95. Currently preparation of oysters is done in a tiny, windowless trailer with no equipment and there is no facility in the community to smoke them for commercial use. This project also integrates with the boat project which will hopefully increase the number of fish and game which needs to be processed.

G. Public Process: The idea for this facility was presented at a public meeting held June 15, 1994 in Tatitlek. The council will ask for ideas from the community on what amenities they would use in the facility. These suggestions would go to the designer.

H. Personnel Qualifications: Gary Kompkoff has been president of the Tatitlek Village IRA council for 15 years and works for the council as supervisor of capital projects. He is chair of the board of

directors for the North Pacific Rim Housing Authority He also fishes commercially and for subsistence.

I. Budget: Detailed information for a complete budget is not available at this time. An overall figure of $515,500 for the construction of the facility and one year's operations and maintenance was based on the cost of a fish processing and storage facility in Levelock, Alaska. Cost estimates are as follows:

1. Personnel	$109,000
2. Travel	15,500
3. Contractual Services	25,000
4. Commodities	1,000
5. Equipment	100,000
6. Capital Outlay	200,000
7. General Administration	50,000
8. Parts, repairs, etc	15,000
TOTAL	$515,500

Project Number
95130

Healing Center
FY 95 Project Proposal

A. Cover Page

1. Long range planning of and training for a Healing Center

2. Project Directors : Martha Vlasoff / PJ Overholtzer

3 Lead Agency : Chugachmiut and Copper Mountain Foundation

4 Project Cost: FY 95- $106.1; FY 96-$120.8 FY 97 $100.7

5. Project Start up: December, 1994; Continuing

6. Project Duration: 5 years (estimated)

7. Geographic Areas: Oil Spill Area Wide

8. Contact Persons: Martha Vlasoff
Copper Mountain Foundation
Box 6
Cordova, Alaska, 99574
424-3777

Sandy Stone
Advocates for Victims of Violence
Box 524
Valdez, Alaska, 99686
835-2980

PJ Overholtzer
Chugachmiut
4201 Tudor Centre Drive
Anchorage Alaska 99508
562-4155

#95130

Mental Health Center
FY 95 Project

B. Introduction

The Exxon Valdez Oil Spill in 1989 was a major disruption to the way of life for the people living in the oil spill affected area not only in a physical realm but also in the emotional and psychological realm. Many mental health programs were established shortly after the spill to try to compensate the great loss that was felt then. But little attention
has been paid to mental health issues in light of the budget cuts of recent years which have left a serious gap in the services urgently needed to help local people cope with what is now appearing to be an ongoing psychological struggle which is partially due to the continued lack of sufficient subsistence resources and doubts whether the food is really safe to eat. Also there is a financial burden to all the communities because the commercial fishing resources are no longer able to support the fleet in Tatitlek, Valdez, Chenega or Cordova and Pt Graham, Nanwalek and the villages around Kodiak .This brings about an increase in dysfunctional behaviors including increased abuse of drugs and alcohol with the accompanying emotional results which usually manifest themselves as spouse abuse, child abuse, depression, compulsive behavior, and lead to an increased incidence of divorce , suicide., and other destructive activities.

C. Need for Project

What is needed for the area is the development of a Healing Center which will be based on the cultural values of the Native people and would provide trainings in and access to counseling to Native people and non-Native people on delayed grief, post traumatic stress associated with the loss of their lifestyle since the oil spill, and the issues surrounding increased drug and alcohol abuse . As the commercial fishing industry continues to dwindle each year there will be a even greater need to help people cope psychologically with the increased financial stress to their families and communities. This project will be to make a concerted effort to help the people who are having a hard time emotionally with the ongoing effects of this oil spill to give them coping tools through trainings, direct counseling, reexamining cultural values and spiritual needs , and planning for the establishment of a Healing Center to be built in a retreat setting to facilitate the constructive changes which are needed in order to empower the affected people to lead sober and productive lives proud of who they are.

#95130

D. Project design

1. Objectives

The Project Director will coordinate public meetings in the villages of Tatitlek, Chenega, Cordova and Valdez to solicit the priorities of these communities to determine what they see as their most pressing problems regarding mental health. A planning consultant will also attend these meetings to work with the communities on visioning what kind of facility would be best suited to accomplish their goal and dreams of a well community. Because the truth is that "until we are all free, none of us are free", applies here too. Unless you deal with the underlying root causes of destructive behaviors in a society whether it is Native or non-Native then all the money you invest in projects and jobs ends up feeding that same destructive mentality which threatens to render a society powerless against its well being. Trainings will be conducted in the villages on delayed grief which has never been dealt with from generation to generation in the Native society dating back to the Russian era of enslavement and torture through the epidemics of the late 1800's and early 1900's on to the devastation of the "64" Earthquake and now the Exxon Valdez Oil Spill.

Living in the villages, the people knew they had a loss of their land in Russia selling Alaska to the Americans; they suffered the loss of their language when the School Systems forbid them to use their Native tongue, and the loss of their cultural values in an acculturation process to embrace the modern Western way of life; but they always believed they still had the bounty of the sea and the pristine atmosphere of the area surrounding their village to fall back on whenever they needed to. Since the Exxon Valdez Oil Spill that confidence has been dashed like the tanker itself, torn apart and no longer a resource to depend on. Losing the confidence that we had in being able to live off the land was just another loss in a series of losses that the Native people have felt since their lands were first "discovered ".What the trainings, counseling and development of a Healing Center will facilitate will be a closure and healing to these intergenerational losses so future generations of the people can be empowered to stop that cycle of abuse.

#95130

Methods

The staff at Chugachmiut will coordinate with the village councils, the mental health programs like the Advocates for Victims of Violence and the project leader Martha Vlasoff to hire a team of consultants including Jane Middleton Moz , a noted trainer in the field of post traumatic stress related issues, and Anna Lattimer President of Native Adult Children of Alcoholics who will be hired to conduct intensive workshops in the affected villages and communities. A planning consultant, Edward Deaux, Ph.D., from The Deaux Enterprise will be hired to conduct planning workshops in the villages for the establishment of the Healing Center. The project will be accomplished over a period of three years of which the first will be dedicated to conducting the intensive trainings and planning workshops. The second year will continue the trainings and work with Mental Health facilitators to develop outreach programs in the local communities to deal with the emotional problems identified by the consultants and coordinators in the first year of the program. There will also be a face-to-face conference in the second year to give the people of the oil spill-affected area an opportunity to share their experiences which they have not had an opportunity to do since the "89" oil spill. The third year will be dedicated to the establishment of the facility which will house the Healing Center.

The Project Directors will coordinate all hiring of consultants and their travel and accomodations in the villages. Also they will be in charge of coordinating the Healing Conference in the second year of the project. Proposals submitted by consultants and consulting firms in response to the Request for Proposals will detail how the consultants will facilitate the meetings and conferences, which communities will support the project, and identify organizations and local people who will work together to accomplish the goals of this project. Proposals will be submitted in the format of detailed work plans including a narrative describing the program proposed and details of the proposed budget.

3. Schedule

October 94	project approval
October 94	develop contract guidelines, evaluate bids award contracts
November -Jan 95	Coordinate with consultants and plan workshops
Feb. -June 95	Conduct workshops
July -Aug.95	Evaluate workshop proceedings
Sept. 95	complete project yearly report
Fy 96	Continued trainings, planning, and conference
Fy 97	Completion of the Healing Center

Technical Support
This project will require technical assistance which will be provided by the consultants.

Location
The location of this project will include the Chugach and Kodiak Region.

E.Project Implimentation
The Copper Mountain Foundation, which is a non-profit subsidary of the Tatitlek Corporation will be primarily responsible for the project with assistance from Chugachmiut, the regional non- profit corporation for the Chugach Region.

F. Coordination
In addition to working with the service programs of Chugachmiut the project will also coordinate with mental health and substance abuse prevention treatment providers throughout the area, including the appropriate divisions of the Alaska Dept. of Health and Social Services.

G. Public process
The public will be involved in all aspects of this project and there participation is key to the success of the project.

#95130

H. Personnel Qualifications

The Project Directors have both worked on coordinating regional projects similar to the one proposed and the Chugachmiut non profit has been ifluential in the implimentation of mental health programs in the region since 1971. (for consultants see attached resume.)

I. Budget	Fy95	Fy 96	Fy 97
Personel	34.6	36.3	38.2
Travel	20.3	40.0	20.0
Contractual	29.0	27.0	25.0
Commodities	5.0	5.0	5.0
Equipment	10.0	5.0	5.0
General Administration	7.5	7.5	7.5
Total	106.1	120.8	100.7

Project Number
95134

Project Title: Chenega Bay Mariculture Development Project

Project Leader: Gail Evanoff

Lead Agency: Chenega Bay IRA Council

Cost of Project: FY 95 - $184.3; FY 96 - $77.5; FY 97 - $75.5

Project Start-up/Completion Dates: October, 1994 to September, 1997

Project Duration: 3 years

Geographic Area: Sawmill Bay, Prince William Sound

Contact Person: David Daisy, 3936 Westwood Drive, Anchorage, AK 99517; phone 243-8544, fax 243-1183

Introduction

This project is intended to provide a long term source of subsistence food and income for the residents of Chenega Bay. It will provide a means for the villagers to maintain their traditional lifestyle in the face of increased and sometimes conflicting use of this area of the Chugach region. The project was initiated in 1992, has already gone through feasibility testing, and has now reached the point where a major capital outlay and market development are needed to enable it to become self sufficient. Continued technical assistance with the project is also needed.

Project Need

This project is needed to replace lost subsistence resources and economic opportunities and provide the village with a means to develop a local bivalve resource in a manner that provides some level of protection against future man-made disasters such as EVOS. The oil spill amply demonstrated how vulnerable the local marine resource are 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.

Project Design

Objectives:

Obtain processing and culture equipment that will make the project more efficient and allow it to become self sustaining. This equipment includes a workboat, an

efficient anchoring system, a processing facility and processing equipment.

Make the growing and processing operation more efficient.

Develop a marketing plan for the cultured oysters.

Methods:

The shell of the processing facility is already in place. All that is needed is for the interior to be finished to meet health specifications and to be connected to water and electricity. The improved anchoring system design has been developed as have the specs for the processing equipment and workboat.

Schedule:

The processing shed will be finished off as soon as funds are available and water and electricity connected as soon as the ground is thawed. The workboat and processing equipment specifications have already been developed and will be ordered as soon as funds are available. Making the project more efficient will continue through 1997 under the guidance of a mariculture expert. A marketing consultant will be contracted in the spring of 1995 to help develop the marketing plan.

Technical Support:

Mariculture expert, marketing expert.

Location:

The project will take place near the village of Chenega Bay.

Project Implementation

The Chenega Bay IRA Council will be primarily responsible for the project with assistance from the Chugach Regional Resources Commission (CRRC).

Personnel Qualifications

The Chebega Bay IRA Council has been involved with the mariculture project since it began in 1992. CRRC has been providing administrative assistance. Jeff Hetrick of Alaska Aquafarms, Inc. will continue to provide training and technical guidance. Mr. Hetrick has extensive experience in mariculture development in Alaska. A marketing expert has yet to be identified.

Budget

This project will fund only a portion of the total mariculture budget. The following are those items from the budget that will be funded by this project,

Item	Estimated Cost		
	FY 95	FY 96	FY 97
Personnel	$37.5	$37.5	$37.5
Travel	$6.0	$6.0	$6.0
Contractual	$23.3	12.0	10.0
Comodities	$15.0	$15.0	$15.0
Equipment	$85.5	$0.0	$0.0
General Administration	$17.0	$7.0	$7.0
Total	$ 184.3	$ 77.5	$ 75.5

This page intentionally left blank.

Project Number
95135

Project Title: Provide funds to offset the increased cost of subsistence hunting and fishing

Lead Agencies: Chenega Bay Village IRA Council

Cost of Project: FY 95 $50.0 FY96 $50.0

Project Start-up/completion dates: January 1995 through September 1995

Duration of Project: Funding for this project should continue until subsistence resources in the harvest areas of Chenega Bay have been restored to pre-EVOS levels.

Geographic Area: This grant will support the community's subsistence gathering activities in Prince William Sound.

Contact Person:
Gail Evanoff
Chenega Corporation
P.O. Box 8060
Chenega Bay, AK 99574

Introduction:

Since the oil spill, declining subsistence resources in Prince William Sound have impacted the community of Chenega's harvesting efforts. The decline in resources requires the residents to travel further and stay out longer, which increases the cost and risk associated with subsistence activities. Funds provided by this grant will directly support the service of subsistence harvesting by reducing costs and risks currently associated with subsistence activities. The cost and risk to individual community members participating in subsistence gathering will be reduced by providing funds to hire larger local boats for the purpose of transporting hunters on a specified number of trips. By using larger, diesel powered boats, hunters will have the ability to cover a larger area more efficiently and with greater safety. This program may also benefit the community by increasing the variety of subsistence resources being harvested. Resources obtained on these trips will be shared with the entire community.

The Dept. of Community and Regional Affairs provided Chenega Bay with a similar grant in 1989/90. Funds for the grant were provided through the Oil Spill Community Assistance Grant Program.

Need For This Project:

Household surveys completed by the Dept. of Fish and Game, Subsistence Division for the years 1985, 1986, 1989, 1990, 1991, and 1992 document subsistence activities in Chenega Bay. The surveys show that the lingering impact to subsistence is not just to the total amount of resources being harvested but also to the types of resources being harvested. The following summarizes the results of the surveys.

The estimated subsistence harvest at Chenega Bay from April 1992 through March 1993 totaled 412.5 pounds per person, which exceeds documented pre-spill harvest levels. The 1992/93 data shows an increase in harvest rates over the preceding year and also exceeded harvest levels

documented several years before the oil spill. The pre-spill data was collected in 1984/85 and 1985/86 and shows harvests of 340.5 pounds per person. When looking at harvest data from Chenega Bay there are two factors that must be considered. The first is that Chenega Bay had just been reestablished when the 1984/85 and 1985/86 surveys were completed. Unfamiliarity with the area and younger, less experienced individuals attempting a subsistence life style for the first time since their childhood may have influenced harvest levels in the community. The second factor is that data is not available from Chenega Bay for the period immediately before the spill. Without this data it can only be assumed that harvest levels continued to increase from 1986 to March of 1989. This assumption is supported by data gathered in Tatitlek during 1988/89. The average subsistence harvest in Tatitlek in the two years immediately before the spill was close to 500 pounds per person. It is likely that harvest levels in Chenega Bay approached this level by the late 1980's.

Although harvest levels have been rebounding, obvious changes to the composition of the harvest have occurred since the oil spill. One of the more notable changes is the decline in the harvesting of marine mammals. In 1991/92, marine mammals contributed only six percent of the harvest, compared to 49 percent in 1984/85. Marine mammals also contributed at a similarly low level in 1992/93. An increase in the harvesting of fish indicates that fish are being substituted for marine mammals and other resources that have declined since the oil spill. In 1992/93, fish were 71 percent of the harvest, compared to 29 percent in 1984/85. Other changes to the composition of the harvest include:

- The herring harvest declined to less than half the average taken before the spill and was used and harvested by fewer households.

- In 1992/93 the harvest of rockfish exceeded all previous use levels and was used by more households than in pre-spill years.

- Although in 1992/93 the harvest of marine invertebrates was twice as high as pre-spill harvest rates, the number of families using clams declined from a pre-spill level of 87.5 per cent to 65.2 per cent in 1992/93. Families have travelled to beaches along Cook Inlet to harvest clams because of their scarcity near the village and the fear of oil contamination. The increase in marine invertebrate harvest is also in part a result of harvesting larger octopus from boats in deep water, rather than smaller ones from dens along the beach. These smaller octopus are preferred, but have been scarce since the spill.

- The shrimp harvest as well as the use of shrimp has declined to below pre-spill levels.

- The per person harvest of birds and eggs remains below pre-spill levels. The number of ducks harvested by the community is also below pre-spill levels.

- In 1992/93 the per capita harvest of black bear and deer was below 1985 levels. The number of families participating in the harvesting of deer was also lower than any time since 1985.

- In 1985/86, 43.8 percent of the households tried to harvest sea lions. In 1992/93, the number of households that tried to harvest sea lions decreased to 17.4 per cent.

- The number of families attempting to harvest harbor seals declined from 56.3 per cent in 1985/86 to 26.1 between 1991 and 1993.

In addition to gathering data through the survey process, Fish and Game staff also interviewed individuals involved in subsistence harvesting. Comments made during these interviews provided personal insights on how subsistence has changed in Chenega. The following presents some of the comments provided by Chenega Bay residents during the 1992/93 survey.

- The clams in the area I'm afraid to use. We went to Port Ashton to get as far away from oil as possible, and not go too far away. We're not gonna eat clams from the oiled areas. I still hunger for clams, shrimp, crab, octopus, gumboots. Nothing in this world will replace them. To finally be living in my ancestors' area and be able to teach my kids, but now it's all gone.

- We're not getting them [gumboots or chitons] here. We get more in English Bay and Port Graham.

- We were out six hours. [We] saw not one [bird] at Cape Elrington. [The] oil spill killed them all. I have been here [in Prince William Sound] 17 years. Now you can run all day and count all the birds on you see on one hand.

- The further you get from the North end of the island [which were oiled] the better the bird hunting.

- There are fewer deer now. Deer are way down since I moved here in '83. [You] used to see them frequently. I didn't even get my limit last year. You have to walk miles and miles before you see them.

- I went around Evans Island and Latouche and Elrington Island saw one mink and eight land otters on Elrington. [About Elrington Island] The animals are fewer than before.

- I went around the island [Evans Island] for seals. [I] didn't see any.

- [I] keep watching for seals. I don't see them any more...I traveled from Esther Island to Chenega Bay and saw one seal. I also went around Knight Island and never saw any.

- One elder discussing seal hunting reported that after the oil spill, they had to go about 32 miles to Icy Bay where there's a glacier. Sometimes they can't make it into the glacier because of the ice. He also added, "it gets expensive."

- We used to go hunting from Chenega Bay, to Bettles Island, about two miles from here. After the oil spill I never saw any seals out here. I've had to go 20 miles with a boat at times to get a seal.

Project Design:

Objectives: Reduce the cost and risk associated with having to travel further to find subsistence resources. Also increase the variety of subsistence foods vailable in the community. Resources harvested during these trips will be shared with the residents of Chenega Bay.

Method: Funds provided will permit the community to hire larger local boats to transport hunters to more distant locations. Funds will be used to hire and fuel the larger boats, hire and fuel skiffs, and hire a skiff operator. To be eligible to participate in this project all boat operators will be required to provide proof of insurance. The hunting trips funded through this grant will be shared by the residents that own boats capable of satisfying any requirements established.

Schedule: Funds provided by this grant will fund trips for one year. The number of trips will be determined by the amount of funds provided. Trips will begin shortly after a grant agreement is signed.

Location: The trips funded by this grant will be used for travel in Prince William Sound.

Project Implementation:

It will be the responsibility of the Chenega Bay IRA Council to implement and administer this grant.

Public Process:

The need for this project was identified by Chenega Bay representatives during a public meeting held in the community in June 1994. The community also submitted a similar request to the Oil Spill Trustee's during an earlier request for project proposals.

Personnel Qualifications:

Gail Evanoff is the vice-president of Chenega Corporation. She has worked extensively with state and federal agencies on oil spill projects. She was involved with the management of the oil spill shoreline treatment in the Chenega Bay area, as well as the management of the earlier grant received from DCRA to allow travel to other areas. She is familiar with the requirements vessels and vessel operators must meet to participate in government funded projects, and is also a highly qualified subsistence user.

Budget:

PERSONNEL	3.0
TRAVEL	1.5
CONTRACTUAL	40.0
COMMODITIES	3.4
EQUIPMENT	0
CAPITAL OUTLAYS	0
GENERAL ADMINISTRATION	2.1
TOTAL	50.0

Project Number:
95136

Project Title: Skin Sewing Crafts Restoration Project

Project Leaders: Monica Riedel

Lead Agency: Subsistence Divisions of ADF&G and NPS.

Cost of Project: FY 95 $29.9 FY 96 $29.9
Start/Completion Dates: 10/95 - 9/97

Project Duration: Two Years

Geographic Area: Chenega Bay, Tatitlek, Port Graham, Nanwalek, Cordova and Valdez.

Contact Person:
Don Callaway
National Park Service, Subsistence Division
2525 Gambell, Suite 102
Anchorage, AK
(907) 257-2408

B. Introduction - Project Overview:

This project proposes to have Monica Riedel, a member of the Native Village of Eyak and owner of Dineega Specialty Furs in Cordova, conduct skin sewing workshops in the communities of Chenega Bay, Tatitlek, Port Graham, Nanwalek, Cordova and Valdez.

C. Need for the Project.

Subsistence resources have been traditionally used by these communities as items for clothing and are currently used by artists in these communities as a basis for small crafts production. The EVOS has limited access to these resources and has inhibited the growth of this self sustaining craft activity. In addition to helping sustain the continuity of this subsistence related service this project will help substitute an enhanced craft activity for economic activities current reduced as a consequence of the EVOS, e.g., commercial fishing.

D. Project Design.

1. Objectives:

To provide continuity in the opportunity to use subsistence related services damaged by the EVOS.

To provide an alternate resource for economic activities damaged by the EVOS.

2. Methods:

This project will conduct two workshops in each of the project communities during the next two years.

All crafts will be made from local resources (i.e., within Prince William Sound and/or Cook Inlet) purchased from Native subsistence hunters.

Existing space (e.g., in community or recreation halls) and materials (e.g., sewing machines) are available to conduct the workshops, although long term production of these crafts will require the construction of additional space and the purchase of additional technology.

3. Schedule:

The workshops will be scheduled to avoid conflict with existing subsistence activities and to maximize community membersA availability.

4. Technical Support:

There is no anticipation of the need for technical support.

5. Location:

The workshops will be conducted in existing community centers.

E. Project Implementation.

The project should be implemented through a cooperative agreement between the Native Village of Eyak (of which Monica Riedel is a member), the National Park Service (NPS) with a subsidiary cooperative agreement between the NPS and the subsistence division of the ADF&G. Section 809 under Title VIII of ANILCA empowers the Secretary to enter into cooperative agreements with other Federal agencies, the State, Native Corporations and other persons and organizations to oeffectuate the purposes and policies of this title.

F. Coordination of Integrated Research Effort.

This project is part of the Subsistence Restoration Planning and Implementation Project (94428), and would further the goal of restoring subsistence services damaged by the EVOS.

G. Public Process.

The Subsistence Restoration Planning and Implementation Project composed of state representatives from the Subsistence Division of ADF&G and the Municipal and Regional Assistance Division of DCRA, along with representatives of the Forest Service and NPS have met in public meetings with the communities of Chenega Bay, Tatitlek, Port Graham, Cordova (including members of the Native Village of Eyak), and Valdez (including the Valdez Native Association) to solicit their recommendations for oil spill restoration projects. This project description is a product of those public meetings. The public at large will have an opportunity to comment during the public process associated with dissemination of FY 95 Draft Work Plan.

H. Personnel Qualifications.

Ms. Riedel is an award winning Native craftsperson.

95136

I. Budget.

PERSONNEL	9.7
TRAVEL	15.1
CONTRACTUAL	0
COMMODITIES	12.1
EQUIPMENT	0
CAPITAL OUTLAYS	0
GENERAL ADMINISTRATION	5.0
TOTAL	29.9

Otter and Shrode Creek Barrier Bypass Project: Final Report

Project Number:	95139B
Restoration Category:	General Restoration (continuation of 94139B1 and B2)
Proposed By:	USFS
Cost FY 95:	$5,200
Cost FY 96:	$0
Total Cost:	$5,200
Duration:	1 year
Geographic Area:	Prince William Sound
Injured Resource/Service:	Cutthroat trout and Dolly Varden

INTRODUCTION

This proposal provides funding for the final report for the Otter Creek and Shrode Creek barrier bypass projects completed in FFY 94 (94139).

NEED FOR THE PROJECT

Otter Creek Barrier Bypass

An Alaska steep pass was built on a barrier falls near the mouth of Otter Creek in 1982. A July 1991 monitoring trip by the US Forest Service indicated that not all fish were able to move past a small vertical falls above the steep pass. Additionally, it was observed that two 1.5 m cascades could be modified for easier passage to a 55 acre lake and a 3 acre pond. The project provides access for all salmon, trout and Dolly Varden.

Shrode Creek Barrier Bypass

The Shrode Creek fishway was initially constructed in 1962 to bypass a 3 m barrier falls and provide consistent access to Shrode Lake and two small unnamed lakes. These lakes are utilized by sockeye, coho, and pink salmon as well as cutthroat trout and Dolly Varden char. Chum salmon are also present in the creek. A 1991 inspection indicated the need for immediate replacement of the gabion baskets as many salmon were impaled and gilled by the deteriorating gabions. The lower concrete wall was undercut by the current and needed to be replaced.

PROJECT DESIGN

A. Objectives

The objective is to complete the final report for EVOS Project 94139 for Otter Creek and Shrode Creek.

B. Methods

Otter Creek Barrier Bypass

A fishpass was designed and constructed to overcome a 1.5 m falls. Two 1.5 m cascades were modified for easier passage. The water level in a jump pool was raised by means of gabions.

Shrode Creek Barrier Bypass

Gabion baskets were replaced and a new cement wall was constructed.

C. Schedule

Oct. 1, 1994 - Jan 15, 1995	Prepare draft report
Jan. 15, 1995	Report distributed for internal review
Feb. 15, 1995	Report distributed for EVOS peer review
April 15, 1995	Report distributed to Trustees

D. Technical Support

None required.

E. Location

Glacier Ranger District office.

PROJECT IMPLEMENTATION

To be carried out by the Glacier Ranger District USFS.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Not applicable.

FY 95 BUDGET ($K)

Personnel	4.5
Travel	0.0
Contractual	0.0
Commodities	0.0
Equipment	0.0
Subtotal	4.5
Gen. Admin.	.7
Total	5.2

This page intentionally left blank.

Salmon Instream Habitat and Stock Restoration--Pink Creek and Horse Marine Barrier Bypass Development

Project Number:	95139D
Restoration Category:	General Restoration
Proposed By:	ADFG
Cost FY 95:	$61,600
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	5 years
Geographic Area:	Kodiak Island and Afognak Island
Injured Resource/Service:	Sockeye salmon and pink salmon

INTRODUCTION

This project is result of a Trustee Council funded three-year survey of the Kodiak Island oil-impact area which identified feasible, cost effective instream habitat restoration and development techniques for salmon. In 1993 (FY94) one project on Afognak Island (Little Waterfall Creek) was identified as feasible and was funded by the Trustees. The selection of this project was based on preliminary cost to benefit data. Two additional projects have been identified on Kodiak and Afognak Islands as cost-effective upon further cost to benefit analysis. These projects are designed to replace injured salmon spawning habitat by providing access to existing habitat. The projects are: 1) Horse Marine Creek Barrier Bypass - Kodiak Island; 2) Pink Creek Barrier Bypass - Afognak Island.

Horse Marine Creek Barrier Bypass:
The project at Horse Marine Creek on southern Kodiak Island will provide access to spawning habitat capable of supporting 15,307 pink, 3,124 coho and 8,594 sockeye salmon. With consistent escapements to this habitat,annually, approximately 28,214, 22,914 and 90,237 pink, coho, and sockeye salmon would be produced. The average escapement of pink salmon at Horse Marine Creek has been 3,864. Coho and sockeye escapements do not reach optimum levels at low flow periods. The project will benefit areas effected by the oil spill by replacement production.

Pink Creek Barrier Bypass:

The project at Pink Creek on Afognak Island will provide consistent access to spawning habitat capable of supporting 4,512 pink and 516 coho salmon. Consistent annual escapements into this habitat could produce 8,317 and 3,782 pink and coho salmon, respectively. Pink Creek drains into Afognak Bay which was oiled in 1989.

NEED FOR THE PROJECT

These projects will help restoration by enhancing salmon populations and improving the commercial, sport, and subsistence fishing opportunities on Afognak and southern Kodiak Islands. Thus, lost fishing opportunities, as result of the oil spill, will replaced or mitigated for.

PROJECT DESIGN

The goal of this project is to increase pink, coho and sockeye salmon spawning capability, and overall salmon returns, by enhancing fish passage above barriers in Horse Marine and Pink Creeks.

A. Objectives

1. Final evaluation of pre-project production parameters (egg-to-fry survival, salmon escapement and spawning distribution)

2. Determine final barrier bypass design for Horse Marine Creek..

3. Obtain the necessary permits for construction .

4. Construct two barrier bypasses in the oil spill impacted area.

5. Evaluate the success of the barrier bypasses by estimating spawning numbers utilizing enhanced habitat as well as the relative abundance of juveniles produced each year.

6. Conduct necessary project maintenance each year.

7. Provide documentation of project progress and results.

B. Methods

Horse Marine Creek:
A barrier bypass will be designed and constructed to facilitate salmon passage over a 3.0 m falls. Low water diversion structures will be installed and a salmon diversion weir constructed to lead salmon into entrance tanks.

Pink Creek:

This project will require a channel be cut with diversion of stream flow to allow salmon passage over 1.9 m falls.

C. Schedule

Each project will require pre-construction planning, permitting and surveys, construction, and a period of five years for performance monitoring. This evaluation period is necessary for projects producing sockeye and/or coho salmon which return as adults at age 5 or 6. The Horse Marine Creek project will likely require construction to be contracted, thus, initial planning is scheduled for FY95 with construction in FY96. The Pink Creek project will be completed in FY95. The following table describes the anticipated schedule of tasks for years 1 and 2 for each project.

Task	Period	Pink Creek	Horse Marine Creek
Pre-project surveys, planning	10/94-9/95	X	X
Final engineer surveys	7/95		X
Permitting, planning, administration, award contract	1/95 - 4/95	X	X
Project construction	5/95 - 6/95	X	
	5/96 - 6/96		X
Spawner abundance estimates	8/95 - 11/95	X	
	8/96 - 11/96		X
Progress reports	as required	X	X
Egg-to-fry survivor estimates	3/96	X	
	3/97		X

D. Technical Support

General administrative support is provided by the Administrative, Habitat and Restoration Division, and Commercial Management and Development Divisions (CFMD) of the Alaska Department of Fish and Game (ADFG). The project leader of this project is primarily funded by general funds and program receipts (Kodiak Regional Aquaculture Association - KRAA - cooperative funding) from the State of Alaska. Engineering support is provided by CFMD of the ADFG, funded by general funds from the State of Alaska. This study is directly associated with ongoing rehabilitation and enhancement projects funded by program receipts provided by KRAA.

E. Location

The project will be located at Pink Creek on Afognak Island and Horse Marine Creek on southern Kodiak Island. Pink Creek drains into Afognak River which drains into Afognak Bay on eastern Afognak Island. Horse Marine Creek drains into Olga Bay. The benefits of this

project will be realized by increasing pink, coho and sockeye salmon returns to these systems, providing salmon for harvest. The residents of the city of Kodiak, and the village on northern Afognak Island as well as southern Kodiak Island will benefit economically from this project through direct commercial fishery receipts and all associated business enhancement. In addition, sport fishers, guides, and lodge owners as well as subsistence fishers, will benefit directly and provide direct economic return to the associated communities.

PROJECT IMPLEMENTATION

The Alaska Department of Fish and Game (ADFG) will implement the project. The steeppass construction at Horse Marine Creek will likely require implementation through a competitive contract process. The ADFG is currently managing approximately eight barrier bypass projects on Kodiak and Afognak Islands, therefore, is the appropriate agency to implement this project.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The ADFG, CFMD Division, Development and Research Sections operate sockeye, coho king and pink salmon development projects at Frazer, Pauls/Laura, Portage and Little Waterfall Creeks, located on Kodiak and Afognak Islands. The Department conducts all maintenance, monitoring and evaluation activities associated with this fisheries development program with funding provide by KRAA through program receipts. This includes lake enrichment, smolt sampling, limnological sampling, and weir operation. In addition, the Finfish Management Section of CFMD Division conducts fisheries management operations in the area.
Also, KRAA operates a sockeye stocking programs via Pillar Creek Hatchery at Hidden Lake. In addition, KRAA operates Kitoi Bay Hatchery on northern Afognak Island, producing pink, coho, chum and sockeye salmon for commercial harvest. All evaluation associated with Pillar Creek and Kitoi Bay hatcheries is conducted by ADFG with funds provided by KRAA program receipts. Lastly, the Alaska Department of Natural Resources, Kodiak State Parks operates several coho escapement weirs on Shuyak Island, located just north of Afognak Island. The ADFG provides equipment and logistical support, as well as conducting aerial salmon escapement surveys in the area. This project will be coordinated with all of the above mentioned programs.

FY 95 BUDGET ($K)

Personnel	42.7
Travel	1.2
Contractual	4.2
Commodities	6.8
Equipment	0.0
Subtotal	54.9
Gen. Admin.	6.7
Total	61.6

Project Number
95140

Project Title: Subsistence Skills Program

Project Leaders: Helmer Olson

Lead Agency: Valdez Native Association

Cost of Project: FY 95 $36.7 FY 96 $36.7
Start/Completion Dates: 1/95 through 9/95

Project Duration: 3 years

Geographic Area: Valdez, Alaska

Contact Person:
Helmer Olson, President
Valdez Native Association
P.O. Box 1108
Valdez, AK 99686
(907) 835-4951

#95140

B. Introduction - Project Overview:
This project would provide funding for programs to support the passing on of subsistence skills, communication between the generations and to promote community healing. Classes would be provided in various activites, including survival skills, carving, beading, and Native drumming and dancing. Support would also be provided for community gatherings, such as potlaches, as well as storytelling by elders.

C. Need for the Project.
In the summer of 1989, the Exxon Valdez oil spill all but turned the community of Valdez on its head. In addition to concerns about the possible effects of the oil on the safety of subsistence resources, there was economic and social upheaval as well. The population of the City of Valdez swelled from 4,300 to over 12,000 in a matter of weeks. This massive influx of transients overwhelmed the town, and disrupted the normal social, cultural and subsistence activities of the residents. This disruption was keenly felt by the Native community in Valdez. The additional population created pressure on existing facilities in the city, and as a result, food prices and rents skyrocketed. Many community residents found it necessary to take the higher paying oil spill jobs in order to keep up with the increased cost of living in the community. These jobs were usually 60 hours per week, and required employees to be away from home. Subsistence hunting and commercial fishing were abandoned, both because of contamination fears, and because all the activity aimed at cleaning up the oil would make such activities difficult, if not impossible to carry out. Traditional ways of coping with disaster were insufficient to deal with the situation.

Some people responded to the combination of the disruption of their normal lives and the high salaries they received as oil spill workers, by reverting to substance abuse. The result was a dramatic increase in domestic violence, family breakups, and mental health problems. This, in turn, meant the disruption of the social, cultural and subsistence activities continued beyond the departure of the oil spill workers.

The Board of Directors of the Valdez Native Association sees a need to reinforce the traditional heritage of the Native community in Valdez in order to repair the damage to subsistence activities and the transmission of traditional knowledge caused by the EVOS.

Cultural activities normally enjoyed by the Valdez Natives range from fur sewing, beading, ivory carving and various forms of traditional dancing. The individuals who possess these skills are often quiet craftsmen who, left to themselves in a semi-urban setting, overlook the need to pass on their skills. This program would provide the opportunity for these people to display their skills and crafts, and teach them to others.

The traditional Native potlach meal has long been a source of community spirit that permits friends and relatives to get together to eat and share events with each other. A potlach also serves as an opportunity to allow leaders to recognize the accomplisments of young people, acknowledge the importance of elders, to seek testimonials of conflict resolution, adversity and personal growth. These all help to engage a community and create a spirit of togetherness, family and purpose.

This project will help restore pride in Native accomplishment, and help to restore the subsistence services that have been disrupted by the Exxon Valdez oil spill and its aftermath.

D. Project Design.

1. Objectives:
To restore subsistence services, the transmission of traditional skills and knowledge, and community cohesion, damaged by the EVOS.

2. Methods:
This will be done by providing classes to teach skills, traditions and crafts, and by holding traditional community getherings and potlaches. This will help to restore subsistence activities, and will also help foster communication between community elders and young people.

3. Schedule:

Community gatherings	1 time each year
Beadworking classes	4 times each month
Native drumming and dancing	2 times each month
Life coping skills	1 time each month
Ivory carving classes	2 times each month
Russian Christmas	1 time each year
Native language workshop	1 time each week
Basketry classes	6 times each year
Survival skills training	2 times each year
Women's group meetings	1 time each month
Youth leadership meetings	1 time each month
Elders memories (storytelling)	1 time each month
Traditional cooking/baking	8 times each year

4. Technical Support:
This project will not require technical support as defined in the Invitation to Submit Restoration Projects for Fiscal Year 1995.

5. Location:
The classes and gatherings will take place in Valdez. When possible, the offices of the Valdez Native Association will be used, but for some of the larger gatherings, it will be necessary to rent a hall in the community.

#95140

E. Project Implementation.
The project should be carried out by the Valdez Native Association.

F. Coordination of Integrated Research Effort.

This project is part of the Subsistence Restoration Planning and Implementation Project (94428), and would further the goal of restoring subsistence services damaged by the EVOS.

The Valdez Native Association already has a program in place to facilitate the disribution of native foods from local hunters to elders. VNA also has a scholarship program which is funded by proceeds from weekly bingo games.

G. Public Process.

The Subsistence Restoration Planning and Implementation Project composed of state representatives from the Subsistence Division of ADF&G and the Municipal and Regional Assistance Division of DCRA, along with representatives of the Forest Service and NPS have met in public meetings with the communities of Chenega Bay, Tatitlek, Port Graham, Cordova (including members of the Native Village of Eyak), and Valdez (including the Valdez Native Association) to solicit their recommendations for oil spill restoration projects. This project description is a product of those public meetings. The public at large will have an opportunity to comment during the public process associated with dissemination of FY 95 Draft Work Plan.

H. Personnel Qualifications.
Helmer Olson is the President of the Valdez Native Association. He has a demonstrated track record of running state and federally funded programs. Since 1990, he has guided VNA in assuming responsibility for several grant programs previously run by the regional Native association.

I. Budget.

PERSONNEL	2.0
TRAVEL	1.5
CONTRACTUAL	28.2
COMMODITIES	
EQUIPMENT	0
CAPITAL OUTLAYS	0
GENERAL ADMINISTRATION	5.0
TOTAL	36.7

Afognak Island State Park Interim Support

Project Number:	95141
Restoration Category:	General Restoration
Proposed By:	DNR
Cost FY 95:	$309,400
Cost FY 96:	$21,500
Total Cost:	$395,400
Duration:	5 years
Geographic Area:	Afognak Island
Injured Resource/Service:	Marbled murrelet, harlequin duck, black oystercatchers, river otters, harbor seals, sea otters, anadromous fish, bald eagle nests, and recreation.

INTRODUCTION

In November 1993, the Trustee Council purchased 41 thousand acres of land adjacent to Seal Bay, Afognak Island. In its resolution accepting the seller's offer, the Council found that these lands "include important habitat for several species of wildlife for which significant injury resulting from the oil spill has been documented." The resolution cited important nesting areas for marbled murrelet; nesting and foraging areas for harlequin ducks; adjacent shore used by black oystercatchers and river otters; harbor seal haulouts along the shoreline; concentrations of sea otters off Tolstoi Point; eight documented anadromous streams; ten documented bald eagle nests; and high value wilderness-based recreation such as hunting, boating and fishing.

In May 1994, the Alaska State Legislature designated the land and water around Seal Bay as Afognak Island State Park. A letter of intent accompanying the act stated, in part:

> It is the intent of the legislature that sources of funding other than state general funds be sought for the management of Afognak Island State Park. It is also the intent of the legislature that at least five public use cabins be built within Afognak Island State Park. A primary source for these purposes is moneys managed by the *Exxon Valdez* Trustee Council.

This proposal requests funds necessary to manage and protect Afognak Island State Park until such time as the State can generate moneys for that purpose.

NEED FOR THE PROJECT

Until reliable sources of funding for operations and maintenance of the new state park are secured, the most that can be expected is periodic visitation from park rangers out of Kodiak. Interim support for operations will enable field staff and volunteers to monitor use of the new park and discourage resource degradation, as well as oversee actions taken to comply with the road closure plan and reforestation requirements. Compliance with the road closure plan and reforestation requirements is the responsibility of the seller.

The logging roads in the park were created by removing overburden to bedrock and then grading the bedrock. It will take many years for the road beds to revegetate. The statutory road closure requirements, with which sellers must comply, will stabilize the road surfaces but not lead to revegetation. This project will move the overburden back onto the road surfaces leading to natural revegetation of the road surfaces.

Revegetation of the road surfaces will restore, to some extent, habitat values diminished by roadbuilding. In addition, some roads in the park should be converted to trails provided they serve restoration objectives. For example, they could channel public use away from sensitive habitats or enhance recreational experience.

PROJECT DESIGN

A. Objectives

1. Assurance that public use of Afognak Island State Park is consistent with restoration objectives.

2. Compliance with the road closure plan and reforestation requirements, which are the responsibilities of the seller.

3. Restoration of habitat through revegetation of road surfaces.

4. Conversion of certain roads to trails to meet restoration objectives.

B. Methods

1. Permanent seasonal staff will make occasional visits to the park; develop, in coordination with ADFG, a land use and management plan for the park; and identify cabin sites sensitive to injured resources and services.

2. Volunteers in Parks (VIPs) will monitor public use of the park and develop a resource inventory for use by staff in forming a land use and management plan for the park and identifying cabin sites.

3. Overburden will be moved onto approximately nine miles of roadbeds so they can revert to natural vegetation. This effort will be completed during FY 96.

4. A plan will be developed to convert some existing roads to trails. The plan will be completed in FY 96.

C. Schedule

Recruitment of volunteers would begin in December 1994. Permanent seasonal staff and volunteers would be onsite from late May through August. The trail conversion plan and revegetation efforts will be completed in FY 96.

D. Technical Support

None.

E. Location

Afognak Island State Park.

PROJECT IMPLEMENTATION

Afognak Island State Park will be operated and managed by the Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, through permanent seasonal staff and Volunteer in Parks (VIPs). Pulling overburden back onto roadbeds will be done under contract.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The Division of Parks and Outdoor Recreation will coordinate its actions with other Trustee Council actions on Kodiak, Afognak, and Shuyak Islands.

FY 95 BUDGET ($K)

Personnel	10.0
Travel	8.0
Contractual	270.0
Commodities	2.0
Equipment	0.0
Subtotal	290.0
Gen. Admin.	19.4
Total	309.4

Contractual services is the estimated cost of pulling overburden back onto the roadway of logging roads to provide a climate for natural revegetation. There are approximately nine miles of 16-foot wide logging roads to be rehabilitated on Afognak Island. The logging roads in the park were created by removing overburden to bedrock and then grading the bedrock. It will take many years for the road beds to revegetate. The statutory road closure requirements, with which sellers must comply, will stabilize the road surfaces, for example, by removing bridges and culverts; however, they not lead to revegetation. Revegetation of the road surfaces will restore, to some extent, habitat values diminished by roadbuilding. A contract is expected to be issued in FY 95, with work continuing through FY 96.

Prince William Sound Herring Genetic Stock Identification

Project Number:	95165
Restoration Category:	General Restoration (carry-forward)
Proposed By:	ADFG
Cost FY 95:	$105,400
Cost FY 96:	$118,300
Total Cost:	Unknown
Duration:	3 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pacific herring

INTRODUCTION

Herring are a major resource in Prince William Sound from both a commercial and ecological perspective. The timing of the *Exxon Valdez* oil spill (EVOS) overlapped the annual spring migration of herring spawners to nearshore staging areas. Over 40% of the herring spawning staging and egg deposition areas and over 90% of the documented summer rearing and feeding areas were lightly to heavily oiled prior to the spawning events. As a result, herring encountered oil during each of their four life stages in 1989 and, to a lesser extent, in 1990. Adult herring traversed oil sheens and mousse while traveling northward and eastward. Eggs were deposited on oiled shorelines and were "dipped" in sheen through tidal action while incubating. Larvae hatched that contained lipophilic petroleum hydrocarbons in their yolk sacs and encountered sheen near the surface while in their most sensitive state. Post-larval or juvenile herring swam through and remained near lightly to heavily oiled shorelines, regularly encountering sheen, mousse and dissolved oil particulates and components through the summer while feeding in shallow nearshore bays and passes.

In 1993, the total observed spawning population was less than one-third of preseason predictions and the average sizes of herring in each age class were some of the smallest on record. Only limited commercial herring fishing occurred. Preliminary pathology results implicated viral hemorrhagic septicemia (VHS) as a potential source of mortality and stress. In 1994, as in 1993, the spawning population was below preseason predictions. Aerial surveys indicated the population was less than minimum threshold harvest levels and no commercial fishing was allowed. The ex-vessel value of the herring fisheries in 1992 was $12.0 million. In 1993, the ex-vessel value dropped to $2.0 million and no commercial harvest occurred in 1994.

This project will enable resource managers to better understand herring population dynamics to improve the recovery process. In addition, it will aid local resource users to make appropriate pre-season plans based on accurate and precise herring projections.

Incorporating genetically derived stock structure is crucial to the success of any fisheries or restoration program. Consistent exploitation of mixed stocks has to lead to the demise of the least productive stocks. Unfortunately, defining the stock structure of herring has been particularly difficult. There is evidence that herring home, but straying may also be substantial. Morphological and meristic differentiation of herring from discrete geographic regions has been used as evidence for the existence of genetically distinct stocks, but much of this variation may be environmentally mediated and has not been confirmed with genetic data.

Previous surveys of herring using the genetic techniques of allozyme electrophoresis have generally revealed differentiation only over broad geographic regions. Two distinct races of Pacific herring (Asian/Bering Sea - eastern North Pacific) have been defined, with further subdivision between Gulf of Alaska and more southerly North Pacific stocks. However, more recently, genetic divergence among local spawning populations of Pacific herring in the vicinity of northern Japan using allozyme markers has been described.

An explosion of new genetic techniques has occurred in recent years as a result of recent advances in molecular biology. The utility of these newer techniques to detect fine genetic structure in Pacific herring has not been properly assessed. We propose to use a combination of current allozyme techniques combined with mitochondrial and nuclear DNA techniques to more accurately define the stock structure of herring from the EVOS-affected area. The data can also be used to estimate the stock composition of non-spawning aggregations contributing to the fisheries in Prince William Sound. These data on stock structure will be essential in improving the stock assessment model in Prince William Sound and therefore the development of a restoration plan for the damaged herring stock.

NEED FOR THE PROJECT

Pacific herring *Clupea pallasi* are a major resource in Prince William Sound (PWS) from both commercial and ecological perspectives. Five commercial herring fisheries in PWS have an average annual combined ex-vessel value of $8.3 million. Pacific herring provide important forage for many species including some species severely injured by the *Exxon Valdez* oil spill. Predator species include humpbacked whales, seals, sea lions, gulls, sea ducks, shorebirds, halibut, salmon, rockfish, and other fish. In addition, several thousand pounds of herring and herring spawn-on-kelp are harvested annually for subsistence purposes and form an important part of the local native culture of Chenega and Tatitlek.

The goal of this project is to improve the accuracy of current stock assessment methods and models thus improving resource management. Incorporating genetically derived stock structure is crucial to the success of any fisheries or restoration program. Improved accuracy of stock distribution information will allow fishery managers to make fine adjustments of fishing quotas to harvest the maximum available surpluses with the lowest possible risk of overharvest, damage to the resource, or economic loss to the fishing industry. This information is also needed to help interpret oil spill damage results. Because commercial and subsistence herring harvests represent substantial contributions to local economies, intensive management is expected to benefit all communities in PWS. Restoration efforts can be directed and evaluated through improved fishery management and continued resource monitoring.

PROJECT DESIGN

A. Objectives

We propose to initiate a study to test for genetic heterogeneity among spawning aggregations of Pacific herring within Prince William Sound. The objectives of the study are to:

1. Screen population samples using an array of molecular techniques for DNA-level genetic analysis. Techniques under consideration include DNA sequencing of mitochondrial and nuclear regions, microsatellite analysis (analysis of regions with variable number of tandem repeats (VNTR)), RAPD analysis (random amplified polymorphic DNA markers), and restriction analysis of mitochondrial and nuclear regions.

2. Screen population samples using alloyzme electrophoresis.

3. Evaluate the null hypothesis a single panmictic population of herring Prince William Sound using the results from a and b above.

A comprehensive survey of the entire EVOS-affected areas may be designed in future years pending the results of Objective 3.

B. Methods

Field collections of spawning Pacific herring will be made from four representative sites within Prince William Sound. The collection sites will be chosen to maximize the potential genetic differentiation among the aggregations. A sample of 100 individuals will be collected from each aggregation. Tissue extracts from muscle, liver, eye, and heart will be collected. Extracts from individual fish will be preserved in both alcohol and in liquid nitrogen.

A request for proposal will be issued for the molecular analyses to be conducted at the contractor's facilities. Allozyme electrophoretic analysis will be conducted by ADFG following standard protein electrophoretic techniques.

The specific molecular techniques to be investigated will be chosen based on: 1) a review of the current literature and recently available research results, and 2) responses and qualifications of competitive bidders.

C. Schedule

Activity	Inclusive Dates	
Advertise and award contract for DNA analyses	October 1994	January 1995
Collection of baseline samples	April 1995	
Laboratory analyses	May 1995	December 1995
Draft status report FY95	March 1996	
Second-year sample collection	April 1996	December 1996
Second-year lab analyses	May 1996	December 1996
Final status report FY95	August 1996	
Draft final report	March 1997	
Final report	August 1997	

D. Technical Support

Administrative support is provided by the Administrative, Habitat, and Commercial Fisheries Management and Development Divisions (CFMD) staff of the Alaska Department of Fish and Game. The project leaders are fully funded with general funds from the State of Alaska. Project assistants are fully or partially funded by this project. Laboratory support is provided by the ADFG Genetics Program which includes facilities for tissue archival, allozyme analysis, PCR-based and other DNA analyses, and data analyses. These studies are integrated with ongoing studies by the CFMD for efficiency in completing the objectives.

E. Location

Field research will be conducted within the confines of PWS and exact locations will depend upon the distribution of spawning herring. Laboratory studies and data analysis will be conducted at the ADFG area office in Cordova and regional office in Anchorage.

PROJECT IMPLEMENTATION

The statewide genetics laboratory within the Division of Commercial Fisheries Management and Development is located in Anchorage and is well equipped for allozyme and DNA studies. Current staff include geneticists, a genetics biometrician, and laboratory technicians. Collection of specimens and biological data will coordinated by ADFG's ongoing herring research program in Prince William Sound and with the EVOS project Disease Impacts on Prince William Sound Herring Populations.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The genetic analyses and biometric analyses will be coordinated among all Trustee Council projects related to genetics including 94320D, 94191, and 94255.

Sharing of project results will be used to evaluate and revise current strategies for management of commercial herring fisheries if warranted. Project results will also be used to improve our understanding of results from previous oil spill damage assessment studies.

FY 95 BUDGET ($K)

Personnel	30.6
Travel	2.0
Contractual	60.5
Commodities	3.5
Equipment	0.0
Subtotal	96.6
Gen. Admin.	8.8
Total	105.4

This page intentionally left blank.

Institute of Marine Science - Seward Improvements EIS

Project Number:	95199-CLO
Restoration Category:	Administration, Public Information and Science Management (closeout)
Proposed By:	ADFG
Cooperating Agencies:	All Trustee Agencies
Cost FY 95:	$46,500
Cost FY 96:	$0
Duration:	1 year
Geographic Area:	Gulf of Alaska
Injured Resource/Service:	Multiple resources

INTRODUCTION

On January 31, 1994 the Trustee Council approved financial support for project 94199, Required Infrastructure Improvements for the Institute of Marine Science - Seward and authorized the Executive Director to:

1. Take necessary steps to secure NEPA compliance;

2. Consult with appropriate entities, including the University of Alaska, the City of Seward, the Seward Association for the Advancement of Marine Science, and appropriate Trustee Agencies to review the assumptions relating to the proposed improvements and capital and operating budgets;

3. Develop an integrated funding approach which assures that the use of trust funds are appropriate and legally permissible under the terms of the Memorandum of Agreement and Consent Decree;

4. Prepare a recommendation of the appropriate level of funding for consideration by the Trustee Council that would be legally permissible under the terms of the Memorandum of Agreement and Consent Decree.

This project will close out the process of preparation of the Environmental Impact Statement

and the consultation needed to prepare the revised project description and budget for the proposed expansion and improvements of research facilities affiliated with the Institute of Marine Science in Seward.

NEED FOR THE PROJECT

Federal law requires an Environmental Impact Statement (EIS) for major federal actions significantly affecting the quality of the human environment. The Trustee Council members have agreed that this project would follow an EIS process for NEPA compliance.

Additionally, the project provides for the completion of consultation and analysis needed to develop a recommendation regarding use of settlement funds that would be appropriate and legally permissible to support proposed improvements with an estimated cost of up to $25 million. The Trustee Council is likely to consider this recommendation in late October 1994.

PROJECT DESIGN

A. Objectives

In FY 94, the first objective was to initiate a process to review the assumptions relative to the research functions, improvement needs, and capital and operating budgets for the proposed facility. The second objective was to initiate and formulate a National Environmental Policy Act process to identify and analyze the environmental and social consequences of the proposed facility. The third objective was to review the proposed improvements to ensure that they are legally permissible under the terms of the Memorandum of Agreement and Consent Decree. In FY 95, the objectives will be to complete and publish the EIS Record of Decision and to finalize the Executive Director's recommendation to the Trustee Council concerning the appropriate level of capital funding for the facility. It is anticipated that this project will close out by December 31, 1994.

B. Methods

The first objective was accomplished through the formation of a Scientific Review Group comprised of Trustee Council representatives and the University of Alaska to review the project assumptions and advise the Seward Association for Advancement of Marine Science (SAAMS) and the project architects and consultants on the design and operation of the proposed improvements.

The second objective was accomplished through development and publication of an EIS for the proposed facility.

The third objective was accomplished through regular consultation between the project staff and the Trustee Council legal team and review of a detailed construction cost budget for the

progress schematic design of the proposed facility.

In FY 95, objectives will be met through preparing and publishing the Record of Decision for the proposed project and preparation of a revised project description and budget for the Executive Director containing the results of the consultation and EIS process described above.

C. Schedule

The Draft EIS was published on June 17, 1994. The Final EIS is scheduled to be published on or before September 16, 1994. The Record of Decision is scheduled to be published on or before October 28, 1994. The revised project description will be distributed in mid-September. The Executive Director's funding recommendation is scheduled to be acted on in late October.

D. Technical Support

Federal and state agency and University of Alaska personnel will provide technical expertise to the Scientific Work Group, the review of assumptions associated with the project, and the EIS process. Consultants to SAAMS will provide architectural, engineering, project management, and EIS preparation expertise. The Chief Scientist and peer reviewers will review the research assumptions associated with the project.

E. Location

All of the analysis and writing will be conducted in Anchorage, Alaska.

PROJECT IMPLEMENTATION

The ADFG project coordinator will be responsible for consultation with appropriate entities and preparing the revised project description and budget for the Executive Director's funding recommendation. The DOI EIS coordinator will be responsible for ensuring that the EIS process is completed on time.

COORDINATION OF INTEGRATED RESEARCH EFFORT

During FY 94, meetings were held with representatives of other Gulf of Alaska marine research facilities (PWS Science Center, Copper River Delta Institute, Fisheries Industrial and Technical Center, Auke Bay Laboratories) to coordinate and discuss the research functions of the proposed facility. Additionally, regular contacts are kept with the Chief Scientist to keep him apprised of planning for the proposed facility. Meetings were also held with University of Alaska - Fairbanks researchers involved in the SEA program to coordinate the facility, vessel, and anticipated research components of the project.

FY 95 BUDGET ($K)

Personnel	29.3
Travel	10.1
Contractual	1.9
Commodities	0.6
Equipment	0.0
Subtotal	41.9
Gen. Admin.	4.6
Total	46.5

Public Access

Project Number:	95200
Proposed By:	ADNR
Cooperating Agency:	USFS
Cost FY 95:	$154,700
Cost FY 96:	$256,100
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Prince William Sound and Kodiak Island Borough
Injured Resource/Service:	Multiple resources

INTRODUCTION

The Alaska Native Claims Settlement Act (ANCSA) provided for identification of easements to access public land. They were identified in the conveyance process and recorded in conveyance documents, but have not been depicted graphically in any publication.

The proposed project has two phases:

Phase I. Identification and mapping of easements in atlases for public distribution for the Prince William Sound area and Kodiak Island Borough.

Phase II. Marking of easements in Prince William Sound to accurately locate them and to preserve continued right of access.

This project directly addresses the Trustee Council's concern about public access in the habitat protection process. Furthermore, the clear, graphic depiction in a single-source document of the location of legal access to public land will expand and enhance public recreation opportunities.

Phase I of this project was proposed in FY 94 as 94200. It was disapproved by the Trustee Council with the recommendation that "ADNR coordinate with the federal agencies on the development of a recreation plan for the spill area and expenditure of state criminal funds." Trustee Council action preceded recent concerns about public access in the habitat protection

process. Nonetheless, in compliance with the Trustee Council's recommendation, ADNR has submitted to Alaska State Parks a request for state restitution funds for preparation of easement atlases for Prince William Sound and Kodiak Island Borough. A decision is not expected until late Summer 1994.

NEED FOR THE PROJECT

Access is a critical element for management and use of land whether federal, state or privately owned. Completion of the Prince William Sound Access Atlas and an acess atlas for the land within the Kodiak Island Borough will provide restoration teams, scientists, negotiators for land acquisitions and recreational users with graphic depiction of land ownership and the legal public access at a scale of 1" to a mile as well as written narratives of each easement. The atlases will be available for use by governmental agencies and the public if funding becomes available for collecting and entering information into GIS as well as project completion.

An easement atlas for the Kenai Peninsula Borough was published in December 1993 as part of the Kenai Area Plan for State Lands.

PROJECT DESIGN

A. Objectives

1. Create 1:63,360-scale maps of the following data for Prince William Sound and the Kodiak Island Borough:
   a. land ownership;
   b. ANCSA 17(b) easements across private land;
   c. roads, trails, docks and airports that provide public access; and
   d. navigable waterbodies.

2. Ensure continued right of access in Prince William Sound under 43 CFR by marking ANCSA 17(b) easements.

B. Methods

Phase I - Identification and Mapping (Lead agency: ADNR)

1. The U.S. Forest Service will produce a printout of their records for confirmation of easements before the Prince William Sound Atlas is printed.

2. The Alaska Department of Natural Resources will:

   a. Enter all ANCSA 17(b) easements across private land in Prince William Sound

and the Kodiak Island Borough into GIS using ARC/INFO.

b. Inventory and enter into GIS all roads, trails, docks and airports that provide public access.
c. Edit land ownership coverages.
d. Inventory and enter into GIS all navigable waterbodies.
e. Create 1:63,360-scale maps of the data.
f. Prepare map color separations on an electrostatic plotter.
g. Print and distribute easement atlases.

Phase II - Marking (Lead agency: USFS)
The easements that need to be marked include 45 trails and 37 site easements along the coast of Prince William Sound, 20 roads and trails and 13 sites around the town of Cordova, and 5 trails and 4 sites near Miles Lake. Additional easements are expected to be withheld in pending conveyance documents. About 15 miles of trail and 10 to 12 sites can be completed in a season. In Phase II of this project, the U.S. Forest Service will:

1. Identify conflicts that must be resolved..

2. Verify in the field the usability of easement locations and other proposed resolutions of conflicts.

3. Mark easements, survey them using GPS coordinate system for easy incorporation into GIS datasets, and place signs for public recognition.

C. Schedule

Phase I, identification and mapping of easements, will be completed by the end of FY 95. Phase II, marking easements within Prince William Sound, will begin in FY 96 and continue through FY 98.

Phase I - Identification and Mapping

Prince William Sound	
Confirmation of easements	Nov 94
Color separations to printer	Dec 94
Easement atlas distributed	Jan 95
Kodiak Island Borough/AK Peninsula	
Complete data entry	Feb 95
Complete public/agency meetings	Apr 95
Edit and finalize data	Jun 95
Complete check plots	Jul 95
Color separations to printer	Aug 95
Atlas distributed	Sep 95

Phase II - Marking

Identification of conflicts	FY 95
Field verification	FY 95
Easements marking and surveying	FY 96-98

D. **Technical Support**

The easement atlases will be printed under contract with a private firm. Estimated csot is $48,000.

E. **Location**

Atlases will be prepared for Prince William Sound and Kodiak Island Borough. Easements will be marked in Prince William Sound only.

PROJECT IMPLEMENTATION

This project would be implemented by ADNR and the USFS. ADNR maintains GIS datasets for this information and can efficiently and effectively complete the project. The USFS manages most of the ANCSA 17(b) easements in Prince William Sound.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will complement and provide input to the habitat protection process. It will also provide data and information for two projects proposed for FY 95: the Information Management project and the Terrestrial Habitat Protection Project.

FY 95 BUDGET ($K)

		ADNR	USFS	TOTAL
100	Personnel	40.3	30.0	70.3
200	Travel	2.5	3.0	5.5
300	Contractual Services	52.0	10.0	62.0
400	Commodities	0.0	2.0	2.0
500	Equipment	0.0	0.0	0.0
600	Capital Outlay	0.0	0.0	0.0
	Subtotal	94.8	45.0	139.8
	General Administration	9.7	5.2	14.9
	Total Cost	104.5	50.2	154.7

This page intentionally left blank.

Restoration of the Coghill Lake Sockeye Salmon Stock

Project Number:	95259
Restoration Category:	General Restoration (continuation of 94259)
Proposed By:	ADFG
Cooperating Agency:	USFS
Cost FY 95:	$333,000 (includes $86,600 for data analysis and report writing of FY 94 work)
Cost FY 96:	$325,900
Total Cost:	Unknown
Project Duration:	5 years
Geographic Area of Project:	Prince William Sound
Injured Resource/Service:	Sockeye salmon

INTRODUCTION

This project will restore the natural productivity of Coghill Lake and the resident sockeye salmon (*Oncorhynchus nerka*) population through lake fertilization. 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 may have 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 dangerously 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 travelling 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.

NEED FOR THE PROJECT

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.

PROJECT DESCRIPTION

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. ADFG 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.

A. Objectives

The ADFG component of the project will achieve the following objectives each year:

1. Apply liquid fertilizer to Coghill Lake between June and September,
2. determine the response of lake nutrient levels, primary and secondary production, and plankton species composition to lake fertilization,
3. determine if the prey composition, growth, and overwinter survival of sockeye salmon fry changes in response to lake fertilization, and
4. estimate the effect of fertilization on lake carrying capacity and smolt-to-adult survival.

B. Methods

Objective 1

Lake fertilization is recommended for one sockeye life cycle (5 years) to elevate the

productivity of the lake and the resident sockeye salmon population. A pharmaceutical-grade liquid fertilizer will be applied to the lake by releasing it from a low-flying aircraft. Application will consist of six to nine passes of five-minute duration one day each week. Approximately 3,000 kg of fertilizer will be applied each day. Fertilizer will be applied over the middle third of the lake comprising an area of 3.9 km^2. Twenty-three thousand kilograms of liquid fertilizer (20-5-0) containing 20% nitrogen and 5% phosphorus will be applied from mid-June to August 1. Thirty-one thousand kilograms of nitrogen fertilizer (32-0-0) comprising equal portions of ammonium, nitrate-nitrite, and organic nitrogen will be applied from August 1 to early September. People reserving the cabin at Coghill will be notified of the fertilization schedule. Notices will also be posted in the cabin. Fertilizer will be applied no closer than a mile and a half from the cabin and lagoon where most recreational activity takes place. The pilot will not drop fertilizer in a portion of the application area if anyone is within that area.

Objective 2

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-μm 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 after Vollenweider (1976). Euphotic zone depth and algal standing crop will be estimated after Schindler (1971) and Strickland and Parsons (1972), respectively. 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 25 m depth.

Objective 3

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 120-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 ten 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 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 methods developed by Volk et. al. (1984). 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.

Objective 4

The effect of lake fertilization on lake carrying capacity will be evaluated using techniques developed by Koenings and Burkett (1987). The mean annual zooplankton biomass for Coghill Lake will be used as the independent variable in a regression model relating zooplankton biomass in Alaskan lakes to smolt biomass. Actual smolt biomass in Coghill Lake will be compared with expected smolt biomass from the regression model to evaluate growth and mortality of sockeye fry in Coghill Lake. The effect of lake fertilization on smolt-to-adult survival will be also be evaluated using techniques developed by Koenings. The mean size of Coghill Lake smolt will be used as the independent variable in a regression model relating mean smolt size in Alaskan lakes to smolt-to-adult survival. Actual smolt-to-adult survival will be estimated when the fish return as adults one to three years after outmigration.

C. Schedule

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	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

D. Technical Support

Hydroacoustic fish abundance estimates in Coghill Lake will be provided by the Prince William Sound Science Center (PWSSC). The staff of the PWSSC have considerable expertise in quantitative hydroacoustic techniques including work at Coghill Lake in FY94. Their continued participation in this project will provide of consistency in hydroacoustic techniques and thus valid interannual comparisons of fry abundance estimates.

E. Location

This project will be conducted at Coghill Lake which is located in northwest PWS on the east shore of Port Wells. The Coghill Lake sockeye salmon population migrates through several fishery districts in western PWS.

PROJECT IMPLEMENTATION

The ADFG will collect field samples of juvenile salmon for this project. The ADFG is responsible for managing the sockeye salmon resource in the PWS area. In addition, the ADFG is responsible for the development, oversight, and evaluation of salmon enhancement projects in PWS. The ADFG has conducted limnological and sockeye salmon smolt studies in Alaska during the past twenty-five years. The PWSSC will conduct hydroacoustic surveys of Coghill Lake to estimate fry abundance. The staff of the PWSSC have considerable expertise in quantitative hydroacoustic techniques including work at Coghill Lake in FY94.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will be integrated the project Coded-wire Tag Recovery of Other Salmon Species. This project will provide estimates of fishery catches of Coghill Lake sockeye salmon that are needed to estimate the total return of salmon to Coghill Lake and smolt-to-adult survival.

FY 95 BUDGET ($K)

Personnel	127.1
Travel	2.5
Contractual	157.3
Commodities	16.0
Equipment	0.0
Subtotal	302.9
Gen. Admin.	30.1
Total	333.0

Subtidal Monitoring: Recovery of Sediments in the Northeastern Gulf of Alaska

Project Number:	95285-CLO
Restoration Category:	Monitoring (closeout)
Proposed By:	NOAA
Cost FY 95:	$121,000
Cost FY 96:	$0
Total Cost:	$121,000
Duration:	1 year
Geographic Area:	Gulf of Alaska
Injured Resource/Service:	Subtidal organisms

INTRODUCTION

Subtidal sediments were found to be contaminated by oil at five locations in the Gulf of Alaska (GOA) in 1989. Although hydrocarbon contamination was usually confined to shallow sediments (0-3 m) in GOA, sediment contamination reached a depth of 20 m at at least one location (Chugach Bay). Recovery rates of subtidal marine sediments contaminated by petroleum hydrocarbons at the latitude of GOA are poorly known. Recovery to background levels of hydrocarbons in subtidal sediments at the contaminated sites in GOA may be nearing completion. The purpose of this project was to determine the amount of oil remaining in the subtidal environment at the locations formerly contaminated by oil in GOA sediments there and to compare the amount of oil remaining in sediments at those locations with that at comparable locations in Prince William Sound.

This study will provide the first assessment since 1990 of the contamination of subtidal sediments by *Exxon Valdez* oil outside Prince William Sound. The study will provide information on environmental hydrocarbon concentrations of use to the study on subsistence food [Project Identification Number (PIN), 94279] and the clam study (PIN 94081).

NEED FOR THE PROJECT

The resource that will be monitored is subtidal sediments in the bathymetric depth range of 0 to 100 m on the Kenai and Alaska Peninsulas. Demersal fish, benthic invertebrates, certain diving birds and mammals prey on organisms associated with subtidal sediments. Investigators

attempting to restore or monitor recovery of populations of these organisms following the *Exxon Valdez* oil spill will need to know the concentrations of petroleum hydrocarbons present in these sediments.

PROJECT DESCRIPTION

A. Objectives

1. Determine the composition and concentration of petroleum hydrocarbons from the *Exxon Valdez* oil spill in intertidal and subtidal sediments (0-100 m) in the Gulf of Alaska by GC/MS.

2. Compare concentrations of hydrocarbons in subtidal sediments outside Prince William Sound with concentrations at comparable depths inside the Sound.

3. Compare concentrations of hydrocarbons in subtidal sediments outside Prince William Sound in 1994 with concentrations found at the same stations in 1989 and assess the extent of recovery of those sediments.

4. Complete hydrocarbon analysis of sediments collected in Prince William Sound in July 1993.

B. Methods

The methods will be similar to those employed for sediment sampling under the Natural Resource Damage Assessment Subtidal Study Number 1. They are summarized briefly below. Sediment samples will be collected at one intertidal station and five subtidal stations. Intertidal collections will be made at a single tidal height in the range of +1 to -1 m relative to mean lower low water (MLLW) depending on the distribution of fine sediments. Three samples, each a composite of 8 subsamples, collected randomly along a 30 m transect laid parallel to the shoreline will be taken at each intertidal site. These samples will be collected at low tide or by divers.

Subtidal sediment collections will be made at 3, 6, 20, 40 and 100 m below MLLW. Collections at 3, 6 and 20 m will be made by divers on transects laid along the appropriate isobath and sampled in the same way as described above for the intertidal transects. Samples taken at depths below 20 m will be collected with a Smith-McIntyre grab. Three grabs will be taken at each depth. Four subsamples will be removed at randomly selected points within each grab. The subsamples will be combined to form one sample per grab.

All samples collected by hand (including those removed by hand from the Smith-McIntyre grab) will be taken from the surface (top 0-2 cm) of the sediment column. Samples taken by hand in the intertidal region will be collected using a chrome-plated brass core tube (3.6 cm inside diameter) and chrome plated spatula. Each subsample will be transferred to a sample jar using

the spatula. The core tube and the spatula will be washed, dried and rinsed with methylene chloride between samples. Sample jars will be cleaned to EPA specifications for hydrocarbon sampling. The jars will be fitted with teflon lined caps also cleaned to EPA specifications. Samples will be placed in coolers with ice immediately after collection and will be frozen within an hour. Appropriate blanks will be collected at each site. Chain of custody procedures will be followed after collection of all samples.

C. Schedule

Sediment sampling wasl be conducted in July 1994. Chemical analyses will be completed by November 1994. Data compilation and analysis will be completed by March 1995. A progress report will be submitted in November 1994 and a final report will be completed by April 1995.

D. Technical Support

The project will require technical support in hydrocarbon chemistry (UV spectrophotometry and gas chromatography/mass spectrometry). The chemistry will be performed at the Auke Bay Laboratory.

E. Location

This project sampled 7 sites in the Gulf of Alaska (2 reference sites and 5 contaminated sites) and four sites in Prince William Sound (2 reference sites and 2 contaminated sites). The sites were Black Bay, Tonsina Bay, Windy Bay, Chugach Bay, Hallo Bay, Katmai Bay, Wide Bay Moose Lips Bay, Northwest Bay, Olsen Bay and Sleepy Bay. Except for Wide Bay which was sampled only in 1989 all sites were sampled once in 1989 and in 1990 under the NRDA program .

PROJECT IMPLEMENTATION

Name	Responsibility
Stanley Rice	Overall management
Charles O'Clair	Management of data analysis and report writing.
Jeffrey Short	Management of chemical analyses.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The agency will contribute, partially, the management salaries of Rice, O'Clair and Short (~$34K). The project will pay the salaries required for field work, analytical chemistry and data analysis. During the time period October 1, 1993 to September 30, 1994 the agency will complete hydrocarbon analysis, data compilation and analysis and report writing for the field study conducted in Prince William Sound in July 1993.

FY 95 BUDGET ($K)

Personnel	97.9
Travel	3.0
Contractual	0.0
Commodities	5.4
Equipment	0.0
Subtotal	106.3
Gen. Admin.	14.7
Total	121.0

Prince William Sound Pink Salmon Stock Identification and Monitoring Studies (CWT)

Project Number:	95320B
Restoration Category:	General Restoration (continuation of 94320B)
Proposed By:	ADFG
Cost FY 95:	$260,500
Cost FY 96:	$248,600
Total Cost:	$509,100
Duration:	2 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon

INTRODUCTION

In the decade preceding the *Exxon Valdez* Oil Spill (EVOS) production of pink salmon *Oncorhyncus gorbuscha* in Prince William Sound (PWS) ranged from 10 to 15 million fish and represented an important component of the commercial fishery on salmon. Much of the spawning for pink salmon (up to 75% in some years) occurs in intertidal areas. These 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.

Salmon populations impacted by the EVOS are heavily exploited in commercial, sport, and subsistence fisheries and their restoration can most effectively be achieved through more sensitive management of the commercial fishery. The populations (stocks) in areas heavily impacted by the EVOS are present in fisheries dominated by hatchery fish. 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 will require accurate inseason estimation of the stock composition of the catch if different harvest rates are to be achieved for damaged wild stocks versus hatchery stocks. This project will provide those estimates.

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. Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association, and the Alaska Department of Fish and Game 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, with the Trustee Council providing matching funds. This proposal is to request the same matching funds for the 1995 season.

NEED FOR THE PROJECT

Populations of wild pink salmon in PWS which were injured by the EVOS continue to experience poor reproductive success. These populations must be protected from other sources of injury or mortality which could further reduce their long term reproductive success.

Adult returns from injured wild populations mingle with other wild and hatchery populations in PWS waters and all are heavily exploited by commercial fisheries. Successful restoration of injured populations will require that they be exploited at a lower rate in these fisheries until their reproductive rates return to historic average levels. Minimizing the exploitation of injured wild populations will insure that sufficient numbers adults from enter streams to spawn. This project provides fisheries managers with real time estimates of the numbers of wild and hatchery fish in commercial harvests. These estimates enable managers to identify areas where exploitation of wild populations can be minimized while permitting the timely harvest of economically important hatchery returns.

PROJECT DESIGN

This project is designed to provide estimates of hatchery and wild fish contributions to commercial and cost recovery fisheries of pink salmon in Prince William Sound. 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.

A. Objectives

1. 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;

2. Provide timely in season estimates of hatchery and wild stock contributions to harvests by time and area to fisheries managers;

3. 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;

4. Estimate marine survival rates for each uniquely coded hatchery release group and;

5. 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 specific to each hatchery release group, and fisheries management actions taken to reduce the exploitation on wild stocks based on in season estimates of the stock composition of fisheries harvests.

B. Methods

Tag recoveries will be made from a stratified random sample. Fisheries will be stratified by district, discrete time segments and processor. For each stratum, 15% of the pink salmon commercial harvest and the cost recovery harvest will be scanned for fish with a missing adipose fin. Catch sampling will be conducted in processing plants located in Cordova, Valdez, Anchorage, Whittier, Kenai and on floating processors. Brood stock sampling will also occur at all 4 PWS pink salmon hatcheries. A minimum of 50% of the daily brood stock requirements at each hatchery will be scanned for fish with missing adipose fins.

In the catch, cost recovery and brood stock samples, the total number of fish scanned and the total number of fish with missing adipose fins will be recorded. The heads of fish with missing adipose fins will be removed, labelled and shipped to the Tag Lab in Juneau for tag removal and decoding. Tag recovery, scanning, and catch data will be merged in a computer data base and returned to Cordova for analysis.

C. Schedule

June 20 - Sept 15, 1995	Tag recoveries in commercial fisheries, cost recovery harvests, and brood stocks. Inseason catch stock composition estimates by time and area for management of commercial and cost recovery fisheries.
Nov 30, 1995	Draft Report
Jan 30, 1996	Final Report

D. Technical Support

ADFG will supply biometrics support to ensure that project methods and data analyses will provide inseason stock contribution estimates at levels of accuracy and precision required for management of wild stocks in PWS.

E. Location

Sampling of salmon catches from commercial and cost recovery fisheries will occur in shore based processing plants in Cordova, Valdez, Whittier, and Kodiak and on floating processors in PWS. Extraction and decoding of tags will be accomplished by the ADFG 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.

PROJECT IMPLEMENTATION

This project is applied research which has direct and immediate applications to ADFG's statutory obligation to manage fisheries. Feasibility studies for the massive coded wire tagging and recovery operations required to manage PWS pink salmon were conducted by ADFG and the local, private aquaculture associations for two years prior to the EVOS. These agencies developed the methods described for this project, they have the infra-structure (e.g. the ADFG coded wire tag laboratory) in place for large scale tagging and tag recovery operations, and they are the logical choice for conducting this project.

The project is proposed as a cooperative effort to be funded by the Trustee Council, ADFG, and PWS aquaculture associations. Coded wire tags recovered by this project are presently applied by Prince William Sound Aquaculture Corporation (PWSAC) and Valdez Fisheries Development Association (VFDA) at their expense. The annual cost of tag application by these private non-profit corporations is approximately $160 thousand. Funds provided by the EVOS Trustee Council for tag recovery activities will be matched in part by ADFG, PWSAC and VFDA. Funds from the latter two sources will be conveyed to Alaska Department of Fish and Game through cooperative agreements.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The monitoring, research and restoration objectives of this project are integral to the success of ecosystem research and restoration efforts described by the Sound Ecosystem Assessment (SEA) plan. It is an integral part of a package of proposed projects including the SEA (95320), the Salmon Otolith Marking (95320c), and the Pink Salmon Egg and Alevin Mortality (95191) projects. This project monitors the total returns and survival rates of wild stocks identified as damaged by the Pink Salmon Egg and Alevin Mortality Study (95191) and provides information critical to their restoration. This project provides survival estimates for individual release groups from the Experimental Release component of the SEA proposal. These estimates are critical to

several components of SEA including those investigating:

1. The dependence of pink salmon survival on sea surface temperatures, and other oceanographic features of PWS during the fry and juvenile life stages.

2. The dependence of pink salmon survival on the abundance, size, growth rate, and distribution of pink salmon fry and juveniles and, zooplankton population distribution, abundance, and species composition, and

3. Pink salmon survival in relation to abundance, size, growth rate, and distribution of pink salmon fry and juveniles and the abundance distribution, size, and species composition of predator populations.

This project is also directly linked to the proposed Otolith Marking project . Otolith marking is a logical extension of marking technology which will ultimately replace many of the functions of coded wire tags and provide more accurate and precise estimates of hatchery and wild contributions to salmon catches and escapements in PWS at less expense. However, until otolith marks can be applied, coded wire tagging and recovery projects will continue to provide those estimates.

This project will integrate tender fleet tracking, processor plant logistics, and crew scheduling with existing ADFG salmon port sampling projects. Local aquaculture associations which apply tags as part of study 95320 provide all tagging, fry release, sales harvest, and brood stock data necessary for data analysis. Aquaculture associations also provide room, board, and logistics support for brood stock samplers at their hatcheries. Air charter and boat transportation required to get samplers to remote locations in PWS will be shared with other projects having similar needs.

FY 95 BUDGET ($K)

Personnel	175.1
Travel	12.0
Contractual	26.6
Commodities	14.7
Equipment	4.0
Subtotal	232.4
Gen. Admin.	28.1
Total	160.5

This page intentionally left blank.

Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon in Prince William Sound

Project Number:	95320C
Restoration Category:	General Restoration (continuation of 94320C)
Proposed By:	ADFG
Cost FY 95:	$642,200
Cost FY 96:	Unknown
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon

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 averaged approximately 10 million fish annually over the last two decades. The huge fry outmigrations and subsequent adult returns of pink salmon play major roles in the Prince William Sound (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.

PWS pink salmon returns originating from brood years subsequent to the EVOS have been aberrant or weak. Returns of wild and hatchery pink salmon in 1991 were only slightly below the mid-point of the pre-season forecast but arrived late and had very compressed run timing. The fish were also small and in advanced stages of sexual maturity long before reaching their natal streams. As a result of this small size and advanced maturity, the fish were of little commercial value. Returns of pink salmon in 1992 and 1993 were far fewer than expected. The 1992 return of wild pink salmon was the fourth smallest even year return in the last 30 years and the hatchery return was less than one third of expected. The 1993 return of wild pink salmon was the third smallest in the last 30 years and the hatchery return was less than one fifth of expected.

Pink salmon returns to PWS are dominated by hatchery produced fish. In addition to their dominance in the catch, hatchery stocks may also complicate management of PWS fisheries by straying into streams and spawning with wild fish. The magnitude and range of straying by both hatchery and wild pink salmon stocks in PWS may significantly influence the success or failure of restoration efforts directed at wild stocks. The definition of what constitutes a wild population and the scale of restoration efforts may change if significant straying also occurs among wild populations. If straying of hatchery fish is significant and does lower the fitness of wild populations, restoration efforts which concentrate on insuring that spawning escapement goals are met may fail if no attention is given to the origins of the escapement.

Coded wire tags have been the tool of choice for applying unique marks to populations of pink salmon in PWS. The methodology has been used extensively to estimate hatchery and wild stock contributions to commercial harvests and has also been used in preliminary straying research. Despite its usefulness, there are drawbacks to coded wire tag technology. Approximately 1 million coded-wire tags must be applied to pink salmon fry each year to obtain catch contribution estimates for returning adults. Tagging and recovery are both very labor intensive and the number of tags applied and recovered are sometimes inadequate for the levels of accuracy and precision desired. Coded wire tags are also intrusive, tags can be shed, and tagging may affect subsequent survival. Tag loss through shedding and differential mortality of tagged individuals affects subsequent estimates of adult returns based on tag recoveries. There is also recent evidence that poor placement of coded-wire tags may cause salmon to stray.

Because of the cost and problems associated with coded wire technology, other alternatives for marking larger portions of populations with relatively inexpensive non-intrusive methods must be investigated. By marking most or all of the fish in a population, sample sizes at the time of tag recovery can be much smaller without affecting the accuracy and precision of contribution estimates. Non-intrusive marks which cannot be shed and which do not affect survival or behavior will eliminate important sources of error in mark-recapture population and straying rate estimates.

NEED FOR THE PROJECT

Development of a precise and less expensive stock separation tool will benefit wild salmon. Fishery managers will obtain a more powerful tool for use in reducing fishery exploitation on damaged wild stocks. The reduced cost of otolith marking compared with coded-wire tagging will allow restoration of salmon stocks with less impact on funds available for other species. The technique will initially be developed for pink salmon in Prince William Sound, but will likely be used for other salmon species in the EVOS impact area in the future. The communities of Homer, Seward, Valdez, and Cordova will be most affected by this project, since the economy in these communities is based on the salmon resource.

The tetracycline marking component of this project is designed to test the feasibility of a potentially powerful research and monitoring tool for wild populations of salmon in PWS. Wild populations of salmon are vital to the health of the marine, freshwater, and terrestrial portions

of the PWS ecosystem and to the fishing industry which is the cornerstone of the area economy.

PROJECT DESCRIPTION

This project will develop otolith mass marking as an inseason stock separation tool for salmon. This data is essential information used by fishery managers to reduce fishery exploitation rates on damaged wild salmon stocks. Coded-wire tags are presently used for this purpose, but otolith marking is expected to provide more accurate information at a lower cost. Recognizing the need to develop mass marking technology for pink salmon in PWS, the Alaska Department of Fish and Game (ADFG) and Prince William Sound Aquaculture Corporation (PWSAC) reviewed the feasibility of otolith thermal marking at PWS hatcheries as well as otolith recovery in the commercial fisheries.

Otoliths are small bones in the inner ear of fish. These bones can be marked through systematic changes in water temperature during egg incubation. The resulting marks are bands of light and dark material in the otolith similar to the bands in a tree. These induced marks can be used to identify hatchery-produced salmon in the fishery. Because all hatchery-produced salmon are marked using this technique, the cost of catch sampling is expected to be reduced, and the precision of inseason stock composition estimates are expected to be improved.

This project will be conducted cooperatively by the ADFG, PWSAC, and Valdez Fisheries Development Association (VFDA). In 1994, PWSAC and VFDA will install the necessary equipment and otolith mark all pink salmon embryos in the Armin F. Koernig (AKF), Wally H. Noerenberg (WHN), Cannery Creek (CCH), and Solomon Gulch (SGH) hatcheries. The equipment will be installed in the summer of 1994, and marking will begin after the embryos have passed the eyed stage of development. Heated water will be introduced at the hatchery head troughs allowing treatment of millions of pink salmon embryos simultaneously.
The project will be conducted over two pink salmon lifecycles, marking both odd- and even-broodline fish. This approach is necessary because (1) 35% and 75% of odd- and even-broodline spawners utilize intertidal habitats, respectively, and (2) experience with two complete lifecycles is needed to fully develop a program that integrates induced banding code quality, otolith processing rates and costs, and statistical designs for catch sampling. Cyclic temperature changes in salmon redds associated with the semi-diurnal tide produce natural otolith banding patterns in intertidal-spawning pink salmon. Embryos rearing in upstream redds are exposed to less regular stream temperature changes. Interannual differences in the proportion of upstream and intertidal spawners and natural stream temperature flucuations may produce very different natural otolith banding patterns in wild pink salmon populations in different years. It is essential that the relationship between wild salmon otolith banding patterns, induced otolith banding-code quality, otolith processing rates, and catch sampling design be fully integrated in the program. The quality of induced otolith banding-codes and natural banding patterns in wild populations will affect the ability of otolith readers to identify 'marked' fish. A reduction in the reader's ability to identify marked fish will affect the sample sizes needed to estimate stock composition, the total cost of otolith processing, and ultimately the efficacy of the program.

The feasibility and cost-effectiveness of sampling the commercial catch for otoliths will depend upon whether a representative sample can be collected from the fishery. Estimation of stock composition in commercial catches has always been important for effective fisheries management. Several sampling techniques will be evaluated in 1995 using fin-clip experiments to determine if a truly random sample is obtained from each tender load.

When otolith marked fish return as adults in 1996 and 1997, approximately 13,000 pink salmon otoliths will be processed in each year to estimate stock composition and corresponding confidence levels in PWS fisheries. The catch sampling program will also evaluate the variation in stock composition among tenders as well as between processors. A cost function for catch sampling will also be developed. This information will be used to produce an optimum allocation of sampling resources among tenders and processors. Monte Carlo simulation techniques will be used in conjunction with the data collected in this study to assess sampling power and refine sample sizes.

The ADFG Otolith Laboratory has the expertise required to rapidly process large numbers of otoliths. Approximately 250 otoliths can be processed and decoded by a single experienced technician within a working day. In 1993, the Otolith Laboratory processed 2,300 otoliths. These otoliths were recovered from Hawk Inlet commercial fishery catches and were used to estimate pink salmon contributions from the Gastineau Hatchery operated by DIPAC near Juneau.

A component of this study (*objective 4*) is designed to test the feasibility of chemically marking fish otoliths or skeletal parts by short term immersion in a dilute solution of tetracycline during the embryo or emergent fry life stages. Tetracycline has been used very successfully to apply chemical marks in many other fish species. Tetracycline is now regularly permitted by the United States Food and Drug Administration (FDA) for use as an antibiotic and otolith marking agent on fish destined for human consumption. Marks from tetracycline are permanent, relatively easy to apply, easily recognizable, and at low dosages do not appear to be alter fish survival. While the most widely reported means of applying tetracycline is by feeding, several investigators have reported successful marking of fish species by immersion in dilute solutions of the chemical. Spot and pinfish, coregonids, and striped bass, have all been successfully marked using immersion methods. There are less documented instances of pink and chum salmon having been successfully marked by immersion as well. While probably not cost effective for large hatchery releases reared in massive flow through incubator systems, tetracycline immersion is an attractive alternative for marking much smaller wild populations of pink salmon as the migrate out of their natal streams as fry. Marking the total fry population in a stream provides an accurate and precise tool for estimating total adult returns and survival. As a non-intrusive method which does not appear to alter fish behavior, chemical otolith marking may also provides a powerful tool for investigating straying among wild populations.

A. Objectives

1. Develop engineering designs and install otolith thermal marking equipment in the AFK, WHN, CCH, and SGH hatcheries.

2. Apply otolith thermal marks to all pink salmon embryos rearing in the AFK, WHN, CCH, and SGH hatcheries.

3. Collect voucher samples and evaluate the quality of otolith thermal marks applied to pink salmon embryos at AFK, WHN, CCH, and SGH hatcheries.

4. Identify a feasible methodology for otolith marking wild pink salmon outmigrant fry using tetracycline.

   a. Test and refine remote field camp methods and equipment to be used for immersing wild pink salmon fry in tetracycline solutions for up to 18 hours at varying temperatures,
   b. determine the minimum immersion time and temperature of pink salmon fry in tetracycline solution to insure that otoliths from 100% of the individuals immersed have a unique fluorescent tetracycline mark which is distinguishable from otoliths selected randomly from a pool of individuals which are not immersed,
   c. compare short term growth and survival among pink fry which are treated with tetracycline following capture versus those which are not.

B. Methods

Objective 1

Project concept designs will be developed for water heating systems at AFK, WHN, CCH, and SGH hatcheries. Key physical constraints and biological parameters considered in development of the designs will include: (1) the hatchery floor plan and incubation water system, (2) historic pink salmon development and water temperature data, (3) current equipment on site, (4) approximate thermal marking schedule, and (5) an assumed temperature increase of 3.5° C at each incubator. It is expected that the equipment needed for water heating will be installed in a module attached to the outside of each hatchery. This approach will eliminate the need to take up valuable space within each hatchery for thermal marking equipment. Concept designs will include a boiler with a self-contained glycol system and heat exchanger housed in a portable skid-mounted covered module. Fuel, water, and electricity will be provided to each thermal marking module. Designs for plumbing and electrical installation will vary among hatcheries due to differences in the utility configuration at each site.

Otolith marking technology has been developed at the Gastineau Hatchery operated by DIPAC in Juneau, Alaska. The DIPAC thermal marking system has been successfully used to mark 120 million pink and chum salmon embryos in the hatchery. The DIPAC system cannot mark all embryos simultaneously, but the hatchery operators have worked around the limitations to produce quality thermal marks. The experience gained at DIPAC will facilitate successful development of thermal marking technology at PWS hatcheries.

Pink salmon will be marked during the egg-to-hatch stage at PWS hatcheries. This approach will eliminate the need to degass the incubation water. Gas saturation is usually not a problem for salmon embryos prior to hatch. Salmon eggs maintain a positive internal pressure which

allows them to tolerate total dissolved gases (TDG) up to 110-116%. It would be uncommon to have TDGs of greater than 110% in incubation process water, but it may be possible to drive TDGs this high through aggressive heating. TDGs will be monitored during the thermal marking process. After hatch, gas supersaturation may cause salmon alevins to develop gas bubble disease. Expensive degassing equipment would be required to otolith mark pink salmon alevins.

Objective 2

A unique otolith thermal banding code will be used for each pink salmon hatchery in PWS. A unique hatchery mark will provide consistency in both application and recovery of the mark. The thermal mark will be applied in the eyed-egg to hatch zone of the otolith. The eyed-egg to hatch window occurs between October and December with an average length of 35 days. Approximately 22 days will be required to apply the thermal banding code at each hatchery. The hatchery-specific codes will be composed of 5-7 thermal rings (Table 1). A single code for each hatchery will allow estimation of survival rate by hatchery. However, hatchery operators may also need to estimate survival rate for three treatment groups within each hatchery. In this case, a treatment-group code composed of three thermal rings will be applied in addition to the hatchery-specific basemark to distinguish among treatment groups.

Table 1: Proposed basemarks for PWS pink salmon hatcheries. The thermal schedule describes the actual temperature regime. The letter "H" refers to the relatively Hot water, and "C" refers to Cold; the difference between the two temperature levels being 3.5 degrees Centigrade. The number directly before the thermal level is the number of rearing-hours at that level. Numbers in parenthesis before an "X" denote the number of repetitions.

Facility	Thermal Schedule	Banding Pattern
Cannery Cr.	(3X)48H:24C,(1X)96H:24C,(3X)48H:24C	III IIII
WHN	(4X)48H:24C,(1X)96H:24C,(2X)48H:24C	IIII III
AFK	(5X)48H:24C	IIIII
VFDA	(7X)48H:24C	IIIIIII

Objective 3

Quality control during mark application is an important part of the otolith thermal marking program. Quality control is related to mark decoding, since it will largely determine a reader's ability to properly identify the mark. The placement of the thermal banding code on the otolith is critical to mark quality. The banding code will be applied by lot (group of eggs taken on a

single day) or groups of lots, when the embryos are at the appropriate stage of development. Each incubating appliance will be sampled to ensure the mark was correctly applied. We expect that developmental stage and thus basemark placement will differ among lots within the hatchery. Temperature recorders will be installed at various points in the incubation system during mark application to document temperature changes.

A stratified-random sampling design will be employed to estimate the proportion of unmarked otoliths at each PWS pink salmon hatchery. One month after mark application, a random sample of alevins will be taken from each lot, preserved in 100% ethanol, and sent to the ADFG Otolith Laboratory in Juneau. Sample sizes will be selected in proportion to lot size, but a minimum of 100 alevins will be taken from each lot. At least thirty alevins will also be collected from each of 20 streams during the annual pre-emergent fry survey conducted by ADFG. The samples will be used initially to validate that each hatchery-specific code was properly applied. Blind tests will then be conducted to estimate the proportion of alevins marked at each hatchery. A reader's ability to distinguish hatchery-specific codes, and marked otoliths among unmarked otoliths will used to determine the proportion marked. The set of otoliths for the blind tests will be obtained from a random subsample of alevins (n=300) taken from each hatchery sample combined with 600 wild alevins (total 1800 otoliths). Samples from all sources will be randomly combined to construct six test sets of otoliths (n=300). This test design will result in a composition of otolith types very similar to that encountered in samples taken from the commercial fishery when the fish return as adults. Two blind tests will be conducted with each of three readers.

Blind tests will be conducted at the ADFG Otolith Laboratory in Juneau. After the otoliths are extracted from the alevins, they will be fixed to a glass slide with thermo-plastic cement. A grinding wheel will be used to remove material from one side of the otolith and expose the internal structures. The depth of grinding will be monitored by repeated viewing under a dissecting microscope. After the internal bands are exposed, the thermal mark will be decoded under a compound microscope.

Objective 4

Marking feasibility studies will be conducted adjacent to the Prince William Sound Aquaculture Corporation Cannery Creek Hatchery in Unakwik Inlet, PWS, using equipment identical to that proposed for future field camp use. Fry for the study will be donated by the hatchery.

a. Testing Marking Procedures

A buffered solution of tetracycline hydrochloride (Tetra-bac) diluted to 400 parts per million in fresh water will be used to mark all treatment groups in this experiment. Although lessor dosages have been successfully used for some warm water species, this dose has been used with success in chum salmon. Emergent hatchery pink salmon fry immersed in this dose for 24 hours during a small test conducted by the Cordova ADFG staff in the March of 1994 had no short term mortalities and exhibited no signs of stress during exposure. Short also reported that results improved to a point with increasing temperature and length of immersion. This study will test 12 unique combinations (t_{ij}) of immersion time (i) and temperature (j). Immersion

times of 3, 6, 12 and 18 hours (i = 1,2, 3, and 4) will be tested at 2°, 5°, and 8° C (j = 1,2, and 3). There will be five replicates (r = 1,2,3,4, and 5) for each t_y.

Sharr et al. (1994c) observed as many as 50,000 fry migrating daily from moderate sized pink salmon streams during tagging and enumeration studies conducted in PWS in 1990 and 1991 as part of NRDA F/S Study 3 . Larger streams having peak daily fry outmigrations of 100,000 fish per day may be considered for enumeration and tagging studies if otolith marking proves to be feasible. Projections of costs and logistics constraints indicate that heating water and loading densities for immersion baths will be the factors which define the upper limit of chemical otolith marking at a remote field camp. Present projections for fry handling and personnel time as well as fuel and camp supply needs indicate that a typical two person crew at a remote fry enumeration camp can heat approximately 540 liters of tetracycline solution daily for marking fry. Under these constraints, loading densities of approximately 2,500 fry per treatment bag (approximately 180 fry per liter) must be possible if 100,000 fry are to be marked daily. Local aquaculture associations use loading densities as high as 320 fry per liter of aerated water for fry transport operations. It is likely that loading densities that high will result in significant mortalities among fry in a heated tetracycline immersion bath but it is assumed that the required densities of 180 fry per liter can be maintained. This experiment will also test that assumption.

Three 750 liter water baths, one for each temperature treatment, will be prepared in large insulated fish totes. Water will be heated and maintained at temperature by thermostatically controlled electric immersion heaters supplied by a gasoline powered generator. Fry emerging from hatchery incubators will initially be divided into 60 groups (12 treatments x 5 replicates) of 600 individuals each. Each 600 fish group will be placed in a clear polyethylene bag containing four liters of hatchery (stream) water at ambient stream temperature. Compressed air will be supplied to each bag via air stones to insure that fry receive adequate oxygen. A pre-mixed 135 ml. buffered tetracycline solution prepared by dissolving 2.25g of Tetra-bac and 2.0g dibasic sodium phosphate in 135ml of warm (~30°C) fresh water will be cooled to stream temperature and added to the each of 60 treatment bags. Fifteen additional bags will be left untreated and used for controls (c_y) to test the effects of tetracycline on survival at different temperatures and exposure times. Treatment bags and control bags will be transferred in equal numbers to each of the three heated water baths. The water temperature in treatments bags will be monitored and when all bags in a tote have reached the desired immersion temperature, timing for duration of immersion will begin. At the endpoints of each time treatment, five treatment bags will be removed from each of the three totes, transferred to a saltwater enclosure in front of the hatchery and allowed to cool to ambient seawater temperature. Fry from each bag will then be transferred to separate saltwater rearing cylinders constructed of fine meshed plastic screen (vexar). In addition, at the start of the treatment day fifteen groups of 600 fry each will be transferred directly from the hatchery into saltwater rearing cylinders. These fry will act as controls for testing the marking effectiveness of each of the 12 treatments. All treatment and control groups will be held and fed in saltwater rearing pens for four weeks to insure that the treatment band is deposited on the otolith and that otolith growth occurs beyond the marking band. At the end of four weeks, fry from each rearing cylinder which represent one replicate of a treatment group will be transferred to a light proof black plastic bottle containing 90 % ethyl

alcohol and shipped to the Alaska Department of Fish and Game Otolith Processing Laboratory in Juneau (Otolith Lab) for otolith removal and processing.

b. Determining the Minimum Required Treatment

If otolith marked wild populations are to be considered as being representative of other unmarked wild populations then one important criteria for marking success should be that application of the mark does not significantly affect survival. The number of mortalities in each 600 fish treatment and control group will be enumerated for the treatment and rearing periods and totaled. A one way analysis of variance will be used to test for total mortality differences between each treatment group and their corresponding control. Any treatment which has total mortalities significantly greater than those observed in the corresponding control group will be eliminated from further consideration as a potential marking treatment.

All otolith extractions and processing will be completed by the Otolith Lab. Initially a random sample of 30 otoliths from the first replicate of the maximum treatment group (18 hours at 8° C) will be mounted and processed to determine if the maximum treatment resulted in a tetracycline mark. If some or all of the 30 otoliths examined bear no mark it will be assumed that lesser treatments are equally or more ineffective, that tetracycline marking procedures tested are not effective, and that the experiment should be terminated with no further expenditure of funds for otolith processing. If all 30 otoliths are marked then a systematic search will be initiated to find the minimum treatment required to insure that a recognizable mark is produced in 100 percent of the individuals treated.

The systematic search for the minimum required treatment from among those having no effect on survival will proceed according to the following steps:

(1) 30 otoliths from each replicate of t_{11} will be processed and examined by a trained observer.

(2) If all 30 are marked, 30 more otoliths from the first replicate t_{111} will be extracted, mounted on slides then randomly mixed with 30 similarly prepared otoliths from the control group of fish c_0. The trained observer will examine this pool of 60 otoliths and attempt to correctly identify the treated individuals.

(3) If the observer correctly identifies all of the treated individuals from a pool of t_{111} and c_0, the procedure in step (2) will be repeated three more times for similar t_{111}, t_{112}, t_{113}, t_{114}, t_{115} and control pools.

(4) If at any point in these tests the observer fails to detect a mark on an otolith which has been treated, the procedure will terminate for $i=1$ and begin anew at step (1) for $i=2$ through 4.

(5) If the observer fails to classify any time treatments of temperature $j=1$ with 100 percent accuracy the steps (1) through (4) will be repeated for treatments t_{12} through t_{34}.

(6) At the first instance of the observer correctly identifying all marked individuals in all replicates for a treatment t_{ij} it will be determined that this is the minimum treatment suitable for marking.

Subsequent to identifying the minimum suitable treatment, 30 otoliths from each of the first replicates of each remaining untested treatment group which had no significant mortalities may be examined to determine if more readily identifiable marks available and if accidentally elevated temperature in the field may adversely affect marking. If a more readily identifiable mark is identified, steps one through three list above will be repeated for that treatment. If 100 percent classification accuracy is achieved by the observer for all replicates of the treatment, this new treatment will be designated as the minimum treatment of choice and the former selected treatment will become the alternate treatment of choice. The decision as to which to use in future field studies will based upon which had the lowest mortality rate during treatment and subsequent rearing.

c. Testing Effects of Tetracycline

If results of the marking study indicate that tetracycline is a suitable marking agent for use on wild pink salmon an FDA permit will be acquired for use in future years when marked fish are to be released. As part of the permit, the FDA stipulates that investigators must contribute to furthering the knowledge about the biological effects of tetracycline. Typically they require that a set of controls be maintained for each treatment application of the chemical and that results of treatments and controls be compared. Because fry are not being released, these comparisons are not required for this feasibility study. However, they can be done at no additional cost and by doing them, we may facilitate obtaining future permits when fish are to be released.

Mortalities from each of the treatment controls (c_{ij}) which were held in fresh water but subject to time and temperature treatments will be enumerated and totaled for the treatment and rearing phases of the experiment. A one way analysis of variance will be used to test for significant differences between mortalities observed among controls and those observed in the corresponding treatment groups immersed in tetracycline (t_{ijr}).

C. Schedule

This project will be conducted over one pink salmon life cycle for both the odd- and even-broodline populations. Embryos will be otolith marked in the fall of 1994 and 1995. The adult fish from the 1994 and 1995 year classes will return to PWS as adults in the summers of 1996 and 1998.

Table 2: Schedule of activities for otolith thermal marking program over the duration of the project (FY 1994-1997).

Date	Activity
2/94- 8/94	Install water heating equipment at PWS pink salmon hatcheries
10/94-12/94	Apply otolith banding codes to even-broodline embryos at hatcheries
2/95- 4/95	Apply coded-wire tags to even-broodline pink salmon fry at hatcheries
4/1/95	Submit annual project report for FY 1994
7/95- 9/95	Develop a method to collect random otolith samples from tender boats

10/95-12/95	Apply otolith banding codes to odd-broodline embryos at hatcheries
2/96- 4/96	Apply coded-wire tags to odd-broodline pink salmon fry at hatcheries
4/1/96	Submit annual project report for FY 1995
8/96-10/96	Recover thermally marked even-broodline adults from the commercial fishery
8/96-12/96	Determine optimal allocation of sampling effort and refine sample sizes
4/1/97	Submit annual project report for FY 1996
8/97-10/97	Recover thermally marked odd-broodline adults from the commercial fishery
8/97-12/97	Re-evaluate optimal allocation of sampling effort and sample size estimates
4/1/98	Submit annual project report for FY 1997

Table 3: Schedule of activities for tetracycline marking component in 1994.

Dates	Activity
4/5 - 5/5	Apparatus set up at Cannery Creek Hatchery, marking immersion treatments, and rearing of treatments and controls
5/5 - 5/15	Dismantle and remove equipment at Cannery Creek and ship otolith samples to Otolith Lab
5/15 - 9/15	Process otoliths at Otolith Lab
4/1/95	Submit annual project report for FY 1994

D. Technical Support

Data archiving services will be required to insure that all information obtained from this project is adequately documented and catalogued. The ADFG Commercial Fisheries Management and Development Division will provide biometrics support for review of project methods and data analyses. The ADFG Otolith Laboratory will supply otolith mass processing expertise.

E. Location

This project will be conducted in the PWS region. Embryos will be thermally marked at the AFK, WHN, CCH, and SGH hatcheries operated by the PWSAC and VFDA. Otolith code development and quality control work will be conducted at the ADF&G Otolith Laboratory in Juneau. In future years, an otolith catch sampling program will be developed. Catch sampling will likely occur in all PWS communities, as well as, Anchorage, Kenai, and Kodiak. Data analyses and reporting will be completed by ADF&G staff in Cordova and Anchorage. The tetracycline marking component of the project will be conducted at the CCH Hatchery.

PROJECT IMPLEMENTATION

The ADFG will oversee installation of thermal marking equipment in PWS hatcheries and develop otolith catch sampling designs. The ADFG is responsible for managing the pink salmon resource in the PWS area. In addition, the ADFG is responsible for the development, oversight, and evaluation of the salmon enhancement program. The ADFG has considerable experience in large-scale fish marking programs including the PWS coded-wire tag program. The existing ADFG fishery management program in PWS will provide salmon catch data needed to complete this project. The PWSAC and VFDA will install and operate otolith thermal marking equipment at four pink salmon hatcheries in PWS. These organizations are the operators of these facilities.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The Otolith Mass Marking Project (94187) will be highly integrated with several other salmon restoration projects in PWS. This project will complement the Sound Ecosystem Assessment (SEA) program (Project 94320). SEA is a multi-disciplinary program designed to develop an understanding of the mechanisms regulating ecosystem function in PWS. During its first year, SEA will focus on the interactions of pink salmon and herring with other components of the PWS ecosystem. Otolith marked fish will provide a valuable tool for examining interactions between wild and hatchery salmon during the early marine period. The Salmon Growth component of SEA will utilize otolith marked juvenile pink salmon to (1) evaluate habitat overlap between wild and hatchery salmon, (2) compare size composition of wild and hatchery salmon in mixed schools, and (3) develop a tagging program to estimate juvenile salmon mortality within PWS and in the Gulf of Alaska. The Salmon Predation component of SEA will utilize otolith marked juvenile salmon to determine if predators select wild or hatchery salmon. Projects 94185 (Wild Salmon Straying) and 94192 (Hatchery Salmon Straying) were deferred in 1994 to allow for development of otolith thermal marking and tetracycline marking technologies in PWS. Without the availability of a non-intrusive mass marking methodology it is unlikely that reliable estimates of total return, survival, and straying rates for wild salmon populations would be possible. Therefore, the monitoring, research and restoration objectives of this project are related to several other projects including the Pink Salmon Genetics project (94189), and the Pink Salmon Egg and Alevin Mortality (94191) projects.

FY 95 BUDGET ($K)

Personnel	25.7
Travel	1.6
Contractual	568.6
Commodities	10.4
Equipment	8.2
Subtotal	614.5
Gen. Admin.	27.7
Total	642.2

Purchase of Isotope Radio Mass Spectrometer

Project Number:	94320I(3)
Restoration Category:	Research
Proposed By:	University of Alaska Water Research Center, Inst. of Northern Engineering
Lead Trustee Agency:	ADFG
Cost FY 95:	$257,400
Cost FY 96:	$0
Total Cost:	$257,400
Duration:	1 year
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

The increased demand for stable isotope ratio analyses associated with studies of ecosystem dynamics in Prince William Sound has currently filled our analytical capabilities almost to capacity. Projected demands for the FY95 year and beyond indicate that a major increase will occur in the number of samples associated with oil-spill related studies. This may mean substantial delays in data acquisition even if no serious machine breakdowns or personnel problems occur. The sample load from the SEA projects coupled with other proposed studies by both the Prince William Sound Science Center and the research institutes at the UAF indicate that a substantial increase in load in the order of several thousand samples will occur next year.

PROJECT DESCRIPTION

This proposal seeks funds to purchase a Europa isotope ratio mass spectrometer and support a technician to accomplish the projected analysis load in a timely fashion and to provide a buffer in case of a serious machine breakdown or personnel delays with our current system. The system proposed for purchase will analyze carbon and nitrogen isotope ratios simultaneously

and will allow efficiency of operation through the use of common components. We currently operate a Europa ANCA 20/20 machine and will aim at acquiring a similar piece of equipment.

We are also requesting funds for a technician to operate the equipment. Our mass spectrometer technician, N. Haubenstock, is fully occupied in keeping the current equipment operational and with sample processing, data entry and associated tasks. She would be unable to maintain and operate two machines simultaneously without technical assistance. The enclosed budget provides for that assistance.

We propose to house the system in the Water Research Center as part of the UAF Stable Isotope Ratio Mass Spectrometry Facility. The Water Research Center has room in the air conditioned laboratory to house the instrument and the required regulated power and ancillary facilities such as a sample preparation laboratory.

We request the funds to purchase a Europa automated mass spectrometry system complete with automated sample combustion system and the data handling capabilities. The price quoted for this system is approximately $145,000 with an additional $15,000 requested for the start-up materials including a Cahn electromicrobalance, high-purity gases, additional primary standards and a small bench-top grinder for homogenizing samples.

We identify this equipment in order to take advantage of a consolidated supply of spare parts and expendables and, more importantly, the accumulated knowledge of operational details gained over the past years with our present Europa system.

The mass spectrometer will be operated as part of the UAF Stable Isotope Mass Spectrometry Facility which is jointly supported by the Water Research Center, Institute of Northern Engineering and the Institute of Marine Science. We have successfully operated this facility since 1985 and steadily expanded our services and capacity to the University community. The proposed instrument is anticipated to be fully occupied with samples generated by the SEA project and related EVOS Trustee Council-funded studies. There will be no singular dedication of the machine to these samples as all samples are run in order of receipt and by sample type. Set-up for a particular sample type will include all incoming compatible samples on that machine. Analysis fees will be charged for all samples as they reflect usage of expendables (high purity oxygen and helium, replacement combustion tubes, combustion tube packing, computer supplies, sample cups, etc.). They do not reflect operator costs which are budgeted separately.

SCHEDULE

1 Nov	Order mass spectrometry system
15 Feb	Anticipated receipt and installation

1 Mar and continuing	Attain operational status and commence isotope ratio analyses on samples

FY 95 BUDGET ($K)

Personnel	45.3
Travel	0.0
Contractual	0.2
Commodities	5.0
Equipment	164.0
Subtotal	214.5
Overhead	42.9
Total	257.4

This page intentionally left blank.

PWSAC - Experimental Fry Release

Project Number:	95320K
Restoration Category:	Research (continuation of 94320K)
Proposed By:	Prince William Sound Aquaculture Corporation
Lead Trustee Agency:	ADFG
Cost FY 95:	$47,300
Cost FY 96:	$53,400
Total Cost:	Unknown
Duration:	Unknown
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon

INTRODUCTION

Pink salmon hatcheries operated by the Prince William Sound Aquaculture Corporation annually release approximately 400 million pink salmon fry from three hatcheries located in the northern, northwestern, and southwestern corners of Prince William Sound. The fact that release timing, release location, size at release and number released per day can be controlled makes the hatchery pink salmon attractive as an experimental tool. The Sound Ecosystem Assessment (SEA) program advocates that experimental releases of hatchery juveniles will provide a powerful test of the influence of ocean-entry timing and of fry size at ocean entry on losses to predators.

NEED FOR THE PROJECT

SEA focuses on processes and mechanisms that regulate losses of fry and juveniles to predators after emergence from nearshore natal habitats. Research suggests that fry size is an important determinant of survival during early marine residence. The pink salmon fry release project supports SEA research to investigate this hypothesis.

PROJECT DESIGN

A. Objectives

1. Rear 8 million early emerging fry each at the Wally Noerenberg Hatchery (WNH) on Esther Island and Armin F. Koernig Hatchery (AFK) on Evans Island to 1.5 gram live weight for release in mid-June.

2. Determine the marine survivals of fry in experimental releases from coded wire-tagged individuals recovered in the brood stocks and common property fishery the following year.

3. Compare the marine survivals of late released larger fry with other releases at these same hatcheries.

B. Methods

AFK and WNH hatchery pink salmon fry begin exiting the incubators volitionally at an average weight of 0.23 grams in mid March. Following enumeration, the pink fry are conveyed to saltwater rearing pens. Approximately 8 million fry will be loaded in two rearing pens of 4 million each at the two hatchery locations. Coded Wire Tags (CWT) will be applied to approximately 1 out of every 200 fry in the experimental groups.

All fry will be fed a standard commercial diet of soft semi-moist fish food during the 75-85 days prior to release. Releases will occur simultaneously at the two facilities on or about June 15 when the fry are expected to have attained an average live weight of 1.5 grams. Routine reports on the rearing status of the fry as well as final release information will be communicated to SEA biologists on board trawl and purse seine vessels to assure nearshore and open water sampling is targeted on released fry.

C. Schedule

Feb 1995-Apr 1995: Oversee development of incubating pink salmon eggs and perform routine eggcare and incubation environment monitoring.
Mar 1995-Jun 1995: Enumerate, CWT, rear and release pink salmon fry.
Apr 1995-Jun 1995: Coordinate/communicate rearing and release of hatchery pink salmon fry with SEA research team.

D. Technical Support

The PWSAC salmon program receives technical support from permitting agencies, University of Alaska Fairbanks, University of Alaska Juneau, and PWS Science Center. The ADFG pathology lab, genetics lab, and coded wire tag lab are among specific expertise areas overseeing the hatchery salmon program.

E. **Location**

This project will take place in PWS at the Armin F Koernig Hatchery on Evans Island, and the Wally Noerenberg Hatchery on Esther Island.

PROJECT IMPLEMENTATION

PWSAC will implement the project in conjunction with ADFG as the lead agency.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is part of the SEA program research initiated in 1994 and proposed for continuation in 1995 as a powerful test of the influence of ocean-entry timing and of fry size at ocean entry on losses to predators.

FY 95 BUDGET ($K)

Personnel	0.0
Travel	0.0
Contractual	43.8
Commodities	0.0
Equipment	0.0
Subtotal	43.8
Gen. Admin.	3.5
Total	47.3

This page intentionally left blank.

Herring Predation by Humpback Whales in Prince William Sound

Project Number:	95320V
Restoration Category:	Research
Proposed By:	North Gulf Oceanic Society
Lead Trustee Agency:	ADFG
Cost FY 95:	$279,800
Cost FY 96:	$0
Total Cost:	$279,800
Duration:	1 year
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pacific herring

INTRODUCTION

In Southeastern Alaska and Prince William Sound, herring (*Clupea harengus pallasi*) and krill (*Euphausia pacifica, Thysanoessa spinifera, T. raschii*) are considered important prey items of humpback whales. Photo-identification and enumeration studies of humpback whales in Prince William Sound have been conducted every year from 1980 to 1994. Observations during these studies suggest herring as a food item of humpback whales. In Sitka Sound (southeastern Alaska) herring are an important fall/winter food item for humpback whales. Humpback whales were closely associated with the herring schools in western Prince William Sound during acoustic surveys completed by the Alaska Department of Fish and Game and Prince William Sound Science Center in 1993. There is concern that humpback whale predation may limit the recovery of the diminished herring biomass in the Sound. Additionally, the reduced herring resource may restrict the feeding opportunities for the whales and eventually reduce the population of whales that feed in Prince William Sound. This project will test the hypothesis that herring are a seasonally important food item of humpback whales in Prince William Sound and that the whales have a significant impact on the recovery of the EVOS damaged herring resource.

NEED FOR THE PROJECT

Because of the recent precipitous decline of the herring population in Prince William Sound, it is important to understand which factors are limiting the herring population and may effect or delay its recovery. Predation by humpback whales may be one of these factors.

Adult humpback whales may weigh as much as 43.9 metric tons, although, their average weight may be somewhat less. It has been estimated by Sargent that the feeding rate for adult rorquals is about 4% of body weight per day. Von Ziegesar et al. identified 59 humpback whales in 1989 and 65 whales in 1990 in Prince William Sound. If approximately half these whales (30 individuals) were to feed exclusively on herring during the September/October period (60 days), it is conceivable that they would consume as much as 3000 metric tons of herring. Aerial surveys in April of 1994 suggest that the current herring biomass in the Sound is in the range of 20,000 metric tons. Humpback whales could consume a substantial proportion of this biomass. During the October 1993 herring hydroacoustic surveys, humpback whales were repeatedly observed in the same area as both large aggregations and scattered schools of herring. On one instance, an estimated 15 or more whales were associated with a very large herring school between Green Island and Applegate Rocks. Whales were often associated with scattered schools of herring in the waters between Seal Rocks and Bay of Isles. Most of the herring were observed at depths of 10 to 60 meters. These shallow schools are well within the diving range of humpback whales, estimated to be 0-120 meters by Dolphin (1987). If herring are a critical prey item for the endangered humpback whales in the Sound, the diminished herring population may reduce the population of whales. In turn, the currently developing whale watching segment of the tourist industry will be negatively impacted.

PROJECT DESIGN

A. Objectives

Investigators will examine the impact of humpback whales on EVOS damaged herring stocks in Prince William Sound. In addition, they will assess the importance of herring as a food of Prince William Sound humpback whales. The seasonal importance of herring in the whales diet will be examined using acoustic and photographic techniques and whales enumerated using photo-identification techniques. Estimates of herring consumption by whales will be developed and a model of whale predation will be constructed.

B. Methods

Humpback whales will be located by search of historically important feeding areas or by using reports from other vessels. Whales feeding in the areas of operation of the SEA herring biomass surveys and other SEA hydroacoustic surveys will receive primary attention. Once located, feeding whales will be tracked on sonar as they descend to feed. Layers or patches of feed will also be visible on the sonar scan. The whales movement through these patches can be

observed and charted with sonar. This technique was established by Dolphin and has been used subsequently by J.Straley in southeast Alaska. Specially outfitted still cameras with video monitor will be lowered into the feed patches being used by the whales. Photographs of prey will be taken to determine species composition and density. Detailed hydroacoustic assessment of identified humpback whale prey biomass will be made by other SEA hydroacoustic survey vessels when possible. Concurrently, a skiff working from the survey vessel will conduct photo-identification operations in the area, enumerating individual humpback whales. Numbers of whales using specific feeding locations will be determined as well as estimates of numbers using the entire region. Estimates of prey consumption will be constructed based on metabolic requirements of the whales, prey composition, and the numbers of whales in the feeding population.

C. Schedule

Primary survey effort (25 days) will occur in October 1995 in conjunction with the proposed SEA herring biomass surveys. Additional surveys will be conducted in June/July 1995 (10 days) and September 1995 (10 days) to provide a more complete picture of whale seasonal feeding habits. These surveys will be coordinated with other SEA hydroacoustic assessment surveys. A summary of field activities will be provided in early November. Data analysis will occur in November and December 1995 and January 1996. Draft annual report will be submitted in March 1996.

D. Technical Support

Computer modeling and biometric support will be provided by project personnel at the Prince William Sound Science Center.

E. Project Location

Work will occur in southwestern Prince William Sound. Location of fieldwork will be dependent on humpback whale distribution. Distribution varies from year to year. However, in late fall (October), distribution is expected to coincide with the location of herring in the Montague Strait and waters east of Knight Island. Earlier surveys (June/July and September) will be located in Montague Strait or Lower Knight Island Passage.

PROJECT IMPLEMENTATION

This study will be conducted by the North Gulf Oceanic Society in conjunction with the Prince William Sound Science Center, University of Alaska, and Alaska Department of Fish and Game as a core project in the SEA program. NGOS personnel have over 14 years of experience studying humpback whales using photo-identification techniques. NGOS maintains an annually updated photographic catalogue of individual humpback whales. NGOS has conducted

preliminary hydroacoustic studies of humpback whale prey in cooperation with the National Marine Fisheries Service.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The success of this project will rely on coordination with other herring oriented projects in the SEA package. Fieldwork will be closely coordinated with 320H The role of Zooplankton in the Prince William Sound Ecosystem and 320N Nearshore fish/ Acoustics project.

FY 95 BUDGET ($K)

Personnel	7.2
Travel	0.0
Contractual	254.0
Commodities	0.0
Equipment	0.0
Subtotal	261.2
Gen. Admin.	18.7
Total	279.8

Waste Oil Disposal Facilities (Carry-forward of 1994 Funds)

Project Number:	95417
Restoration Category:	General Restoration (carry-forward)
Proposed By:	ADEC
Cost FY 95:	This project was funded for $232,000 in FY 1994; it is not yet complete. Authorization to spend FY 1994 funds ends on October 31, 1994. The Council is asked to reauthorize use of unspent funds to complete the project.
Cost FY 96:	$399,500
Total Cost:	Unknown
Duration:	1 year (additional funds may be requested in 1996 depending upon the results in 1995)
Geographic Area:	Oil spill area
Injured Resource/Service:	Multiple resources

INTRODUCTION

Project 94417, Waste Oil Disposal Facilities, was approved by the Trustee Council on January 31, 1994 for $232,200. As of June 1994, this project was awaiting conclusion of NEPA compliance activities. The project is expected to begin during late June or early July 1994, and it will not be completed before October 31, 1994. This project description requests that the Trustee Council allow funds not spent in fiscal year 1994 be used to complete the project in fiscal year 1995. Total expenditures for the two fiscal years will not exceed the $232,200 previously authorized by the Council.

NEED FOR THE PROJECT

(From the 1994 Project Description)
Vessels in Prince William Sound and the Gulf of Alaska, especially in the zone affected by the *Exxon Valdez* oil spill, generate large quantities of used motor oil and other lubricants. In spite of regulations and enforcement actions to the contrary, a substantial (but unknown) amount of this waste oil finds its way into the marine environment. During the recovery phase of the spill it is desirable to eliminate additional sources of hydrocarbon contamination to the marine environment. The ports of Whittler, Homer, Seaward, and Valdez all support increasingly large

fleets of pleasure and recreational craft in addition to the resident and transient commercial fishing fleets. Cordova and Kodiak are seasonally among the busiest fishing ports on the West Coast. Villages such as Tatitlek, Chenega Bay, Port Graham, English Bay, and the Kodiak Island villages are home port for small-scale commercial fishing and subsistence-use vessels.

Proper disposal of used oil has long been viewed as a problem throughout the area. Handling, storage, and transportation of used oil has carried considerable cost and potential liability, especially under now-outdated federal regulations that routinely placed almost all waste oil under hazardous waste handling regulations. While some communities have waste oil collection facilities, others do not. Even at these few sites with collection facilities what to do with the waste oil once it is collected remains a major problem.

Nationwide, regulatory and financial issues have discouraged people from properly disposing of waste oil; more often than not, waste oil was illegally dumped in landfills, sewer systems, or other open sites. In 1992, the U.S. Environmental Protection Agency estimated that 170 million of the 190 million gallons of waste oil generated in the nation found its way into the environment due to improper disposal; this represents approximately 16 times the amount of oil spilled by the *Exxon Valdez*. On August 12, 1992, USEPA changed its classifications regarding waste oil recycling and disposal, eliminating many of the regulatory disincentives frustrating the development of good waste oil handling and disposal in the nation.

The change in federal rules offers the Trustee Council an opportunity to support a project that would reduce the amount of waste oil entering the marine environment in the area affected by the *Exxon Valdez* oil spill. Reducing or eliminating other sources of hydrocarbon contamination in the spill area is desirable as it will help resources injured by the spill recover quickly.

The entire restoration effort would be enhanced by the successful implementation of this project. By providing an environmentally acceptable method of waste oil disposal the continuing introduction of hydrocarbons into the marine environment would be reduced thus permitting natural recovery to continue as quickly as possible.

PROJECT DESIGN

A. Objectives

To reduce the incidental introduction of oil into the spill area ecosystem by providing alternative methods of disposal of waste oil products.

B. Methods

This project would create a waste oil recycling and/or disposal pilot program in a few communities that wish to participate. Depending on the success of the program this year, it will be proposed for expansion in future years. Communities could propose to use marine pollution control grants from the Trustee Council to purchase equipment for recycling and/or disposing

of waste oil depending on what method(s) the community felt most appropriate to the local conditions. Volume of waste oil, distance from recycling centers, the need or opportunity for re-use of oil, and the costs (in terms of both money and mechanical complexity) of continuing operation would be among the criteria used to evaluate proposals from the communities.

Communities wishing to participate in this program would submit proposals. An evaluation committee would review the applications for technical and regulatory feasibility. Awards would be made and the communities would begin installation.

These facilities would be wholly owned by the local organization or government that applied for the funding. Maintenance and operation would be paid by the communities through user fees, assessments, or cost-recovery plans (e.g., reuse of waste oil for heating municipal facilities) depending on the wishes and resources of the communities. The facilities would be monitored, information collected, and a report prepared detailing the success or failure of the project.

C. Schedule

August - July 1994	Meet with communities to get assistance in developing proposal packets and scoring criteria
September 1994	Send out proposal packets to communities and advertise
Nov - Feb 1995	Receive submittals, convene proposal evaluation committee, review and rank proposals, notify recipients, negotiate grant/contract awards
March - May 1995	Communities proceed with equipment purchases and development
Jan. - Feb. 1995	Project manager visit communities
June 1995	Receive first project reports from communities
Sept. 1995	Receive second operations report from communities

D. Technical Support

A small amount of computer support would be required in collecting the data reported by the grantees and storing it in a data base. The information would be utilized in preparing a report for the Trustees as to the relative success of the project.

E. Location

Communities within the spill affected area.

PROJECT IMPLEMENTATION

This project was approved for Fiscal Year 1994 and is being implemented by DEC.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project is a different type from other projects in the spill in terms of logistics, and community contacts. Thus, no specific coordination is needed.

FY 95 BUDGET ($K) (carry-forward of FY 94 funds)

Personnel	49.6
Travel	19.9
Contractual	142.9
Commodities	2.4
Equipment	0.0
Subtotal	214.8
Gen. Admin.	17.4
Total	232.2

Restoration Plan Environmental Impact Statement/Record of Decision

Project Number:	95422-CLO
Restoration Category:	Administration, Public Information and Science Management (closeout)
Proposed By:	USFS
Cooperating Agencies:	All Trustee Agencies
Cost FY 95:	$20,000
Cost FY 96:	$0
Total Cost:	$20,000
Duration:	1 year
Geographic Area:	Prince William Sound, Gulf of Alaska, Kenai Peninsula, Kodiak Archipelago, Alaska Peninsula
Injured Resource/Service:	Multiple resources

INTRODUCTION

This project will analyze the environmental effects of implementing the Draft Restoration Plan developed over the past two years, develop alternative Restoration Plans, and disclose the effects in an Environmental Impact Statement.

NEED FOR THE PROJECT

Federal law requires an Environmental Impact Statement for major federal actions significantly affecting the quality of the human environment. The Trustee Council members have agreed that the Restoration Plan constitutes a major federal action, and, subseqently, an Environmental Impact Statement is required before a final restoration plan is adopted.

PROJECT DESIGN

On October 8, 1991, a federal court approved a settlement between the State and Federal governments and Exxon Corp. under which Exxon agreed to pay $1 billion in criminal restitution and civil damages to the governments. The State and Federal Trustees will receive

$900 million in civil damages from Exxon over 10 year period. These funds are to be used to restore, to their pre-spill conditions, the natural resources and the services they provide that were injured by the *Exxon Valdez* oil spill. This includes the restoration of any natural resource injured, lost or destroyed and the services provided by that resource or a natural resource which replaces or substitutes for the injured, lost or destroyed resource and affected services. Restoration includes all phases of injury assessment, restoration, replacement, and enhancement of natural resources, and acquisition of equivalent resources and services.

All decisions concerning restoration and uses of restoration funds are determined by six natural resources Trustees, three Federal and three State. The three Federal Trustees are: the Administrator for the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, the Secretary of the of Agriculture and the Secretary of the Interior. The three State Trustees are: The Commissioners of Fish and Game and Environmental Conservation, and the Attorney General. A Trustee Council, located in Alaska, which is made up of designees of the Federal Trustees and the three State Trustees, is responsible for all decisions relating to the assessment of injuries, uses of the restoration funds, and all restoration activities including the preparation of a Restoration Plan.

On April 10, 1992 (57 FR 12473-12475) the Forest Service published a Notice of Intent to prepare an EIS on the Restoration Plan. Since then, the Trustee Council has developed a draft Restoration Plan which has become the proposed action for the analysis to be conducted in the EIS. The proposed action (Draft Restoration Plan) consists of nine policy statements, a discussion of categories of restoration actions and broad objectives for injured resources. The policies for identifying and conducting restoration actions are:

1. The restoration program will take an ecosystem approach.

2. Restoration activities may be considered for any injured resource or service.Most restoration activities will occur within the spill area.

3. Restoration activities outside the spill area, but within Alaska, may be considered, however, when the most effective restoration actions for an injured migratory population are in a part of its range outside the spill area or when the information acquired from research and monitoring activities outside the spill area will be important for restoration or understanding injuries within the spill area.

4. Restoration activities will emphasize resources and services that have not recovered. Resources and services will be enhanced, as appropriate, to promote restoration. Restoration projects should not adversely affect the ecosystem.

5. Projects designed to restore or enhance an injured service must have a sufficient relationship to an injured resource, must benefit the same user group that was injured, and should be compatible with the character and public uses of the area.

6. Competitive proposals for restoration projects will be encouraged.

7. Restoration projects will be subject to independent scientific review before Trustee Council approval.

8. Meaningful public participation in restoration decisions will be actively solicited.

9. Government agencies will be funded only for restoration work that they do not normally conduct.

Four types of restoration actions are identified and discussed in the Draft Restoration Plan: general restoration, habitat protection and acquisition, monitoring and research, and public information and administration. Alternatives to the proposed action will place different emphases on each of these categories of restoration actions, while satisfying the policies and objectives for injured resources described in the Draft Restoration Plan.

General Restoration consists of activities that fall within manipulation of the environment and management of human use for reduction of marine pollution. Decisions about conducting general restoration projects would look at the following factors: extent of natural recover, the value of an injured resource to the ecosystem and to the public, the duration of benefits, technical feasibility of the project, likelihood of success, the relationship of costs to expected benefits, potential for harmful side effects, benefits to more than one resource, effects on health and human safety, consistency with applicable laws and policies, and duplication with other actions.

Habitat Protection and Acquisition is a category that includes the purchase of private land or interests in land such as conservation easements, mineral rights, or timber rights. It also includes recommendations for changing public agency management practices. Specific policies that relate to habitat protection and acquisition are proposed. These policies deal with the ranking potential lands to determine potential benefits, the need for a willing seller, fair market valuation, post acquisition management of the acquired lands, and the involvment of the public in the prioritization process.

Monitoring and Research consists of recovery monitoring, restoration monitoring, and ecological monitoring and research. Specific policies governing the selectiion and performance of monitoring activities are discussed in the Draft Restoration Plan.

Public Information and Administration consists of all necessary administrative actions that are not attributable to a particular project. The Draft Restoration Plan goal is to limit administrative costs to an average of no more than 5% of overall restoration expenditures for the remainder of the settlement period.

General restoration objectives have been developed for resources that have been categorized as recovering, not recovering, recovery unknown, archaeological resources, wilderness, and services. These broad objectives will guide in the development of annual work plans.

Using an interdisciplinary approach, the important issues that arose from the proposed

Restoration Plan were analyzed and alternative restoration plans developed. These alternatives were analyzed and a draft Environmental Impact Statement was written and made available to the public and Trustee Council. The public and agencies commented on the Draft Environmental Impact Statement. After comments are analyzed and the draft statement revised, a Final Environmental Impact Statement will be issued. The Trustee Council will then be able to adopt a Final Restoration Plan. A Record of Decision will be prepared, signed, and distrubuted.

The Final Restoration Plan EIS will address all resources and services addressed in the Final Restoration Plan. This includes bald eagles, black oystercatchers, killer whales, sockeye salmon, common murres, harbor seals, harlequin ducks, marbled murrelets, Pacific herring, pigeon guillemots, pink salmon, sea otters, intertidal ecosystem, subtidal ecosystem, clams, cutthroat trout, Dolly Varden, river otter, rockfish, archaeological resources, and designated wilderness areas. Services addressed will include subsistence, commercial fishing, and recreation and tourism.

PROJECT DESIGN

A. Objectives

The FY94 objective of this project was to identify relevant issues from implementing the proposed Draft Restoration Plan, analyze the environmental and social consequences of implementing the Draft Restoration Plan and alternative Restoration Plans, and display the information in an Environmental Impact Statement. In 1995, the Record of Decision will be published and distributed, and the project, subsequently, will be completed.

B. Methods

An interdisciplinary team of State and Federal resource specialists will review available resource information, analyze the proposed action and alternatives, and write a Draft Environmental Impact Statement.

C. Schedule

A Draft Environmental Impact Statement was released for public comment in June 1994. The Final Environmental Impact Statement will be completed by September 30, 1994. The Record of Decision will be prepared in October 1994.

D. Technical Support

Federal and State agency personnel will provide technical expertise to assure compliance with National Environmental Policy Act requirements. Personnel will also be available to review resource reports and specific sections of the Draft and Final EIS to assure accuracy.

E. Location

All of the analysis and writing will be conducted in Anchorage, Alaska.

PROJECT IMPLEMENTATION

The project team leader will be responsible for coordinating the work of all team members and assuring work is completed on time. Agency specialists will review draft products before the Draft EIS is released to assure the document is accurate and complete.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Not applicable.

FY 95 BUDGET ($K)

Personnel	14.8
Travel	0.0
Contractual	2.8
Commodities	0.0
Equipment	0.0
Subtotal	17.6
Gen. Admin.	2.4
Total	20.0

This page intentionally left blank.

Subsistence Restoration Planning and Implementation

Project Number:	95428-CLO
Restoration Category:	General Restoration (closeout)
Proposed By:	ADFG
Cooperating Agencies:	DOI, USFS
Cost FY 95:	$100,000 (includes $98,000 for data analysis and report writing of FY 94 work)
Cost FY 96:	$47,100 (report writing only)
Total Cost:	$147,100
Duration:	1 year
Geographic Area:	Prince William Sound, lower Kenai Peninsula, Kodiak Island, Alaska Peninsula
Injured Resource/Service:	Subsistence

INTRODUCTION

In FY 1994, the Trustee Council funded a subsistence planning and implementation project to develop a coordinated approach to subsistence restoration and to work with subsistence users to design restoration projects. The purpose of this project in FY 95 is to continue to address the need to restore subsistence uses by cooperatively developing subsistence restoration project proposals for the Trustee Council Work Plan for FY 96. An important goal is to insure the participation of subsistence users in these and other FY 96 planning efforts. Such projects could propose to directly restore resources used for subsistence, provide alternative natural resources, or restore access or people's use of the resource. Guidelines for project content will be developed, project ideas will be solicited and prioritized through a public process, project proposals will be evaluated, and a set of project proposals will be presented to the Trustee Council for funding consideration.

Project ideas developed through this planning process which do not become part of the FY 96 Work Plan may be eligible for funding through grants from a $5 million appropriation of Exxon Valdez criminal settlement funds by the Alaska Legislature. The legislature authorized the Department of Community and Regional Affairs to award grants to unincorporated rural communities in the oil spill area in order to restore, replace, or enhance subsistence resources

or services damaged or lost as a result of the spill (Section 11, Chapter 79, SLA 1993). The legislation requires that selection of grant recipients shall be made after consultation with the state members of the Trustee Council.

NEED FOR THE PROJECT

The purpose of the project is to collaboratively develop and evaluate proposals to restore or enhance injured subsistence resources and lost or diminished subsistence uses. Subsistence uses of fish and wildlife are a vital service that was impaired as a result of the Exxon Valdez oil spill. After the spill, harvest levels declined, sharing of resources was reduced, and the transmission of skills and knowledge about natural resources was disrupted. While harvest levels and participation in subsistence activities have rebounded somewhat since the first two post-spill years, effects of the spill remain. These include concerns about the long term health effects of using resources from the spill area, a loss of confidence in individuals' abilities to judge if resources are safe to eat, scarcity of certain injured subsistence resources (natural resources such as harbor seals, marine invertebrates, and waterfowl) in traditional harvest areas, increased costs associated with subsistence harvests, and reduced opportunities for young people to learn the subsistence way of life. Subsistence uses can be restored only if the natural resource base is healthy and if subsistence users are directly involved in restoring injured natural resources. Projects designed during this process will focus on these goals. During the limited time available in FY 94 to begin this project (funding was only available beginning in June 1994), planning efforts were focused on Prince William Sound and lower Cook Inlet communities. Much of the planning team's time was devoted to developing background information for communities and organizing a comprehensive approach to the subsistence restoration process. In FY 95, therefore, efforts need to expand to involve the remaining spill area communities in the subsistence restoration planning process and to follow-up on project ideas identified during the first round of community meetings in 1994.

PROJECT DESIGN

A. Objectives

The project has three primary objectives for FY 95. The first objective is to implement a comprehensive approach to subsistence restoration begun in FY 94. The second objective is to meet with residents of the subsistence communities in the spill area to identify community needs and priorities related to injured subsistence resources and services. The third is to work with communities to develop proposals to restore reduced or lost subsistence resources and services.

B. Methods

Guidelines for appropriate topics for projects have been developed as part of a coordinated approach to subsistence restoration by the Alaska Department of Fish and Game (Division of Subsistence), the Alaska Department of Community and Regional Affairs (DCRA) (Division of Municipal and Regional Assistance), the U.S. Department of the Interior, and the U.S. Forest Service (the latter two agencies representing the federal Trustee Council members), with assistance from the Alaska Department of Law, Trustee Council staff, and representatives of spill-area communities. An outreach program in subsistence communities will be conducted to solicit ideas and priorities for restoration of subsistence resources and lost or reduced subsistence uses. A local community facilitator will be hired as a nonpermanent employee within the Division of Subsistence to assist with the planning and implementation of community meetings and workshops. Following the meetings, interested parties may develop projects as proposals for funding, for which project staff will provide assistance. After evaluation of the proposals, recommendations will be presented to the Trustee Council for review.

C. Schedule

October 1994. Community meetings to review FY 95 Work Plan; continue work on project ideas developed in FY 94 but not part of the FY 95 work plan, identify new project ideas for FY 96 work plan

November 1994 - March 1995. Continue working with communities and other organizations to develop project descriptions and designs; as necessary, monitor implementation of FY 95 subsistence restoration projects; complete report for FY 94.

March 1995. Conduct community meetings to review project proposals and develop priorities.

April 15 1995. Submit project descriptions for Trustee Council approval.

August 1995. Finalize FY 96 Work Plan; complete final report.

D. Technical Support

This project will not need technical support as described in the proposal guidelines.

E. Location

Prince William Sound, Cook Inlet, Kodiak Island Borough, and the Alaska Peninsula within the spill area

PROJECT IMPLEMENTATION

The ADFG Division of Subsistence maintains an ongoing program of data collection and report

preparation about the role of subsistence activities in Alaska, including the spill area communities. The division is currently involved in a joint project with the U.S. Minerals Management Service, which, among other things, is investigating social effects of the spill. The division is also actively engaged in research on subsistence harbor seal and sea lion harvests in coastal communities of southcentral and southwest Alaska, supported by the National Marine Fisheries Service. In addition, the division is the lead agency on two FY 94 oil spill restoration projects: Project 94279, Subsistence Foods Safety Testing; and Project 94244, Harbor Seal and Sea Otter Co-op Subsistence Harvest Assistance. The Division of Community and Regional Assistance (within DCRA) provides technical assistance services, including grants administration, to communities and has administered an emergency oil spill impact program in the spill area. The U.S. Department of the Interior and the U.S. Forest Service are responsible for management of subsistence activities on federal lands and are member agencies of the Trustee Council.

Relation to Other Damage Assessment/Restoration work: The FY 94 Restoration Plan includes two subsistence restoration projects: 94244 (Harbor Seal and Sea Otter Co-op Subsistence Harvest Assistance) and 94279 (Subsistence Food Safety Testing). Aspects of these projects may be continued as part of projects developed during the cooperative planning effort. Projects more appropriately supported through grants from the $5 million appropriation from the criminal settlement money may also be identified.

COORDINATION OF INTEGRATED RESEARCH EFFORT

As a planning project, a goal of this project will be to coordinate the subsistence restoration program with other research efforts.

FY 95 BUDGET ($K)

Personnel	70.2
Travel	16.1
Contractual	2.0
Commodities	1.0
Equipment	0.0
Subtotal	89.3
Gen. Admin.	10.7
Total	100.0