19.03.06

FY 96 Detailed Project Descriptions

193.6

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

MEMORANDUM

TO: Peer Reviewers
Restoration Workforce
Attorneys
Other Interested Parties

FROM: Sandra Schubert Sandra
Project Coordinator

RE: FY 96 Project Proposals: Revised DPDs and New Budgets

DATE: May 16, 1995

Please find enclosed revised DPDs for the following four projects. In each case, the version of the DPD included in the notebook circulated on May 5, 1995 was incomplete.

96186 Coded Wire Tag Recoveries from Pink Salmon in PWS
96106 Subtidal Monitoring: Eelgrass Communities
(The earlier version of this project was incorrectly titled Herring Bay Monitoring.)
96190 Construction of a Linkage Map for the Pink Salmon Genome
96202 Port Lions Community Hall Construction

Also enclosed are detailed budgets for the following two projects. Detailed budgets were not provided earlier.

96012B Impact of Killer Whale Predation on the Recovery of Injured Resources
96213 Alaska Native Harbor Seal Commission

This replaces earlier version of DPD that went out in peer reviewer's notebook 5/5/95.

Exxon Valdez OIL SPILL
DETAILED PROJECT DESCRIPTION
FOR A
FY 96 RESTORATION PROJECT

Project Title:	**Subtidal Monitoring: Eelgrass Communities**
Project Number:	~~9~~6106
Restoration Category:	Monitoring
Proposer:	Stephen C. Jewett University of Alaska Fairbanks
Lead Trustee Agency:	Alaska Department of Fish & Game
Cooperating Agency:	None
Duration:	One Year: October 1, 1995 - September 30, 1996
Cost FY 96:	$219,136
Geographic Area:	Field work: Western Prince William Sound Data analyses/reporting: UAF/Vista, CA
Injured Resource/Service:	Subtidal organisms

ABSTRACT

This study has focused on the injury to, and recovery of, shallow (< 20 m) subtidal eelgrass communities in western Prince William Sound following the Exxon Valdez oil spill (EVOS). Effects were assessed in 1990, 1991, and 1993 primarily by examining differences in population parameters (e.g., abundance, biomass) of dominant taxa within the subtidal eelgrass habitat. A final resampling of this habitat is planned for the summer of 1995.

In 1990, we noted significant differences between oiled and control sites with respect to a number of taxa. Among the differences noted were greater densities of eelgrass flowers and shoots, amphipods, trochid snails, *Telmessus* crabs, and *Dermasterias* sea stars at the control sites. Other taxa, including small epifaunal mussels, (*Musculus*) and spirorbid worms, a variety of infaunal polychaetes, and juvenile cod were more abundant at oiled sites.

The infaunal benthic community within the deeper portion (3 to 20 m) of the eelgrass habitat appeared especially affected by the EVOS, as there was a decline in diversity as well as reductions in a number of dominant taxa. On the other hand, the benthic community in shallower portions of the habitat, within the eelgrass bed, showed a general enhancement of both diversity and abundance of several dominant taxa. The notable exception was for amphipods, which declined in all habitats.

By 1991 there was strong evidence of recovery at eelgrass by fewer differences in community parameters and dominant taxa than observed in 1990. Although some recovery was still evident by 1993, e.g., large epifaunal crabs (*Telmessus*) and sea stars (*Dermasterias*), many infaunal and small epifaunal taxa were more prevalent in oiled eelgrass sites, resembling 1990.

Polycyclic aromatic hydrocarbon (PAH) concentrations in sediments were generally higher at oiled than control sites and in the deeper portions of the habitat. The highest concentrations observed were greater than 1000 ng g^{-1} at several eelgrass sites in 1990. PAH concentrations declined to less that 100 ng g^{-1} by 1993, but were still somewhat higher at oiled sites.

Many of the observed effects appeared related to the effects of oil. The reduction in the abundance of amphipods were presumably due to the acute toxicity of oil. However, most other declines in population density were probably related to either the sublethal effects of oil or to indirect effects such as increased predation. Increased abundance of most taxa at oiled sites appeared related, either directly or indirectly, to organic enrichment from either oil or from bioremediation.

INTRODUCTION

The shallow subtidal habitats of Prince William Sound, from the intertidal zone to depths of approximately 20 m, typically has dense macrophyte or seagrass assemblages, and is critical habitat for many commercially and ecologically important animals. Subtidal eelgrass beds contain numerous polychaete worms, small snails and clams, amphipods, isopods, sea urchins, and sea stars, many of which serve as food for coastal-feeding fishes, birds, and otters.

The subtidal eelgrass community was one of the several habitats examined relative to *Exxon Valdez* Oil Spill (EVOS) effects and subsequent recovery. Investigations comparing oiled-control sites in this habitat were conducted in 1990, 1991 and 1993 (no sampling occurred in 1992 and 1994) (Jewett et al., 1994).

Almost all components of the eelgrass habitat were affected by the EVOS by the summer of 1990. The health of the benthic community outside the eelgrass bed, at 6-20 m depths, was generally less robust at oiled sites than at control sites. The oiled sites had significantly less total invertebrate abundance; several dominant invertebrate taxa had less abundance and/or biomass. These included families of clams that are important food for sea otters. Another group less prevalent at oiled sites were the oil-sensitive benthic

amphipods. Measured parameters less prevalent at the oiled sites in the eelgrass bed (≤ 3 m) included eelgrass turions and flowers, benthic amphipods, and helmet crabs (*Telmessus cheiragonus*). However, the benthic community in the bed had greater total invertebrate abundance and biomass at the oiled sites, primarily attributable to opportunistic infauna and small epifauna attached to the eelgrass blades.

The 1991 data revealed partial recovery. Outside the eelgrass bed (6-20 m) oiled sites were more similar to control sites than in 1990. The greatest indication of recovery was with benthic amphipods which revealed no differences between oiled and control treatment groups. Within the bed (≤ 3 m), no differences were now evident in density of eelgrass turions or flowers, benthic amphipods, and helmet crabs. However, several of the dominant taxa had lower abundance or biomass at oiled bed sites, indicative that recovery was lagging within the eelgrass bed.

By 1993, four years after EVOS, a reversal was revealed from the 1991 appearance of recovery. While toxic effects were doubtful, some segments of the community were significantly diminished at oiled sites (e.g., amphipods); other segments reflect enhancement at oiled sites (e.g., infaunal polychaetes and epifauna on eelgrass). Sediment oil concentrations dropped from an average of 544 ng PAH g^{-1} in 1990 to 145 ng g^{-1} in 1991 to 50 ng g^{-1} in 1993. Although sediment oil contentrations declined greatly over the three-year period, the oiled sites still had higher concentrations than control sites in 1993. The 1993 data tended to resemble 1990, especially in the bed (≤ 3 m) where densities of eelgrass flowers (Dean et al., submitted MS), bivalves and oil-sensitive benthic amphipods were greater at control sites. Enhancement (stimulation) at oiled sites was evident in several opportunistic or stress tolerant polychaetes (all depths), as well as small epifauna attached to the eelgrass blades (≤ 3 m). Oil-degrading microbes (Braddock and Richter, 1994) presumably stimulated the faunal increases at oil sites as has been observed elsewhere (e.g., Spies and DesMarais, 1983; Spies, 1987). Preliminary examination of selected nearshore fishes (crescent gunnel and pricklebacks) suggested stress-induced abnormalities (i.e., hemosiderosis: Khan and Nag, 1993) at oiled sites.

We know from other studies (e.g., McConnaughey, 1978; Calkins, 1978; Degrange and Sanger, 1987; Shaw and Hameedi, 1988; Bowyer et al., 1994) and from our work that several of the species impacted are important links to higher trophic levels. For example, benthic amphipods are important prey to a variety of fishes and sea birds. The crab *Telmessus* feeds on eelgrass, *Musculus* mussels, and other epiphytes on eelgrass. In turn, *Telmessus* serves as prey for a variety of vertebrates, including sea otters, river otters, and birds (e.g.,). In addition, *Musculus* is a primary component of the diet of juvenile cod that are abundant in the eelgrass habitat. As noted earlier, some of the infaunal bivalves are important food for sea otters. Also, the fishes examined for hemosiderosis are important food for river otters and selected sea birds (Bowyer et al., 1994; Dan Roby, UAF, Pers. Commun).

Our approach for July 1995 is to monitor the various successional stages of the eelgrass community toward stabilization by comparing components from four pairs of oiled and unoiled sites. We will target most of the sites that were sampled in 1990, 1991 and 1993 using the same methodology. We will quantify eelgrass, infauna, amphipods, small epifauna attached to eelgrass, large epifauna (i.e., crabs and sea stars), and juvenile Pacific cod. In addition, we will examine sediment hydrocarbon concentrations and some dominant demersal fishes for hydrocarbons and hemosiderosis. The benefit of continued monitoring of the natural recovery of this habitat is to provide information on the progress and general health of this community, including some key trophic components.

This Detailed Project Description is for the closeout on the subtidal monitoring of the eelgrass communities. It will include analyses and reporting of subtidal eelgrass community information compiled over the duration of this project, 1990, 1991, 1993, and 1995.

NEED FOR THE PROJECT

A. Statement of Problem

Almost all components of the subtidal eelgrass habitat were affected by the EVOS. Our approach is to monitor the various successional stages of the eelgrass community for one more year. Stabilization is anticipated by 1995.

B. Rationale

No man-made restoration has occurred, nor has any been recommended, for the subtidal eelgrass habitat to date. It has been generally viewed that any restoration activities in this subtidal habitat would be unrealistic. Complete restoration or recovery implies not only a return to prior abundance levels, but moreover, a return to ecological pathways within the community which may have taken years to develop. These ecological pathways involve a range and magnitude of biological, chemical, and physical mechanisms with synergistic effects which are little understood, but are believed to be essential to the stability of the community. Drastic changes induced by EVOS undoubtedly altered these pathways and the resulting community may never return to its pre-spill structure and internal integrity, although abundances may return to pre-spill levels.

C. Summary of Major Hypotheses and Objectives

The overall objective is to monitor the natural recovery of the shallow (< 20 m) subtidal eelgrass community in Prince William Sound that was impacted by the EVOS.

D. Completion Date

September 30, 1996

COMMUNITY INVOLVEMENT

Since this study got underway in 1990, it has had intense internal and public review through workshops, EVOS Symposium, meetings, Final Report reviews, and peer reviews of manuscripts for publication, including in a special publication through the Transactions of the American Fisheries Society. No other community involvement efforts are planned.

FY 96 BUDGET

Personnel	$117843.0
Travel	4770.0
Contractual	57000.0
Commodities	3000.0
Equipment	0.0
Subtotal	182613.0
Indirect cost	36523.0
Gen. Admin.	
Total	$219136.0

PROJECT DESIGN

A. Objectives

The overall objective is to monitor the natural recovery of the shallow (< 20 m) subtidal eelgrass community in Prince William Sound that was impacted by the EVOS. The primary objectives are to: 1) spacially compare richness, diversity, abundance and biomass of dominant taxa between paired (oiled:control) sites; and 2) temporally compare these population parameters. A secondary objective is to examine some of the dominant nearshore demersal fishes for evidence of hemosiderosis.

B. Methods

All samples collected in the stratified sampling design in the eelgrass habitat in July 1995 will be processed at University of Alaska Fairbanks. For the percent cover, abundance, and biomass estimates for each of the dominant infaunal and small epifaunal taxa, and for diversity measures for benthic infauna, we will test the null hypothesis of no significant difference among oiled and control sites using a randomization procedure (Manly, 1991). In addition, some community-level analyses will be conducted using ordination procedures such as principal coordinate analysis, stepwise discriminant analysis, and multidimensional scaling. Data from all years, 1990, 1991, 1993, and 1995, will be analyzed.

C. Contracts and Other Agency Assistance

Coastal Resources Associates, Inc., Vista, CA
CRA has been an integral technical component on the EVOS shallow subtidal investigations since 1989. To ensure project continuity, we will subcontract with CRA for analyses and reporting assistance.

Memorial University, Newfoundland, Canada
Dr. R.A. Khan of Memorial University will be contracted to examine intertidal/shallow subtidal fishes for hemosiderosis as a pathological indicator of exposure of fishes to crude oil. Dr. Khan analyzed a few fishes for us in 1993.

NOAA, NMFS, Auke Bay, Alaska
All hydrocarbon analyses on sediment and fishes will be carried out through the Auke Bay Facility; they have previously provided this support for this project.

D. Location

The analyses and report preparation will be conducted at UAF (Fairbanks) and at CRA (Vista, CA).

SCHEDULE

A. Measurable Project Tasks for FY 96

October - December 1995:	Process benthic, hydrocarbon, and hemosiderosis samples;
January 1996:	Data entry and analyses;
February - May:	Draft final report;
June - July:	Peer review of draft final report;

B. Project Milestones and Endpoints

This is the close-out segment of this project. All project objectives will be met in the Final Report on or before September 30, 1996.

C. Project Reports

A final report will be submitted 60 days after the peer-reviewed draft final report is returned.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is closely linked to the monitoring of oil in subtidal (< 20 m) sediments (conducted by NOAA). Several study sites are in common between the two projects.

ENVIRONMENTAL COMPLIANCE

The appropriate scientific sampling permit will be obtained from ADF&G prior to sampling. All operations aboard the research vessel will conform to U.S. Coast Guard safety standards. All SCUBA diving activity will conform to the UAF's scientific diving standards (UAF is a member of the American Academy of Underwater Sciences). This project received a categorical exclusion under NEPA from NOAA.

PERSONNEL

Stephen C. Jewett, Principal Investigator and Research Associate at the School of Fisheries and Ocean Science (SFOS), University of Alaska Fairbanks will be responsible for the organization and the management of this project, including interpretation and synthesis of data and writing of reports. Mr. Jewett has been a Research Associate at UAF since 1975. During this time he has been involved in numerous benthic investigations throughout Alaska that emphasize assessment and/or monitoring. He has been the coordinator of the federal/state EVOS shallow subtidal investigations in Prince William Sound (1989-94). Mr. Jewett also serves as the Scientific Diving Officer for UAF, coordinating all scientific diving operations.

Joan Osterkamp, Executive Director of SFOS, University of Alaska Fairbanks, will be the Financial Officer overseeing the project.

Thomas A. Dean, Ph.D., is President of the ecological consulting firm Coastal Resources Associates, Inc. (CRA) in Vista, CA. He has had a major role in both the shallow subtidal and intertidal EVOS investigations conducted through UAF since 1989. His has extensive experience in long-term monitoring studies with marine plants and invertebrates. Dr. Dean will mainly assist in the analyses and reporting necessary in the carrying out of the project objectives.

Amy Blanchard, Laboratory Supervisor for the shallow benthic component, has direct control and involvement of all laboratory analyses, quality control of the data, and submission of the data to Data Management at SFOS .

Max Hoberg, Research Technician, is a diver/benthic invertebrate taxonomist at SFOS. He will assist A. Blanchard in the laboratory.

Project Leader:

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Stephen C. Jewett
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Project Manager:

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Anchorage, AK 99518-1599
(907) 267-2213 (office); (907) 522-3148 (FAX)

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Date prepared

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel		$117.8						
Travel		$4.8						
Contractual		$57.0						
Commodities		$3.0						
Equipment		$0.0						
Subtotal	$0.0	$182.6						
Indirect		$36.5						
Project Total	$0.0	$219.1						
Full-time Equivalents (FTE)		2.1						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:

NOTE: Indirect Costs are calculated at 20% TDC. However, the University of Alaska and the EVOS Trustee Council are in the process of negotiating a rate agreement, based on the UA current negotiated rate, for projects which are long-term, sole source in origin, and guarantee a minimum amount per year of funding to the University of Alaska. Therefore, this rate is subject to change pending the outcome of the final agreement

1996

Prepared:

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 4A
Non-Trustee
DETAIL

5/4/95

1996 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FFY 1996
	Jewett, S.	Principal Investigator	7.0	7,803		54.6
	To Be Named	Technician	5.0	5,133		25.7
	To Be Named	Technician	4.0	4,908		19.6
	To Be Named	Lab. Asst. II	5.0	3,129		15.6
	To Be Named	Student Asst. II	4.0	571		2.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	25.0	21,544	0	
					Personnel Total	$117.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FFY 1996
	R/T Fairbanks-Anchorage	300	2	7	170	1.8
	R/T Fairbanks-San Diego	800	2	12	115	3.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$4.8

1996

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 4B
Personnel
& Travel
DETAIL

5/4/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed
Description	FFY 1996
Subcontract to Coastal Resources Associates	35.0
HC Analysis	7.0
Communications	0.5
Homosiderosis analysis	10.0
Sediment analysis	4.5
Contractual Total	$57.0

Commodities Costs:	Proposed
Description	FFY 1996
Laboratory Supplies	3.0
Commodities Total	$3.0

1996

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 4B
Contractual & Commodities DETAIL

5/4/95

1996 EXXON VALDEZ TRUS..._COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

1996

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 4B
Equipment
DETAIL

5/4/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel		$15.7						
Travel		$1.2						
Contractual		$14.1						
Commodities		$1.0						
Equipment		$0.0						
Subtotal	$0.0	$32.0						
Indirect		$3.2						
Project Total	$0.0	$35.2						
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

This is the budget for a subcontract for Coastal Resources Associates, Inc. to participate in and assist with project 96106, Stephen C. Jewett, P.I. See attached itemized budget for additional information.

1996

Prepared:

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 5A
Non-Trustee
DETAIL

5/10/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1996
Thomas Dean	Principal Investigator		2.0	6,391		12.8
Dennis Jung	Technician		0.8	1,850		1.5
Bettye Ladd	Secretarial/Clerical		0.7	1,940		1.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.5	10,181	0	
					Personnel Total	$15.7

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1996
R/T San Diego-Anchorage		600	1	5	110	1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.2

1996

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 5B
Personnel
& Travel
DETAIL

5/10/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed
Description	FFY 1996
Telephone and photocopy	0.4
Photocopy	0.1
Insurance	1.8
Rent	1.8
Subcontract-R. Smith	10.0
Contractual Total	$14.1

Commodities Costs:	Proposed
Description	FFY 1996
Office	0.5
Field	0.5
Commodities Total	$1.0

1996

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 5B
Contractual & Commodities DETAIL

5/10/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

1996

Project Number: 96106
Project Title: Subtidal Monitoring: Eelgrass communities
Name: Stephen C. Jewett

FORM 5B
Equipment
DETAIL

5/10/95

CRA BUDGET - RESTORATION OF SUBTIDAL INVERTEBRATES - AKF
1 October '95 to 30 Sept '96

		HRS	RATE	TOTAL
LABOR				
	Thomas Dean	270	$43.00	$11,610
	Dennis Jung (Regular)	120	$14.00	$1,680
	Dennis Jung (Overtime)	0	$21.00	$0
	Richard Smith	0	$40.00	$0
	Bettye Ladd	100	$12.50	$1,250
			Subtotal	$14,540
FRINGE				
	Social Security			$1,112
	Workmans Comp (Clerical)			$11
	Workmans Comp (Lab)			$326
	Workmans Comp (Sampling)			$0
	Workmans Comp (Diving)			$0
			Subtotal	$1,450
TRAVEL				
	Airfare	1 RT SD to Anchorage		$600
	Travel per diem	5 days per diem @$110		$550
			Subtotal	$1,150
SUPPLIES				
	Office Supplies			$450
	Misc field supplies			$0
			Subtotal	$450
OTHER DIRECT				
	Telephone			$240
	Copy Costs			$148
	Postage & Freight			$240
	Insurance			$1,800
	Rent			$1,800
	Subcontract-R. Smith			$10,000
			Subtotal	$14,228
		TOTAL DIRECT		$31,818
INDIRECT				
	Total Direct x 10%			$3,182
		TOTAL COSTS		$35,000

This replaces earlier version of DPD that went out in peer reviewers' notebook 5/5/95.

Coded Wire Tag Recoveries From Pink Salmon in Prince William Sound

Project Number:	96186 (in FY95, was # 95320B)
Restoration Category:	General Restoration and Research/Monitoring
Proposer:	Alaska Department of Fish and Game
Lead Trustee Agency:	Alaska Department of Fish and Game
Cooperating Parties:	Prince William Sound Aquaculture Corp. Valdez Fisheries Development Assoc.
Duration:	Four years
Cost FY 96:	$256,900
Cost FY 97:	$256,900
Cost FY 98:	$256,900
Cost FY 99:	$ 85,000
Cost FY 00:	$0
Cost FY 01:	$0
Cost FY 02:	$0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink Salmon

ABSTRACT

Pink salmon play a major role in the Prince William Sound (PWS) ecosystem as well as the economy of Cordova and other PWS communities. There is a growing body of evidence which indicates that the Exxon Valdez Oil Spill (EVOS) has been at least partially responsible for weak pink salmon returns to PWS. Pink salmon runs are dominated by the larger returns from more productive hatchery populations. To sustain production from wild populations, managers need to be able to estimate the relative spatial and temporal abundance of wild fish in the different fishing areas of PWS. This study will provide accurate, real-time and post-season estimates of hatchery and wild contributions to commercial harvests by date and fishing district, and also to hatchery cost-recovery harvests. This information is important for fisheries managers who must anticipate the effects of fishing strategies to protect injured populations. Similar analyses of coded wire tag data funded by the Natural Resource Damage Assessment (NRDA) and Restoration processes have been used to justify time and area

fishery closures and effectively reduce exploitation on oiled pink salmon populations in portions of southwestern PWS in 1990, 1991, 1992, 1993, and 1994.

INTRODUCTION

Pink salmon play a major role in the Prince William Sound (PWS) ecosystem. Migrating pink salmon fry are an important Spring food source for various fish, birds and terrestrial mammals. Marine mammals, birds, and fish also prey on the ocean life stages of pink salmon and returning adult wild salmon comprise a large portion of the summer diet of terrestrial mammals and birds such as bears, river otters, wolverines, bald eagles, gulls, and kittiwakes. Returning adult salmon also provide a pathway for the transfer of nutrients accumulated from high seas marine areas to near shore and terrestrial ecosystems. As the principal species harvested in the PWS salmon purse seine fishery, pink salmon play a major role in the commercial fishing and fish processing industries which are the backbone of the economy in Cordova and other PWS communities. Ex-vessel values for this fishery ranged from 10 to almost 40 million through the 1980's.

PWS pink salmon returns originating from brood years subsequent to the March 24, 1989, T/V Exxon Valdez oil spill (EVOS) have been aberrant or weak, with the exception of those of 1994. Returns of wild and hatchery pink salmon in 1991 arrived late, had very compressed run timing, and the fish were small and of poor commercial quality. Returns of pink salmon in 1992 and 1993 were far fewer than expected, while those of 1994 were more in line with expectations. 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. Both wild and hatchery returns of 1994 were a significant improvement over the preceding two years.

There is a growing body of evidence which indicates that the EVOS was partially responsible for the weak pink salmon returns to PWS. Much of the spawning for wild pink salmon (up to 75% in some years) occurs in intertidal areas. Intertidal spawning areas are susceptible to marine contaminants and there is strong evidence the EVOS adversely affected spawning success and early marine survival in PWS. Mortalities of pink salmon embryos incubating in the intertidal portions of oiled streams in western PWS have been significantly higher than those which incubated in nearby unoiled streams since 1989 (Sharr et. al. 1994a, Bue et al. (in press)). Despite apparent reductions in the amount of observable oil in intertidal salmon spawning areas since 1990, the differences in mortality between oiled and unoiled streams persisted in 1991, 1992 and 1993 and were also observed in spawning areas upstream of oil influence (Sharr et. al. 1994b, Bue et al. (in press)). These findings may be indicative of heritable genetic damage which has resulted in reproductive impairment among first and second generation fish originating from populations whose fry incubated in oiled streams in 1989 and 1990.

In addition to damage incurred during the embryo stages of development, pink salmon fry and juveniles rearing in the western portions of PWS in 1989 also exhibited reduced growth and survival (Willette and Carpenter, 1994). Because almost all wild and hatchery fry exit PWS through the straits and passages that were most heavily oiled, it is likely that at least portions of almost all pink salmon populations in PWS were damaged as rearing fry and juveniles in 1989. There are presently no data to substantiate any heritable damage to populations which traveled and fed in oiled marine waters as fry in 1989. Nevertheless, such a possibility is plausible given the findings of Sharr et al. (1994c).

Although hatchery pink salmon production (see Attachment 1) in PWS began in the 1970's, the large returns associated with maximum permitted fry production did not occur until the late 1980's and early 1990's and coincided with the EVOS era. Returns of wild salmon are dominated by the larger returns from the more productive hatchery populations and are therefore heavily exploited in commercial, sport, and subsistence fisheries. To sustain production from wild populations, managers must insure adequate escapements of wild fish to their natal streams, and that the escapement occurs in a smooth fashion over the season so that the genetic make-up of the populations is maintained. To achieve these goals, mixed-stock fisheries must be managed to achieve exploitation rates appropriate for the less productive wild populations throughout the season. Managers need, therefore, to be able to estimate the relative spatial and temporal abundance of wild fish in the different fishing areas of PWS.

This study will provide accurate, real-time and post-season estimates of hatchery and wild contributions to commercial harvests by date and fishing district, and also to hatchery cost-recovery harvests. Such catch contribution estimates, together with real-time escapement estimates from an Alaska Department of Fish and Game (ADF&G) aerial survey program will be used inseason by fisheries managers to reduce exploitation on wild stocks and target effort on hatchery returns. Post season analyses of tag recovery data will be coupled with escapement data for wild populations to make estimates of total wild returns, which will in turn allow assessment of the effectiveness of various management strategies. Post season analyses will also identify time and area distribution trends for wild and hatchery fish in fisheries. This information is important for fisheries managers who must anticipate the effects of fishing strategies in future years if injured populations are to be protected. Similar analyses of coded wire tag data funded by the Natural Resource Damage Assessment (NRDA) and Restoration processes have been used to justify time and area fishery closures and effectively reduce exploitation on oiled populations in portions of southwestern PWS in 1990, 1991, 1992, 1993, and 1994.

The results of the coded wire tag recovery project are also critical to the success of an integrated package of Sound Ecosystem Assessment (SEA) studies. The SEA proposal has roots in a broader SEA plan developed by the Prince William Sound Fisheries Ecosystem Research Planning Group (PWSFERPG), a bioregional coalition of PWS scientists, resource managers, resource users, aquaculture associations, and

communities, formed to "develop an ecosystem level understanding of the natural and man-caused factors influencing the production of pink salmon...in PWS". Many of the SEA projects, such as those falling under the Salmon Growth Component and the Salmon Predation Component are dependent upon information provided by this coded wire tag study.

In the absence of the improved management capabilities afforded by this project, salmon stocks in western PWS which have been injured and depleted through oil impacts may be over-exploited in the commercial, sport and subsistence fisheries. Population levels of stocks may be reduced below those needed for rapid recovery and in some instances may result in virtual elimination of impacted stocks. In the absence of the information provided to SEA plan, some of the projects under that plan will fail.

NEED FOR THE PROJECT

A. Statement of Problem

Wild pink salmon runs in Prince William Sound which were injured by EVOS need to be protected from overharvest during commercial fisheries. This is difficult to accomplish since these injured wild populations migrate through fishing areas with uninjured populations as well as large hatchery runs. It is not possible to simply close these fishing areas without severely affecting local and state economies which are heavily dependent upon the commercial fishing industry. Inseason and postseason information on the mix of the various runs in fishing areas allows fishery managers to directly fishing effort away from injured wild runs and achieve desired spawning escapement goals.

B. Rationale

Coded-wire tags have been the tool of choice for applying unique marks to hatchery pink salmon in Prince William Sound. This technique has been used in Prince William Sound to estimate hatchery and wild stock contributions to commercial harvests since 1986, and has also been used in preliminary studies of straying. Although placement and recovery of coded-wire tags is expensive and labor intensive, and effects of tags on survival and homing are not well described, this technique has been the most practical and reliable way in which to mark large numbers of small pink salmon fry.

C. Summary of Major Hypotheses and Objectives

The principal goal of this project has been to increase fishery managers' abilities to protect injured wild pink salmon stocks in mixed-stock commercial fisheries by providing an inseason method to identify stocks. This program will be continued until thermal mass marking of pink salmon otoliths can be developed as a marking tool to replace coded-wire tags. Specific objectives would be to provide inseason and post season estimates of the stock composition of commercial and hatchery cost-recovery harvests; to provide inseason and postseason estimates of the size of wild and hatchery pink salmon

runs; and to estimate marine survival rates of various hatchery release groups.

D. Completion Date

This multi-year project will be completed in either FY 98 or FY 99. At this time, the Trustee Council has approved only a one year of overlap between the coded-wire tag and otolith marking programs. This would mean that 1997 would be the last year to recover coded-wire tags and only funding for final data analysis and report writing would be made available in FY 98. However, peer reviewers at the 1995 Restoration Workshop unanimously recommended two years of overlap between these programs to ensure that coded-wire tags could continue to be applied and recovered in 1998 if the otolith marking program did not meet its objectives in 1997. This would mean funding for final data analysis and report writing would need to be made available in FY 99.

COMMUNITY INVOLVEMENT

This program is cooperatively funded by both Prince William Sound Aquaculture Association and Valdez Fisheries Aquaculture Corporation, the two private, nonprofit hatchery groups operating within Prince William Sound. These two groups are operated by a mix of individuals with ties to commercial, sport, personal use and subsistence fishing as well as community representatives. Large scale tagging programs have been a cooperative effort between ADF&G and these private, nonprofit aquaculture groups since the 1980's.

Project plans and reports on results of the coded-wire tagging program have been reviewed by the Prince William Sound/Copper River Regional Planning Team as well as interested fishing industry groups. As part of the Trustee Council NRDA and Restoration process, the coded-wire tag recovery program has been subjected to extensive peer review and annual public review and comment. Results of the coded-wire tag program were presented at the March 1993 Oil Spill Symposium sponsored by the Trustee Council, the 1993 Pink and Chum Workshop, the annual spring meeting of the Prince William Sound Aquaculture Corporation Board of Directors, and the 1994 Alaska Board of Fisheries meeting.

The coded-wire tag program is also critical to the success of an integrated package of Sound Ecosystem Assessment (SEA) studies. The SEA proposal has roots in a broader SEA plan developed by the Prince William Sound Fisheries Ecosystem Research Planning Group, a bioregional coalition of PWS scientists, resource managers, resource users, aquaculture associations, and communities, formed to "develop an ecosystem level understanding of the natural and man-caused factors influencing the production of pink salmon...in PWS". Many SEA projects depend upon information provided by coded-wire tags.

The project will employ local residents for data collection activities in fish processing plants located in Cordova, Valdez, Whittier, Seward, Anchorage, Kenai, and Kodiak, and at hatcheries in PWS. The project will also employ residents of Juneau for tag extraction and

decoding activities performed by the ADF&G Tag Laboratory. Permanent ADF&G Biologists stationed in Cordova and biometrics staff stationed in Anchorage will complete data analyses and reports. Goods and services required by the project will be obtained from vendors in the local communities where data are collected.

FY 96 BUDGET

Personnel	$116.2K
Travel	$ 12.7K
Contractual	$100.6K
Commodities	$ 2.9K
Equipment	$ 0.0K
Subtotal	$232.4K
Gen. Admin.	$ 24.5K
Total	$256.9K

PROJECT DESIGN

A. Objectives

Funds which match those contributed by ADF&G, PWSAC, and VFDA will contribute to the completion of the following objectives for the 1996 salmon season in PWS:

1. Using undecoded-tag data, provide timely inseason estimates of the temporal and spatial contributions of tagged hatchery stocks of pink salmon to PWS commercial and hatchery harvests.

2. Assess the properties of a new, faster, but potentially less reliable inseason estimator of contributions of tagged hatchery stocks, which is based upon undecoded tags and estimates of tender loads (catches).

3. Using decoded-tag data, provide hatchery-specific estimates of the temporal and spatial contributions of tagged hatchery stocks to the commercial and cost-recovery harvests in PWS.

4. Estimate marine survival rates for each uniquely coded hatchery release group of pink salmon.

B. Methods

Personnel policy, purchasing practices, field camp operations, safety procedures, and project administration will be in compliance the ADF&G Division of Commercial Fisheries Manual of Standard Operating Procedures (SOP). Data collection and estimation procedures are similar to those used in NRDA F/S Study #3. These procedures have been thoroughly reviewed by the NRDA peer review process and approved by the Management Team.

Commercial and Cost-Recovery Harvests

Recoveries will be stratified by district, week, and processor. This stratification was chosen as a result of the findings of Peltz and Geiger (1990) who detected significant differences between the proportions of some tag codes among such strata. The differences indicate that processors tend to receive catches from only certain parts of a district and is believed to be the result of traditional tendering patterns.

Recoveries of pink salmon tags from commercial and cost-recovery harvests will be made as fish are pumped from tenders onto conveyor belts at land-based processors located in Cordova, Valdez, Seward, Anchorage, Whittier and aboard a floating processor after each opening. Fish will be sampled by technicians standing beside the belt. Each sampled fish will be subjected to a visual and tactile examination for a missing adipose fin. It will never be possible for an observer to census all fish from a tender during the unloading process. However, on occasion, holding tanks in processing plants contain fish from only one tender. In those instances it will be possible for an observer standing on the processing line to get a census of an entire tender load which was previously sub sampled by technicians on the unloading conveyor. A Chi-square test of independence will be used to compare the rate of occurrence of adipose fin clips in the census with that observed in the random sample from the load.

Data recorded for each tender will include harvest type (i.e., commercial or cost-recovery catch), fishing district(s) from which the catch was taken, catch date, processor, and the number of fish examined. Catch data will be obtained later from fish tickets.

Heads of adipose-fin clipped fish will be excised, identified with a uniquely numbered cinch tag, and bagged. These heads will then be individually passed through a tag detector machine which produces an audible signal in the event that the head contains a coded wire tag. This procedure yields numbers of undecoded tags in the sample. Heads will then be frozen for subsequent shipment to the ADF&G Coded Wire Tag Laboratory in Juneau (Tag Lab).

Brood Stock Harvests

Tag shedding from release to return and differential mortality between tagged and untagged fish lead to discrepancies between marking rates at release and recovery. Hatchery brood stocks will be scanned for tags in order to estimate adjustment factors which can be used to account for the loss of tags from the population. Three assumptions inherent in the use of the brood stock for this purpose are a) it consists solely of fish reared at the hatchery, b) the propensity for a fish to lose a tag is similar for all fish marked at the same hatchery, and c) for a specific tag code, the marking rate in the commercial fishery is the same as that in the brood stock. It is believed that the first of these assumptions is violated at all facilities except at the W. Noerenberg hatchery (Sharr et. al. 1994f). Consequently, a historical average adjustment factor calculated from

the brood stock from the W. Noerenberg hatchery is considered an appropriate quantity with which to adjust for tag loss and differential mortality. With respect to the second assumption, tagging practices vary little within a facility, and it is believed that the rate of tag loss and tag-induced mortality are similar for all fish tagged within a hatchery. The third assumption relates to the possibility of tag-induced straying of hatchery fish away from the brood. Some histological evidence to this end was referenced in Sharr et al. (1994d), and some more direct preliminary evidence is discussed by Sharr et al. (1994f).

The adjustment factor for a given year may be defined as that quantity which, when multiplied by the marking rate in returning fish, yields the marking rate at release. The factor is 1.0 when there is no tag loss or differential mortality. The adjustment factor for hatchery h, a_h, will be estimated as the ratio of sampled fish in the brood stock to the expanded number of fish based on tags found in the sample :

$$\hat{a}_h = \frac{s_h}{\sum_{i}^{T} \frac{x_i}{p_i}} , \qquad (1)$$

where

T = number of tag codes released from hatchery h,
p_i = tagging rate at release for the ith tag code (defined as number of tagged fish released with the ith tag code divided by the total number of fish in release group i),
x_i = number of tags of the ith code found in s_h and,
s_h = number of brood stock fish examined in hatchery h.

The historical (1989-1994 for inseason, 1989-1995 for postseason) average W. Noerenberg adjustment factor will then be used to adjust contribution estimates (Equation 2) if it can be shown that it was significantly greater than 1.0 at the 90% level.

While only the (historical) adjustment factor associated with the W. Noerenberg facility will be used in any contribution estimation, brood stock samples will be taken during hatchery egg-take operations at each of the four PWS pink salmon hatcheries. Technicians, will examine approximately 95% of the fish through visual and tactile means for missing adipose fins. The number of fish sampled will be recorded and when adipose-clipped fish are found, the heads will be excised and shipped on a weekly basis along with sample data to the Tag Lab.

Tag Extraction, Tag Decoding, and Data Archiving

During the fishing season all sampling data and heads from adipose-clipped fish will be sent daily to the ADF&G Tag Lab. Data received at the Tag Lab will be logged and tag recovery sampling forms edited a for accuracy and completeness. Samples which affect critical fisheries decisions will be processed first. Tag lab staff will locate and remove tags from heads, decode extracted tags, and enter

tag code and sample data into a statewide database accessible to biologists in Cordova. Completed tag recovery data for prioritized samples will be transmitted electronically to Cordova project personnel within 36 hours of the receipt of unprocessed data at the Tag Lab. In the following 12 hours Cordova project personnel will integrate tag recovery and catch data from the ADF&G fish ticket reporting system to estimate hatchery and wild catch contributions. Contribution estimates are used by fisheries managers to implement the inseason management actions required.

Following the fishing season, processing of all lower priority tag recovery samples will be completed by the Tag Lab. All tags recovered throughout the season will be examined a second time to insure that they have been properly decoded. All codes will be validated with a master Pacific States Marine Fisheries Commission (PSMFC) list of codes potentially present in Pacific coast fisheries. Fully edited tag code and sampling data from all samples collected during the season will be forwarded to the Cordova office for final summarization and analyses. A complete historic database of coded-wire tag information from PWS tagging and tag recovery programs will be maintained by the ADF&G Tag Lab, the PSMFC and, the Cordova ADF&G. The ADF&G historic fish ticket catch database is maintained at the ADF&G Juneau headquarters office and in the Cordova area office. All coded wire tagging and recovery data and all fisheries harvest data are freely available from any of these sources.

Postseason Hatchery Contributions and Survival Rates

The contribution of release group t to the sampled common property, cost-recovery, brood stock and special harvests, and escapement, C_t , will be estimated as:

$$\hat{C}_t = \sum_{i=1}^{L} x_{it} \left(\frac{N_i \hat{a}_h}{s_i p_t} \right) , \qquad (2)$$

where

x_{it} = number of group t tags recovered in ith stratum,
N_i = total number of fish in ith stratum,
s_i = number of fish sampled from ith stratum,
p_t = proportion of group t tagged,
a_h = adjustment factor associated with hatchery h, and
L = number of recovery strata associated with common property, cost-recovery, brood stock, special harvests and escapement in which tag code t was found.

The contribution of release group t to unsampled strata, Cu_t, will be estimated from contribution rates associated with strata which were sampled from the same district-week openings as the unsampled strata:

$$\hat{Cu}_t = \sum_{i=1}^{U} \left[N_i * \left(\frac{\sum_{j=1}^{S} \hat{C}_{tj}}{\sum_{j=1}^{S} N_j} \right) \right], \qquad (3)$$

where

U	=	number of unsampled strata,
N_i	=	number of fish in ith unsampled stratum
S	=	number of strata sampled in the period in which the unsampled stratum resides,
C_{ti}	=	contribution of release coded with tag t to the sampled stratum j, and
N_j	=	number of fish in jth sampled stratum.

When a district-week opening is not sampled at all (an infrequent occurrence), the catch from that opening will be treated as unsampled catch of the subsequent opening in the same district.

An estimate of the contribution of tag group t to the total PWS return for 1995 will be obtained through summation of contribution estimates for sampled and unsampled strata. An estimate of the total hatchery contribution to the PWS return will be calculated through summation of contributions over all release groups. A variance approximation for $\hat{C}_t$, derived by Clark and Bernard (1987) and simplified by Geiger (1988) will be:

$$\hat{V}(\hat{C}_t) = \sum_{i=1}^{L} x_{it} \left[\frac{N_i \hat{a}}{s_i p_t} \right] \left[\frac{N_i \hat{a}}{s_i p_t} - 1 \right]. \qquad (4)$$

Assuming that covariances between contributions of different release groups to a stratum can be ignored, summation of variance components over all tag codes will provide an estimate of the variance of the total hatchery contribution. Inspection of the formula given by Clark and Bernard (1987) for the aforementioned covariances shows them to be negligible for large N and s, and to be consistently negative, so that when ignored, conservative estimates of variance are obtained. Variances associated with unsampled strata are believed to be small (Sharr et al., 1994d).

The survival rate of the release group coded with tag t (S_t), will be estimated as:

$$\hat{S}_t = \frac{\hat{C}_t + C\hat{u}_t}{R_t} , \qquad (5)$$

where

$\underline{C}_t$ = contribution of release coded with tag $\underline{t}$ to sampled strata,

$\underline{Cu}_t$ = contribution of release group coded with tag $\underline{t}$ to unsampled strata,

$\underline{R}_t$ = total number of fish in release group coded with tag $\underline{t}$ released from hatchery.

Assuming the total release of fish associated with a tag code is known with negligible error, and that the cumulative variance contributions associated with the unsampled strata are small, a suitable variance estimate for $\hat{\underline{S}}_t$ is given by:

$$\hat{V}(\hat{S}_t) = \frac{\sum_{i=1}^{L} x_{it} \left[\frac{N_i \hat{a}}{s_i p_t}\right]\left[\frac{N_i \hat{a}}{s_i p_t} - 1\right]}{R_t^2} . \qquad (6)$$

Inseason Hatchery Contributions

Inseason fisheries decisions which must be made on very short notice require rapid, real time analysis of coded wire tag data. Three inseason estimates of hatchery contributions of pink salmon will be generated for each opening. The first and most timely estimate will be calculated using knowledge of numbers of tags (undecoded) found in a sample taken from the catch and an estimate of that catch. The presence of tags in adipose-clipped fish will be discerned by passing their excised heads over a scanner identical to those used by the Tag Lab. The estimate of the catch aboard tenders will be obtained from tender captains or processor operators. In the event that catch estimates cannot be obtained, a simple unweighted average (over sampled tenders) proportion of hatchery fish in the catch will be reported. Estimation using undecoded tags requires that assumptions be made about expansion ($1/\underline{p}_t$) and adjustment ($\underline{a}$) factors (see Equation 2). For fishery openings in the western and northern portions of PWS, late run returns from PWSAC facilities are assumed to be the only hatchery contributors. For openings in the Southwestern district, an expansion factor which is a weighted average of all expansion factors associated with tags released at the A.F. Koernig, W. Noerenberg and Cannery Creek hatcheries in 1993, will be used. The weighting scheme depends upon historical contributions of hatcheries to the district in question. A similar weighting scheme for expansion factors will be used for the Coghill and Northern districts and will involve historical contributions associated with the Cannery Creek and W. Noerenberg hatcheries. For openings in the eastern part of the Sound, returns to the VFDA Solomon Gulch facility are assumed to be

the only hatchery contributors. With respect to an appropriate expansion factor for these openings, the average of all factors associated with tags released from the Solomon Gulch facility in 1993 will be used. An average historical (1989-1994) adjustment factor associated with the W. Noerenberg facility will be used for all inseason contribution estimates. These estimates can be made available at any stage of the unloading process, and only require that some sampling has been conducted. The precision of the estimate is, of course, increased as more of the catch is sampled. Such readily available, but less precise estimates will play a significant role in those fishery management decisions that have to be made before the more precise estimates which require exact catch figures and larger sample sizes are available. Calculations of in-season contributions will follow those used to generate post-season results (Equation 2). The second estimator will be identical to the first, except that it will be calculated only after sampling of an opening is completed and after exact tender loads have been reported. The result will be a less timely but more reliable estimate. The third estimator will be less timely still because it will rely on exact catch data and extracted and decoded tags. Use of code-specific expansion factors will, however, provide hatchery-specific contribution estimates and will mean a reduction in bias of the estimates resulting from use of average expansion factors.

Alternatives

Estimation of stock specific contributions to large commercial fisheries requires some sort of natural or man-induced mark which is characteristic of the stock or groups of stocks to be distinguished. Any mark to be used for estimates of stock specific catch contributions for inseason fisheries management must: (1) be naturally present in all or a fixed portion of the population or easy to apply permanently to a fixed portion of the population in the early life stages before stock mixing occurs, (2) be easy to distinguish in adult returns, (3) be present or can be applied to a large enough portion of the population such that significant numbers can be recovered among adult returns in a cost-effective manner for accurate and precise estimates of catch contributions, and (4) not affect survival or behavior of fish.

Until recently, coded wire tag technology has been the only man-induced mark available which meet most of the above criteria. Although this technology has given us the opportunity to distinguish hatchery and wild fish in commercial harvests with reasonable accuracy and precision, it is not without problems. The pink salmon tagging program in PWS is the largest of its kind in the world and is pushing the limit of the technology for both application and recovery. Application in very small fish such as pink salmon may affect survival, may not be permanent (tag loss), and tagging may affect behavior. Some methods exist and are used to adjust for tag loss from differential mortality and tag shedding. The effect of tag-induced straying, though thought to be small, is, however, difficult to accommodate. On the recovery side, large and expensive sampling programs must be implemented to ensure sufficient precision of contribution estimates.

An alternative mark which circumvents the above drawbacks would be desirable. The most likely alternative to coded wire tags are thermal or chemical otolith marks. Otolith marking methods meet all of the five criteria described above. Thermal marks have been thoroughly tested in all salmon species. They are permanent, are easily applied to every individual in a hatchery population and are less expensive to apply and recover relative to coded wire tags. Because they can be applied to every individual in the population, contribution estimates based on thermal marks will be more accurate and precise than those based on coded wire tags. Differential mortality of tagged fish will no longer be a problem. Because the mark is non intrusive, permanent tag loss through shedding and straying of tagged fish will also be eliminated. A large scale otolith marking program for PWS hatchery pink salmon releases has been proposed for 1995 (Study 95320C). Recoveries of otolith marks from these releases can begin in 1997.

Chemical marking of otoliths has not been tested in salmon to the same degree as thermal marking, but is widely used in other species. Chemical marking requires that young fish be fed or immersed in a chemical agent which leaves a recognizable band on otoliths or skeletal structures. Tetracycline is one widely used chemical which deposits a distinctive skeletal or otolith growth band which is florescent under ultraviolet light. Because it is retained in the tissues, Food and Drug Administration permits for its use in fish destined for human consumption fish were initially difficult to obtain but permitting is now done on a routine basis for many species. The method has promise for marking wild fish where heated water is not available for thermal marks.

To date no natural markers have been discovered in PWS pink salmon which allow researchers to distinguish hatchery stocks from all wild stocks. Genetic marks are a possibility but hatchery parent stocks in PWS originated from wild stocks in the area and are shared by more than one facility, and hence are probably not distinguishable.

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C. Contracts:

This is a cooperative program funded by the Trustee Council, ADF&G, Prince William Sound Aquaculture Corporation, and Valdez Fisheries Development Association. ADF&G, Commercial Fisheries Management and Development Division will ensure that 1) pink salmon catches are scanned for pink salmon with clipped adipose fins; 2) representative samples of heads from adipose-clipped pink salmon are collected and shipped to the Juneau Tag Laboratory; 3) information obtained from this project is adequately documented and cataloged, 4) biometrics review of methods and data analysis is obtained, and 5) reports documenting results are written. The ADF&G Tag Laboratory in Juneau will extract and decode all coded-wire tags from samples of pink salmon heads sent from PWS. Funds from PWSAC and VFDA for coded-wire tag recovery operations will be conveyed to ADF&G through cooperative agreements.

D. Location:

This project will be conducted in the PWS region. Pink salmon fry will be marked at the three hatcheries operated by Prince William Sound Aquaculture Corporation (Armin F. Koerning, Wally H. Nurenberg, and Cannery Creek) and the single hatchery operated by the Valdez Fisheries Development Association (Solomon Gulch). Sampling sites will depend upon disposition of the commercial and hatchery cost-recovery harvests and will most likely occur in various PWS communities (i.e. Cordova, Valdez, and Whittier), Seward, Anchorage, Kenai and Kodiak. Some sampling may also be done aboard processing vessels in PWS as well as at hatchery sites.

SCHEDULE

A. Measurable Project Tasks for FY 96

October 1995 - June 1996:	Hire personnel; order supplies; create and test computer programs and spreadsheets; data analysis and reporting
March - April 1996:	Apply tags to pink salmon fry at hatcheries
April 15, 1996:	Submit annual project report for FY 95
June - Sept 1996:	Scan catches; recover tagged fish in harvests and brood stocks; recover/decode tags; provide inseason catch composition estimates by time and area
April 15, 1997:	Submit annual report for FY 96

B. Project Milestones and Endpoints

March - April 1996:	Apply tags to brood year 1995 pink salmon fry
April 15, 1996:	Annual report for FY 95
June - September 1996:	Estimate harvest stock composition for brood year 1994
March - April 1997:	Apply tags to brood year 1996 pink salmon fry (if two year overlap with otolith marking program approved by Trustee Council)
April 15, 1997:	Annual report for FY 96
June - September 1997:	Estimate harvest stock composition for brood year 1995
April 15 1998:	Completion report for program (if only one year overlap with otolith program approved by Trustee Council)
June - September 1998:	Estimate harvest stock composition for brood year 1996 (if these fry were tagged)
April 15 1999:	Completion report for program (if two year overlap with otolith marking program approved by Trustee Council)

C. Project Reports

An annual project report will be submitted by April 15 of each year.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The foundations for this project were firmly established in joint feasibility studies which were conducted by ADF&G and non-profit aquaculture associations in PWS beginning in 1986 and extending through 1988. Results of these studies have been summarized by Peltz and Miller (1990), Peltz and Geiger (1990), and Geiger and Sharr (1990). 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 (NRDA F/S Study #3). Tag recovery efforts for wild and hatchery pink salmon were funded by damage assessment funds in 1989, 1990, and 1991 (F/S Study #3) and by restoration funds in 1992 and 1993 (Restoration Studies 60A and 93067). Results of damage assessment and restoration coded wire tag studies have been reported by Sharr et. al. (1994d, 1994e and 1994f). Following the loss of funds for further tagging of hatchery stocks of pink salmon in 1990, the private non-profit aquaculture groups in PWS have continued to tag pink salmon releases at their own expense. Tags applied to pink fry from the four pink salmon hatcheries in PWS in 1993 must be recovered. Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association, and the ADF&G have pooled their resources to come up with approximately half of the funds required to

field a full fledged pink salmon tag recovery effort in 1995. The additional funds to complete tag recovery efforts and data analyses are to be provided by the Trustee Council.

The pink salmon coded-wire tag recovery program has complimented several other projects since 1989. Improved escapement estimates for PWS pink salmon from NRDA F/S Study 1 and restoration Study 60B were used in conjunction with catch contribution estimates from the coded wire tag recovery projects to adjust fishery exploitation rates and achieve wild stock escapements. Growth and survival estimates from NRDA F/S Study #4 could not have been obtained without F/S Study #3 which provided coded wire tagged fish of known origin and release timing. The pink salmon coded-wire tag recovery program is also integrated with several other salmon restoration projects being conducted in PWS in 1995. It will complement the Sound Ecosystem Assessment (SEA) program, the multi-disciplinary program designed to develop of understanding of the mechanisms regulating ecosystem function in PWS. SEA is focused on interactions of pink salmon and herring with other components of the PWS ecosystem. Marked pink salmon provide a valuable tool for examining interactions between wild and hatchery salmon during the early marine period. The salmon growth component of SEA uses marked pink salmon to evaluate habitat overlap between wild and hatchery salmon, to examine the size composition of wild and hatchery salmon in mixed schools, and to estimate juvenile salmon mortality during the time of ocean residence. The salmon predation component of SEA uses marked pink salmon to determine whether predators select wild or hatchery salmon.

ENVIRONMENTAL COMPLIANCE

This project has qualified for a categorical exclusion to the requirements of the National Environmental Policy Act.

PERSONNEL

The Principal Investigator (PI) for the project will be a permanent full-time Fisheries Biologist III (FB III) for the Alaska Department of Fish and Game. The PI will be responsible for writing project operational plans, administering project budgets, quality control of data collection, supervising data analyses and, co-authoring final reports. A Fisheries Biologist II (FB II) will supervise day to day project operations, maintain data quality, assist in data analyses, and coauthor final reports. The FB II will be assisted by one permanent seasonal Fisheries Biologist I (FB I). The FB I will be in charge of supervising day to day sampling activities in Cordova and will assist the PL in supervising sampling at other ports, on floating processors, and at hatcheries. Non-permanent Fish and Wildlife Technician III's (FWT III) will be stationed in Cordova and Valdez and will assist the FB I as crew leaders. The crews in each port will be non-permanent FWT II's. Each day, two persons on each crew will scan pink salmon at each processing plant. Under the supervision of the FB I, the FWT III's will conduct daily data logging, editing and archiving activities in Cordova and Valdez.

A Biometrician I from the ADF&G Commercial Fisheries and Development Division Region II office in Anchorage will provide biometrics support for the project. The Biometrician I will assist in experimental design, inseason and post season data analyses, and report writing.

The PI, FB II or, FB I will maintain daily phone contact with project technicians stationed in ports other than Cordova or Valdez and at several remote hatchery locations. Copies of data forms from these sites will be faxed to Cordova daily and heads from sampled fish will be shipped once or twice weekly to Cordova via scheduled commercial flights or via chartered aircraft depending upon which is available. The PL, APL, or project Fisheries Biologist I's will make routine supervisory visits to each sampling port via chartered or commercial aircraft at least twice monthly for sampling quality control inspections, data collections, and industry contacts. The Biometrician I will travel to Cordova several times during the season to assist with inseason data analyses and occasionally after the season to assist with final data analyses and report writing.

Fisheries Biologist III Principal Investigator - To be announced.

RENATA RIFFE - Fisheries Biologist II Research Biologist

Ms. Riffe has a Master of Science in Statistics from Colorado State University (1994), a Master of Science in Fisheries Management from the University of Alaska, Fairbanks (1987), and a Bachelor of Science in Fishery Biology from Colorado State University (1981). Since October 1994 Ms. Riffe has worked on the coded wire tag project as an FBII Research Biologist in the capacity of Assistant Project Leader. Prior to her current position, (from June 1991 - October 1994), she was employed as a biologist with ADF&G , Sport Fish Division in Fairbanks, Alaska, and assisted in projects concerning abundance estimation and population evaluation of pike, grayling, humpback whitefish, least cisco, rainbow trout, burbot, chum salmon, and king salmon. From May 1982 - January 1991, she worked as a technician with ADF&G, Commercial Fisheries Management and Development Division in Juneau, Alaska. Her primary duties involved sampling commercial salmon fisheries and salmon escapements, with some report writing. She also developed discriminant function models for stock separation of Lynn Canal sockeye salmon, by scale pattern analysis, developed a computer model which simulated migratory timing of salmon escapements, and evaluated truncated escapement counts. She has authored reports for ADF&G on estimates of abundance and survival rates of round whitefish, compilation of age and length data for rainbow trout in southwest Alaska, and migratory timing of salmon in the Situk River, Alaska.

SEAWAN GEHLBACH - Fisheries Biologist I

Ms. Gehlbach has a Bachelor of Science in biology from the University of New Hampshire (1992). Ms. Gehlbach has worked on the coded wire tag project as an FBI for the past two fishing seasons. Her responsibilities include hiring and supervising 20 Fish and Wildlife Technician II's that sample in eight ports around PWS. In the absence

of a project FB-I this previous season, she was also responsible for the duties of the current APL, and produced inseason data analysis for management staff and post season data analysis for the annual coded wire tag reports. Prior to her current position with ADF&G, she worked for Sport Fish Division in Juneau, as a short term Fish and Wildlife Technician II; her duties included collecting coded wire tag data and catch information for the sport fishery. Ms. Gehlbach has also worked for the Douglas Island Pink and Chum (DIPAC) hatchery in Juneau as a field observer, and later in the hatchery as a member of the incubation and broodstock collection crews.

DAVID EVANS - Biometrician I

Mr. Evans has a Bachelor of Science in soil science from the University of Nottingham (U.K.), a Master of Science and a Doctor of Philosophy degree in soil science from the University of Guelph (Ontario, Canada), and a Master of Science in statistics from Oregon State University. David has worked with the Alaska Department of Fish and Game since October, 1991. His primary responsibility has been analysis of coded-wire-tag data from PWS. He has designed the statistical procedures and computer spread sheets used for inseason analysis of tag recovery data, has overseen most of the post season data analyses and has co-authored interim and final reports for the 1991 NRDA F/S Study #3, the 1992 Restoration Study 60C, and the 1993 Restoration study 93067.

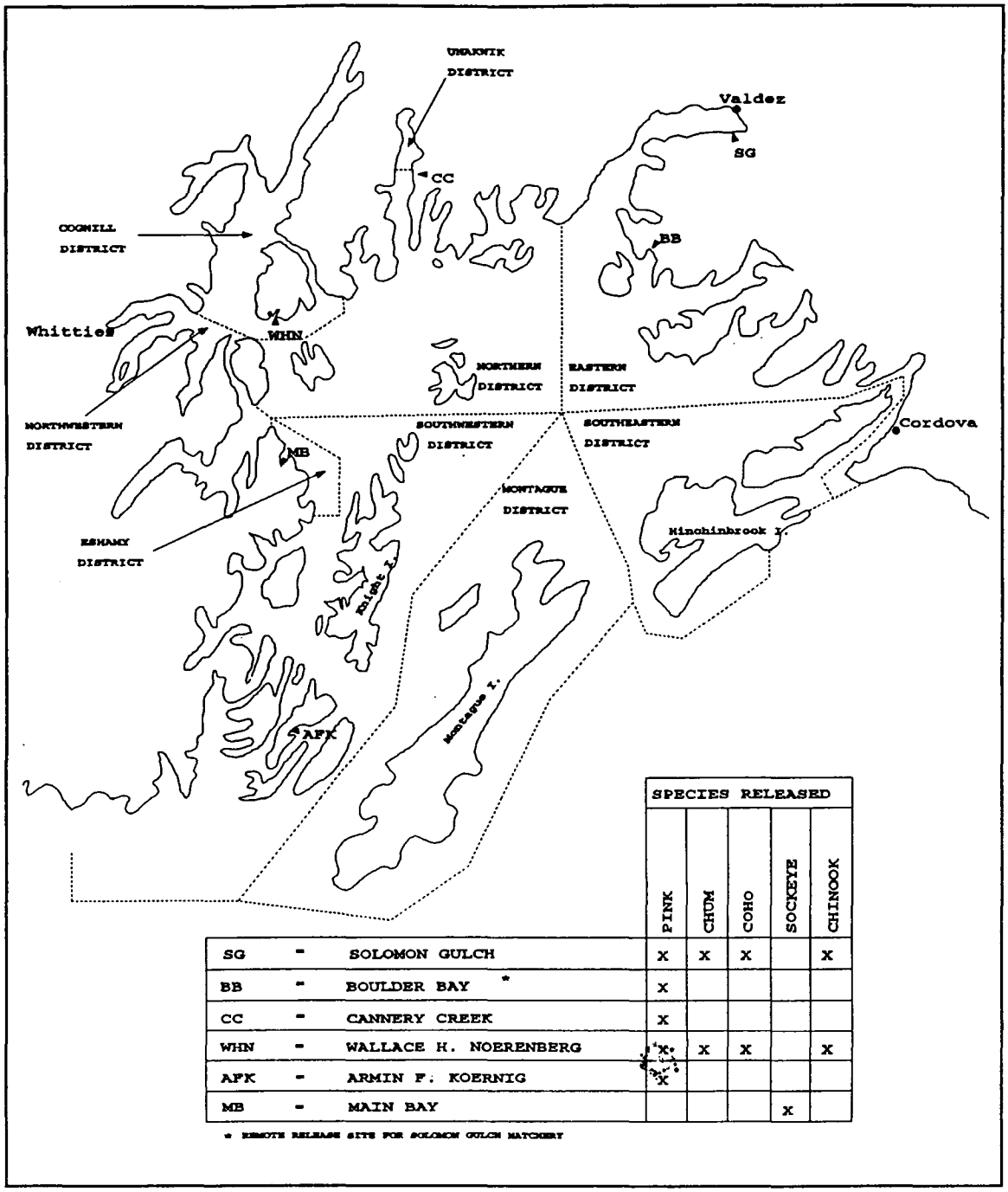

Figure 1. Fishing districts and hatcheries of Prince William Sound, Alaska

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel		$116.2						
Travel		$12.7						
Contractual		$100.6						
Commodities		$2.9						
Equipment		$0.0						
Subtotal	$0.0	$232.4						
General Administration		$24.5						
Project Total	$0.0	$256.9	$256.9	$256.9	$85.0	$0.0	$0.0	$0.0
Full-time Equivalents (FTE)		2.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This is a cooperative project between the Trustee council, Alaska Department of Fish and Game, Prince William Sound Aquaculture Corporation (PWSAC) and Valdez Fisheries Development Association (VFDA). Following is a breakout of funds provided by each entity:

Trustee Council	$256.9 k
ADF&G	$80.0 k
PWSAC	$100.0 k
VFDA	$26.2 k

1996

Prepared:

Project Number: 96186
Project Title: Coded Wire Tag Recoveries from Pink Salmon, PWS
Agency: AK Dept. of Fish & Game

FORM 3A
AGENCY
PROJECT
DETAIL

5/9/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1996
	David Evans	Biometrician I	17E	5.0	5,198	0	26.0
	PCN 115062	FBIII	18A	3.0	5,371	0	16.1
		FTII(Valdez)	9A	3.5	2,159	4,922	12.5
		FTII(Anchorage)	9A	2.0	1,945	1,800	5.7
		FTII(Kodiak)	9A	1.0	2,120	1,580	3.7
		FTII(Kenai)	9A	2.0	1,945	1,800	5.7
		FTIII(Cordova)	9A	2.0	2,439	3,593	8.5
	Seawan Gehlbach	FBI	14B	7.0	4,291	0	30.0
*	PCN 117021	FB-III	18L	1.0	6,333	0	6.3
*	PCN 116110	LIB-I	17J	0.3	5,530	0	1.7
							0.0
							0.0
		Subtotal		26.8	37,331	13,695	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$116.2

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1996
*	Fishery Biologist III and II travel to Anchorage for workshops	224	3	9	150	2.0
	Supervisory trips to Whittier	224	4	8	150	2.1
	Supervisory trips to Anchorage	224	4	8	150	2.1
	Supervisory trips to Seward	224	3	6	150	1.6
	Supervisory trips to Kodiak	610	3	5	150	2.6
	Supervisory trips to Kenai	300	4	7	150	2.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$12.7

1996

Project Number: 96186
Project Title: Coded Wire Tag Recoveries from Pink Salmon, PWS
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed
Description	FFY 1996
Tag Lab Costs	75.0
Air Charters for brood stock sampling	2.0
Air Charters for Supervision and Data Transport	12.2
Dept. of Transportation Vehicle Rental	3.4
Office Costs	3.6
Renting Magnetic Tag Detectors	4.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$100.6

Commodities Costs:	Proposed
Description	FFY 1996
Rain gear, gloves, knives, sampling kits, supplies	2.9
Commodities Total	$2.9

1996

Project Number: 96186
Project Title: Coded Wire Tag Recoveries from Pink Salmon, PWS
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual & Commodities DETAIL

5/9/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96186
Project Title: Coded Wire Tag Recoveries from Pink Salmon, PWS
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

/95

This replaces earlier version of DPD that went out in peer reviewers notebook 5/5/95.

Construction of a Linkage Map for the Pink Salmon Genome

96190

Project Number:	
Restoration Category:	Research
Proposer:	Fred W. Allendorf University of Montana
Lead Trustee Agency:	ADFG
Duration:	Five years
Cost FY 96:	$240,000
Cost FY 97:	$250,000
Cost FY 98 - 00:	to be determined
Geographic Area:	Prince William Sound
Injured Resource:	Pink salmon

ABSTRACT

We propose to construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms. The ability to genetically map the location of oil induced lesions will allow the thorough identification, description, and understanding of oil induced genetic damage. This research will also aid other recovery efforts with pink salmon, including estimation of straying rates, description of stock structure, and testing if marine survival has a genetic basis.

INTRODUCTION

We propose to construct a genetic linkage map for the pink salmon genome. Such a map would provide the necessary platform for identifying genetic damage in pink salmon inhabiting oiled streams following the March 1989 *Exxon Valdez* oil spill (EVOS). A detailed genetic map would also aid other recovery efforts with pink salmon, including estimation of straying rates, description of stock structure, and testing if marine survival has a genetic basis.

Genetic linkage maps have provided the necessary information for understanding genetic variation in species since the rediscovery of Mendel's principles early in this century. A genetic map plays a similar role for a geneticist that a geographical map plays for the explorer of new territories. For many years, genetic maps could only be constructed in a very few model species that were suitable for extensive genetic manipulation (e.g., Drosophila and mice). Recent advances in molecular genetics now make it possible to uncover enough genetic markers to construct a detailed genetic linkage map in almost any species (Postlethwait et al. 1994).

This work will have important significance for ongoing work with pink salmon under the project Oil-Related Embryo Mortalities (Restoration Study 95191A). That project proposes to identify germline mutations in pink salmon exposed to oil. As explained in the FY95 Detailed Project Description (95191A), genetic damage induced by oil may either be small changes in

nucleotide sequence (microlesions) or large-scale changes in chromosome structure (macrolesions). Restoration Study 95191A proposes to screen pink salmon DNA in order to detect such lesions. A detailed genetic map for pink salmon would be invaluable for interpreting the results of Restoration Study 95191A in several ways. First, it will be possible by following the inheritance of any DNA lesions to determine if they are micro- or macro-lesions. Second, these lesions can be mapped to determine if they are randomly spread throughout the genome or if they occur at mutational "hot spots" that are susceptible to oil induced damage.

The construction of a detailed linkage map will also serve as a basis for understanding genetic aspects of pink salmon restoration and supplementation. This work will be performed on both odd- and even-year pink salmon because of the known genetic differences between these fish. In addition, the outbreeding depression found in hybrids suggests that there are chromosomal differences between odd- and even-year fish (Gharrett and Smoker 1991).

NEED FOR THE PROJECT

A. Statement of Problem

Elevated embryo mortalities were detected in populations of pink salmon (*Oncorhynchus gorbuscha*) inhabiting oiled streams following the March 1989 *Exxon Valdez* oil spill (EVOS). These increased rates of mortality persisted through the 1993 field season, three generations after the oil spill, suggesting that genetic damage may have occurred as a result of exposure to oil during early developmental life-stages. The consequences of the putative genetic damage include impaired physiological function of individuals and reduced reproductive capacity of pink salmon populations.

The aggregate of evidence from the field studies and incubation experiment suggests that the embryos exposed to oil in 1989 and 1990 accumulated deleterious mutations in the germline (reviewed in Detailed Project Description of Project 95191A). This hypothesis of genetic damage is consistent with previous field observations and laboratory experiments on the effects of crude oil on early life stages of fish. Long term intra-gravel oil exposures (7-8 months) to freshly fertilized eggs provide embryos sufficient time to accumulate polynuclear aromatic hydrocarbons (PAH's) from very low aqueous concentrations of crude oil. PAH's are abundant in crude oil and are potent clastogens (i.e. capable of breaking chromosomes).

Mironov (1969) observed reduced survival of fish embryos and larvae exposed to very low aqueous doses (1 ul oil/l seawater) of oil. Longwell (1977) reported genetic damage in pelagic embryos affected by the ArgoMerchant oil spill. Moles et al. (1987) confirmed that pink salmon embryos take up PAH's and demonstrated that the uptake was much greater in an intertidal environment than in strictly freshwater conditions. Biggs et al. (1991) found greater numbers of chromosome aberrations in larval herring which incubated in oiled areas than in non-oiled areas. It is likely that the same type of damage may have occurred in pink salmon, and this damage could have affected the germline of exposed individuals (Malkin 1994).

B. Rationale

The recovery objective for pink salmon is healthy and productive populations that exist at prespill levels or levels in unoiled areas. An indication of recovery is when egg mortality in oiled areas match prespill or levels in unoiled areas. The genetic map we propose to construct will be essential for detecting and understanding causes of reduced egg and embryo survival in oiled areas.

The genetic damage caused by exposure to oil may persist longer in populations of pink salmon than in other vertebrates because of the tetraploid nature of the salmonid genome. Salmonid fishes went through a tetraploid event some 25 million years ago that duplicated their entire genome (Allendorf and Thorgaard 1984). The extra genes in pink salmon may mask the effects of mutational damage caused by recessive deleterious alleles. The effects of these deleterious mutations may be uncovered in subsequent generations.

This fundamental genetic information would be of great assistance for three of the four Components of the Pink Salmon Restoration Program:

Toxic Effect of Oil on Pink Salmon: genetic mapping is essential for identifying genetic lesions induced by exposure to oil.

Stock Separation and Management: the genetic markers identified in the course of this study will provide greatly increased power and resolution to identify stocks of pink salmon on a very fine scale.

Supplementation: the genetic markers will also be of great value in genetically identifying fish from supplementation programs and detecting their ecological and genetic interactions with wild fish.

Information gained from this study will provide resource managers with insight into the magnitude and persistence of damages sustained by wild pink salmon due to EVOS. Efforts to restore damaged pink salmon populations depend upon the ability of fishery managers to identify sources of reduced survival and to monitor their persistence. The potential of long term oil exposures to cause genetic damage needs to be understood so that spawning escapement goals can be adjusted if necessary. In addition, verification of the genetic hypothesis would provide the first evidence that the germline of fish exposed to chronic or acute sources of oil pollution can be affected.

Our results may have relevance for other fish species as well (e.g., Pacific herring, *Clupea pallasi*). Comparative gene mapping has shown that the linkage groups in a wide variety of vertebrates have been conserved. If we find that certain loci in pink salmon are mutational "hotspots" for oil induced damage, it would be possible to look for similar hotspots in Pacific herring or other fish species (e.g., rockfish, *Sebastes*).

C. Summary of Major Hypotheses and Objectives

Our primary objective is to construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms in pink salmon. We will use several types of different genetic markers. The primary type will be so-called random amplified polymorphic DNA's (RAPD's) using the polymerase chain reaction (PCR). Our goal is to map several hundred of these loci so that we have a detailed saturated linkage map. We will use these RAPD loci as a basis for mapping other DNA polymorphisms (e.g., microsatellite loci), as well as loci encoding protein polymorphisms (allozymes).

This genetic map will allow testing of several hypotheses of Project 95191A related to identifying sites of genetic damage (lesions) induced by exposure to oil. The primary hypotheses are: (1) Genetic lesions have been induced by oil exposure; (2) These lesions are caused by point mutations (microlesions); (3) These lesions are caused by chromosomal breakage and deletions (macrolesions).

Secondary objectives of this proposed research are to develop a large number of genetic markers for estimation of straying rates, stock separation, and management of pink salmon and for evaluating the success and potential detrimental effects of supplementation programs. A genetic map will also allow us to test the hypothesis that marine survival has a genetic basis to it. We also have a variety of specific genetic hypotheses that we will test as explained in the more detailed Project Design.

D. Completion Date

We propose to continue this work for five years. This will allow us to complete multigenerational studies of inheritance with pink salmon. New genetic markers will be developed in the first year of the study. However, it will take several years to map the markers in both males and females in both odd- and even-year fish. Different objectives will be met throughout the course of the research. This project would be carried out in collaboration with Dr. James E. Seeb, Alaska Department of Fish and Game. The primary laboratory aspects of this research would be carried out at the University of Montana. We propose to use the Alaska SeaLife Center Research Facilities at Seward when they are available. Such a facility will greatly strengthen genetic investigations with pink salmon by allowing multigenerational studies. We cannot estimate budget costs after the first two years without knowing the cost structure of using the Alaska SeaLife facility.

COMMUNITY INVOLVEMENT

This is a specialized project that will not benefit directly from the knowledge of local/traditional people. We will hire local residents when possible for assistance (e.g., maintaining of fish). In addition, as an professional educator in a university I am very committed to educational efforts. These will include informational meetings in the communities of Prince William Sound, including the Alaska SeaLife Center in Seward, and articles in the Trustee Council newsletter.

FY 96 BUDGET

Personnel	124.7
Travel	4.5
Commodities	23.5
Equipment	43.1
Subtotal	195.8
Indirect Costs	44.2
Total	240.0

PROJECT DESIGN

A. Objectives

Our primary objective is to construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms. Pink salmon have 26 pairs of chromosomes (2N=52; Allendorf and Thorgaard 1984), and, therefore, should have a total of 27 linkage-groups (LG's): 25 autosomes, an X-chromosome, and a Y-chromosome. We plan to map enough variable markers so that a new marker, such as a putative lesion identified in Restoration Study 95191A, can be assigned with high probability to one of the 27 LG's. It is impossible to know how many markers this will require because we do not know the total length of the pink salmon linkage map. The linkage map of the zebrafish (*Danio rerio*) has been estimated to be 2317 centimorgans (cM; Postlethwait et al. 1994). We expect the pink salmon map in females will be longer than this because of the polyploid ancestry of salmonids. However, the linkage map in males will be shorter than in females because of the reduced recombination rate in male salmonids (Johnson et al. 1987). We anticipate that it will be necessary to map approximately 500 markers to insure that new markers can be assigned to an existing LG with high probability (Van der Beek and Van Arendonk 1993). For example, 99% of all loci in the zebrafish are estimated to be located within 20 cM of a marker on the map based upon 414 markers.

This project has the following specific objectives:

1. Develop several hundred variable DNA markers in pink salmon and test them for Mendelian inheritance.

2. Construct a linkage map based upon joint segregation patterns of the DNA polymorphisms detected in previous objective.

3. Map putative lesions identified in Restoration Study 95191A.

4. Test for Mendelian inheritance of markers throughout the genome in progeny of fish exposed to oil. Regions that show aberrant segregation ratios in progeny of fish exposed to oil and normal 1:1 ratios in fish not exposed to oil would be candidates for oil-induced lesions.

5. Test for regions of the genome that are associated with traits of adaptive significance (e.g., marine mortality or run-timing).

6. Test if protein markers (allozymes) are under natural selection such that they may not provide accurate information about the genetic structure and amount of gene flow among populations.

B. Methods

Linkage Map (Objectives 1 & 2)

A useful genetic map should contain genetic markers that are abundant, randomly distributed throughout the genome, highly polymorphic, and readily detectable in many laboratories (Jacob et al.

1995). A map of random amplified polymorphic DNA's (RAPD's) markers fits these criteria (Postlethwait et al. 1994). Our work has found that a polymerase chain reaction (PCR) with genomic DNA from fish of the genus *Oncorhynchus* as a template and a single, 10-nucleotide-long primer of arbitrary sequence generally amplifies 5-10 DNA fragments. We have found differences in the fragment patterns between individuals (scored as presence or absence of fragments) that are inherited as simple Mendelian markers in rainbow trout (*O. mykiss*) and cutthroat trout (*O. clarki*). A dominant allele amplifies the DNA fragment with a specific primer, whereas a recessive allele results in the absence of that fragment.

We will avoid difficulties of dominance with these markers by using haploid progeny in which recessive alleles are not obscured by their dominant alternatives (Lie et al. 1994). Stanley (1983) reported that haploid embryos of Atlantic salmon (*Salmo salar*) will develop until just prior to the stage of hatching if development of the eggs is activated by sperm in which the DNA has been inactivated by UV-radiation. We have used this technique routinely with fishes of the genus *Oncorhynchus* (Forbes et al. 1994). This will allow us to follow the segregation and linkage relationships in haploid progeny from females.

Differences in meiosis between male and female salmonids have been found in all species that have been examined (Allendorf and Thorgaard 1984; Johnson et al. 1987). There generally is greater recombination in females than in males (Johnson et al. 1987; Allendorf et al. 1994). In addition, only disomic inheritance has been reported in females. However, in males some loci show patterns of segregation that approach those expected with tetrasomic inheritance (Allendorf and Thorgaard 1984). We will have to test for segregation and linkage in males as well as females because of these sex-specific differences.

There are three possible approaches to test for segregation and recombination in males. One is genotyping in diploid progeny from parents that have been chosen so that presence or absence of a RAPD allele can be determined unambiguously. A second approach is the typing of haploid progeny from males by PCR based genotyping of single sperm; this has been carried out successfully with human sperm (Schmitt et al. 1994). Individual sperm from a single male are sorted into microtiter plates by flow cytometry, and then a PCR reaction carried out. We will perform pilot studies to determine if the latter method is feasible with pink salmon. A third possibility is to examine joint segregation in androgenetic haploids which are produced by treating eggs with radiation before fertilization with normal sperm (Scheerer et al. 1986). This treatment would be carried out in collaboration with Restoration Study 95191A in their use of androgenesis to test for elevated occurrence of harmful recessive mutations in haploid-androgens of oil-exposed ancestry.

The completion of a full linkage map is a large task. We will try to use and develop as many time and labor saving procedures as possible (Lincoln and Lander 1992; Taylor et al. 1994; Perlin et al. 1994; Archibald 1994). Our initial linkage map will be based upon progeny from females, and will be constructed by computer assisted analysis (Lander et al. 1987). We will compare the recombination rates based upon this map to rates of selected pairs of loci in males. The reduced recombination rates in salmonid males means that it will be easier to assign new markers to a LG using male parents. We will test joint segregation of individual markers from different LG's in females to determine if some of these separate LG's in females are linked in males and are therefore syntenic (on the same chromosome).

Identification and Location of Oil-Induced Lesions (Objectives 3 & 4)

This work will be done in collaboration with efforts to detect oil-induced genetic damage under Component 3 of Restoration Study 95191A. Lesions identified in that study through DNA assays of introns, microsatellite loci, or mutational hot spot regions will be tested for joint-segregation with several hundred DNA markers to identify the location of such lesions in the pink salmon genome. A recent paper has found that microsatellite loci show genetic hypermutability because of defects in DNA mismatch repair (Parsons et al. 1995).

Perhaps a more promising approach, however, is to test for regions of the genome associated with non-random survival in haploid progeny. Restoration Study 95191A will test for decreased survival in haploid androgens of oil-exposed ancestry. Examining the segregation of markers throughout the genome in these androgens would provide a more powerful test for lesions. Regions of the genome that depart from the expected 1:1 Mendelian ratio would be candidates for lesions. We will also compare Mendelian ratios in haploid gynogens in a similar manner to haploid androgens. The examination of segregation in gynogenetic and androgenetic haploids will also allow testing for oil-induced chromosomal rearrangements (e.g., inversions and deletions).

Phenotypic Effects and Fitness (Objectives 5 & 6)

The completion of a genome map for pink salmon will allow us to address important genetic issues related to two other Components of the Pink Salmon Restoration Program. The numerous genetic markers identified in the course of this study will provide greatly increased power and resolution to identify stocks of pink salmon on a very fine scale (Stock Separation and Management). The genetic map will allow us to test for the presence of genes having major effects on phenotypes of importance for the management of pink salmon, and to test for phenotypes associated with specific combinations of multilocus genotypes (Lander and Schork 1994).

This aspect of the research will be performed at the Alaska SeaLife Center Research Facilities in the latter years of the study. Large numbers of marked fish will be released and then collected when they return to the facility at sexual maturity. A large sample of the fish will be collected at release so that the genetic characteristics of the fish can be described prior to the marine phase of the life cycle. We will test for genetic effects on phenotypes of special importance by comparing the released and returning fish. This will allow us to test for genes having a major effect on marine survival.

In addition, previous work has demonstrated genetic differences between early and late run fish, and that differences in run-timing has a genetic basis (Smoker et al. in press). We will compare the genotypes of fish returning to the facility at different times to test for genes having a major effect on run timing. We will use a suite of genetic markers spread uniformly throughout the genome. Regions of the genome that show major associations with run-timing can then be examined in more detail by comparing additional markers within that region. A similar approach using only 10 protein markers in hatchery rainbow trout revealed several regions of genome associated with time of spawning (Leary et al. 1989)

Karl and Avise (1992) reported concordant patterns of genetic differentiation for mitochondrial DNA and four nuclear DNA loci in the American oyster (*Crassostrea virginica*) along

the east coast of North America. In contrast, previous allozyme studies had not detected these genetic differences among these same populations. Karl and Avise concluded that the pattern observed for the DNA markers reflected the historical patterns of isolation and gene flow among these populations while this pattern is obscured in the allozymes because of "balancing selection" at the allozyme loci. Similar results have been reported recently in the Atlantic cod (Pogson et al. 1995). These results provide an important challenge to the generally accepted utility of allozyme markers for describing historical patterns and amounts of gene flow between populations. That is, if allozymes are under strong natural selection then they may not provide accurate information about the genetic structure and amount of gene flow among populations.

Pink salmon that are more heterozygous at allozyme loci have greater viability and growth rates than more homozygous individuals (Altukhov et al. 1991; Zhivotovsky et al. 1987). Similar results have been reported in other salmonid species for many phenotypes of evolutionary importance (e.g., developmental rate, egg size, and disease resistance; reviewed by Ferguson 1992). Positive associations between heterozygosity at allozyme loci and important phenotypic characters, such as growth rate, survival, fertility, disease resistance, developmental rate, and developmental stability, have been described in many organisms (reviewed by Zouros and Foltz 1986; Allendorf and Leary 1986).

The mechanism underlying these associations remains unknown. The possible explanations most often considered are either the associations are be the consequence of heterozygosity at the loci examined, or the loci examined may be in linkage disequilibrium with other loci that affect the traits being studied (Leary et al. 1987). It has been argued that these relationships between multiple locus heterozygosity and phenotypes have been found with allozymes because these loci are important in ATP production and protein catabolism (Koehn et al. 1988). We propose to distinguish between these hypotheses by comparing the effects on marine survival of DNA markers and protein polymorphisms. If the enzyme loci themselves are responsible for this effect, then we would expect to find an association between enzyme genotypes and survival, but not between genotypes at DNA markers spread throughout the nuclear genome.

C. Contracts and Other Agency Assistance

None anticipated at this time.

D. Location

Gametes for the inheritance studies will be collected from Prince William Sound in collaboration with the project Oil-Related Embryo Mortalities (Restoration Study 95191A). Embryo incubation will take place at the Armin F. Koernig hatchery in Prince William Sound and at the Genetics Lab facilities of ADFG. The initial laboratory phases of the project will be done at the University of Montana.

We propose to use the Alaska SeaLife Center Research Facilities at Seward when it is available for rearing fish and laboratory analyses. This facility will greatly strengthen genetic investigations with pink salmon by allowing multigenerational studies and testing for effects of

specific genotypes on phenotypes of importance (marine survival, run timing, etc.). We anticipate that much of the laboratory analysis will be performed at this facility when it is available.

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SCHEDULE

A. Measurable Project Tasks for FY 96

15 Aug 95 - 30 Sep 95:	Obtain gametes and create families for inheritance studies with odd-year fish. This will be done under Restoration Study 95191A (Oil-Related Embryo Mortalities).
1 Oct 95 - 31 Mar 96:	Initial screen of odd- and even-year fish for DNA polymorphisms.
1 Apr 96 - 30 Sep 96:	Screening of DNA polymorphisms to test for Mendelian inheritance and joint segregation.

15 Aug 96 - 30 Sep 96: Obtain gametes and create families for inheritance studies with even-year fish.

B. Project Milestones and Endpoints

Objective 1: This objective will be completed by the end of year 1 (FY96).

Objective 2: This objective will be completed by the end of year 3.

Objective 3: This objective will be completed by the end of year 5.

Objective 4: This objective will be completed by the end of year 5.

Objective 5: This objective will be completed by the end of year 5.

Objective 6: This objective will be completed by the end of year 5.

C. Project Reports

Annual reports will be submitted by 15 April of each year. We will publish results from this project in peer-reviewed journals throughout the life of the project.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This work is being done in collaboration with James E. Seeb, Principal Geneticist, ADFG. The inheritance experiments will be in coordination with the project Oil-Related Embryo Mortalities (Restoration Study 95191A). Dr. Seeb and I are also coordinating plans to use the Alaska SeaLife Center Research Facilities at Seward when they are available. Where possible we will share fish samples, gametes, laboratory equipment, and fish rearing facilities.

This work is related to my ongoing genetic research with salmonid fishes that has been supported by the National Science Foundation since 1980. Many of the techniques and approaches proposed here are based upon the results of that research. I also intend to continue seeking support from NSF that will complement the research proposed here. A genetic map for pink salmon will allow us to address a number of fundamental questions in the conservation and genetics of pink salmon and other *Oncorhynchus* species.

ENVIRONMENTAL COMPLIANCE

Our laboratory is regularly screened by the Environmental Health Department of the University of Montana for compliance with all federal, state, and local environmental laws and regulations.

PERSONNEL

Project Leader: FRED W. ALLENDORF

BIRTH: 29 April 1947; Philadelphia, Pennsylvania

MILITARY SERVICE: U.S. Army, 1965-1968 (Vietnam, 1966-1967)

EDUCATION:
B.S., Zoology, Pennsylvania State University, 1971
M.S., Fisheries, University of Washington, 1973
Ph.D., Genetics and Fisheries, University of Washington, 1975 (co-directors, Joe Felsenstein and Fred Utter)

POSITIONS:

1975-1976	Lektor, Department of Genetics and Ecology, Aarhus University, Denmark
1976-1979	Assistant Professor of Zoology, University of Montana
1978-1979	NATO Fellow, Genetics Research Unit, University of Nottingham, England
1979-1984	Associate Professor of Zoology, University of Montana
1983-1984	Visiting Scientist, Department of Genetics, Univ. of California, Davis
1984-1989	Professor of Zoology, University of Montana
1989-1990	Program Director, Population Biology and Physiological Ecology, National Science Foundation (NSF)
1992-1993	Visiting Professor, University of Oregon
1990-	Professor of Biology, University of Montana
1993-	Director, Organismal Biology and Ecology Graduate Program, University of Montana

HONORS:
NATO/NSF Postdoctoral Fellowship, University of Nottingham, 1978-1979
European Molecular Biology Organisation (EMBO), Fellowship, University of Stockholm, 1979
Distinguished Scholar Award, University of Montana, June 1985
Burlington Northern Faculty Achievement Award for Research, University of Montana, June 1987
Elected Fellow, American Association for the Advancement of Science (AAAS), February 1987
Burlington Northern Faculty Achievement Award for Research, University of Montana, May 1991
Elected Member, AAAS Council (Biological Sciences Division)

MAJOR GRANTS:

National Science Foundation Research Grant, EPSCR, 1980-1983, $70,000
National Science Foundation Research Grant, Population Biology, 1980-1982, $60,000
National Science Foundation Research Grant, 1983-1986, $121,000
National Science Foundation, Faculty Research Opportunity Award, 1986, $10,000
United States Department of Agriculture Grant, Aquaculture, 1983-1985, $43,000
National Science Foundation Research Grant, 1986-1989, $148,000

National Science Foundation, Dissertation Research Grant, 1988-1990, $9,850
National Science Foundation Research Grant, 1989-1993, $150,000
National Science Foundation Research Grant, Conservation and Restoration Biology, 1993-1996, $250,000

ASSOCIATE EDITORSHIPS:
Evolution (1987-1990)
Journal of Heredity (1986-1989)
Progressive Fish Culturist (1986-1989)
Molecular Biology and Evolution (1994-)

EDITORIAL BOARDS:
Molecular Biology and Evolution (1983-1989)
Conservation Biology (1990-1993)
Molecular Ecology (1991-present)

PROFESSIONAL SERVICE:

Panel Member, Population Biology and Physiological Ecology, NSF (1987-1989)
Panel Member, International Program, National Science Foundation (1987)
Panel Member, Conservation and Restoration Biology, NSF (1991-1992; 1995)
Council Member, The American Genetic Association (1986-1989)
Genetics Nomenclature Committee, American Fisheries Society (1986-present)
Member, Committee on the Protection and Management of Pacific Northwest Anadromous Salmonids, National Research Council (1992-present)
Chair, Committee of Visitors, Systematic and Population Biology Programs, NSF (1993)

PROFESSIONAL SOCIETIES:
Society for the Study of Evolution
American Society of Naturalists
Genetics Society of America
Society for Conservation Biology
American Association for the Advancement of Science
American Society of Ichthyologists and Herpetologists
American Fisheries Society
American Genetic Association
Desert Fishes Council
Ecological Society of America
Montana Native Plant Society
Society of Systematic Biologists
Society for Molecular Biology and Evolution

BOOK CHAPTERS:

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Lead Agency Project Manager:

_____

Joseph Sullivan (ADFG)

_____

Date Prepared

Construction of a Linkage Map for the Pink Salmon Genome

BUDGET SUMMARY

PERSONNEL	
F. W. Allendorf (2 mo), Project Leader	12,350
Vacant, Research Scientist (12 mo)	33,000
Vacant, Research Assistants (24 mo)	44,400
	89,750
FRINGE BENEFITS	
Project Director (25%)	3,088
Research Scientist (30% + $240/mo health insurance)	12,780
Research Assistants (30% + $240/mo health insurance)	19,080
	34,948
TOTAL PERSONNEL	124,698
OTHER DIRECT COSTS	
Commodities (Laboratory supplies, etc.)	23,500
Travel	4,500
Equipment	43,055
	71,055
SUBTOTAL	195,753
INDIRECT COSTS (49.3% salaries & wages)	44,247
TOTAL	240,000

This replaces the descriptive letter about this project that went out in the peer reviewers' notebook 5/5/95.

CITY OF PORT LIONS, COMMUNITY HALL CONSTRUCTION MATCHING FUNDS REQUEST

Project Number: 96202

Restoration Category:

Proposer: City of Port Lions

Lead Trustee Agency:

Duration: 1 year

Cost FY 96: $150,000

Geographic Area: Kodiak Island

Injured Resource/Service: Recreation and Tourism

ABSTRACT

This request is of for matching funds for the construction of a new Community Hall in Port Lions. This project was interupted by the *Exxon Valdez Oil Spill* due to lack of manpower to complete the project. This project would replace the current Community Hall which has been condemned.

INTRODUCTION

The City of Port Lions had started construction of a new community hall in 1989, however, due to the *Exxon Valdez* oil spill manpower was not available to complete the project and funding was lost. The City of Port Lions has contracted a design firm for new floor plans and design of a new Community Hall. The City of Port Lions has also requested that $175,000 be reallocated for the Port Lions Community Hall. It has been estimated that this money will be enough to complete the shell of the building and not for any furnishings. We are asking for $150,000 from the Trustee Council to add a kitchen, to be used for senior meals and community gatherings, and to purchase furnishings to make the Community Hall functional.

NEED FOR THE PROJECT

A. Statement of Problem

This project is to help replace funding for a new Community Hall that was planned prior to the *Exxon Valdez* oil spill. At the current time there is no adequate place in Port Lions for community gatherings and meetings. This project is designed to restore a recreation facility for the City of Port Lions.

B. Rationale

This project was interupted by the *Exxon Valdez* oil spill. The oil spill activities in and around Port Lions and Kizhuyak Bay required all available manpower, thereby, leaving no man power to build a new Community Hall. Due to the lack of manpower and progress on the project funding was lost. Completion of this project will provide for a gathering place for the community that was lost due to the *Exxon Valdez* oil spill.

C. Summary of Major Hypotheses and Objectives

The sole objective of this project is to construct a new Community Hall that, when completed will be usable by the community for gatherings.

D. Completion Date

Completion of this project is estimated for the end of FY '96.

COMMUNITY INVOLVEMENT

The Community of Port Lions has been involved with this project since it's inception. During the last couple of years the community has become more concerned about completing the project, due to the lack of space for gatherings.

The Port Lions City Council is committed to the completion of this project and is committing all available resources of the City to it's completion. The Port Lions City Council is also committed to using local labor to complete this project to provided needed work for the community.

FY 96 BUDGET

The estimated budget for the amount requested is as follows:

Construction of Kitchen	50,000
Furnishings	25,000
Labor	60,000
Admin Costs	15,000
Total	150,000

PROJECT DESIGN

A. Objectives

This project will include the completition of a new Community Hall for the City of Port Lions. This new hall will include a gathering/meeting hall, commercial kitchen, handicap restrooms, Office for the Village Public Safety Officer, and storage space for old files.

This project will replace the existing hall which has been condemned because of structural failure. The original Community Hall was built after the 1964 earthquake and was used to house and feed the volunteers and villagers from Afognak who came to Port Lions to rebuild and relocate after the village on Afognak was destroyed. After the construction the hall was used as the school and also housing for the teachers until a new elementary school was built. Over the years the hall has been used by many groups, such as the School Districts athletic programs, the senior meals program, community dances and potlatches, Port Lions Tribal Council Offices, Village Public Safety Officer office, City Council meetings, and Coordination Office for the *Exxon Valdez* oil spill response for Port Lions and Kizhuyak Bay.

This project was originally scheduled for completion in 1989, however, due to the lack of manpower to complete the project, funding was lost. The manpower that was to be used for the construction was used for oil spill response and recovery in and around Port Lions.

The City of Port Lions has asked the Alaska Legislature to reappropriate $175,000 from another project to the Community Hall. The Port Lions City Council feels that the Community Hall is a major priority and is needed much more than the other project, which is a water line to the boat harbor. Communication between the City of Port Lions and our representatives is positive and we are anticipating that the reapproriation will be approved.

B. Methods

This project will be completed with the funds requested using local labor. Design, floor plans, and engineering plans have already been completed.

C. Contracts and Other Agency Assistance

The only component of this project to be contracted out is the design and engineering. This part of the project has allready been completed and paid for by the City of Port Lions.

No other agency assistance is perceived, except for the final plan review and approval of the State Fire Marshal's Office.

D. Location

This project will be located within the Port Lions City limits and the building will be built where the existing Community Hall is located.

The community that will be affected most by this project is the City of Port Lions. Outlying settlements on the north end of Kodiak Island and the settlements and residents of Afognak and Shuyak Island will also use this facility as a polling place for elections.

SCHEDULE

A. Measurable Project Tasks for FY 96

This project is expected to be completed by the end of FY96, with the following draft schedule

Design and Engineering	Completed
Demolition of old Hall	June 1, 1995
Construction of new hall	July 1, 1995
Completion of new hall	January 1, 1996
Final report	July 1, 1996

B. Project Milestones and Endpoints

The entire project is estimated to be completed by January 1996. The design and engineering for this project has allready been completed. Demelotion of the old hall is expected to begin June 1, 1995, with construction of the new hall begining July 1, 1995.

C. Project Reports

Project reports will be made on a quarterly basis, with final report prior to July 1, 1996.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

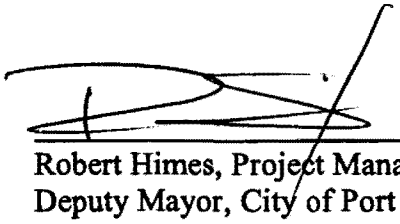
This project has been and will continue to be coordinated by the Port Lions City Council. Efforts have been underway to have funds reappropriated, and reports from our representative indicate that this will be approved.

ENVIRONMENTAL COMPLIANCE

This project is not covered by environmental laws or permit requirements.

PERSONNEL

Pete Squartsoff, Project Leader
Mayor, City of Port Lions
P.O. Box 110
Port Lions, Ak 99550
(907) 454-2332 (0ffice)
(907) 454-2420 (fax)



Robert Himes, Project Manager
Deputy Mayor, City of Port Lions
P.O. Box 110
Port Lions, AK 99550
(907) 454-2332 (office)
(907) 454-2420 (fax)

Community Hall Committee Members:

Pete Squartsoff, Mayor
Wayne Lukin, Council Member
Kevin Adkins, Community Member

Date Prepared: May 10, 1995

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1996	Proposed FFY 1996	PROPOSED FFY 1996 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
Personnel	18.0	24.0						
Travel		9.0						
Contractual	~~40.0~~	171.0						
Commodities		23.5						
Equipment		N/C						
Subtotal	~~58.0~~	227.5	LONG RANGE FUNDING REQUIREMENTS					
General Administration	11.5	7.0	Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Project Total	$69.5K	234.5K	$164.0K					
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1996

Prepared:

Project Number: ~~96012~~ 96012B-
Project Title: Killer whale predation on Lasan seals
Lead Agency: NOAA

FORM 2A
PROJECT
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel	18.0	24.0						
Travel		9.0						
Contractual	40.0	171.0						
Commodities		23.5						
Equipment		N/C						
Subtotal	58.0	227.5						
General Administration	11.5	7.0						
Project Total	ca 9.5K	234.5K	164.0K					
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1996

Prepared:

Project Number: 96~~xxx~~012B
Project Title: Killer whale predation on Sea otters
Agency: 720AA

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:

PM	Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1996
	Bruce Wright	Program Manager	GS12	1.5			5.0
	Marilyn Dahlheim	Principal Investigator	GS12	2.5			10.0
	Field personnel	[redacted]	GS7/9	3			7.0
		Clerical Administrative (MMMX)		1.0			2.0
						Subtotal	

Those costs associated with program management should be indicated by placement of an *. Personnel Total 24.0

Travel Costs:

PM	Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1996
	Transportation of scientific personnel from Seattle, Washington to other areas within U.S. to Prince William Sound, Alaska. Conduct of field work.		4-5	90	–	6.0K
	Travel for P.I.'s to/from Alaska workshops/meetings.		3	12-15	–	3.0K

Those costs associated with program management should be indicated by placement of an *. Travel Total *9.0K

1996

Project Number: 96 ~~XXX~~ 012B

Project Title: Killer whale predation on Steller sea lions

Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs: Description	Proposed FFY 1996
1. Logistical Support of field personnel (Vessel charter)	$90.0K
2. Analysis of Data / Report (* Note: $13.0K of this covers budget shortfall from FY95). * includes one field researcher's salary.	81.0K
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$171.0K

Commodities Costs: Description	Proposed FFY 1996
Firm purchase & development costs. Maintenance of research equipment (skiffs, fuel/food. Maintenance of Scientific gear. Cameras). Transport of Scientific gear. Purchase of darts / sampling collection gear & storage.	$23.5K
Commodities Total	$23.5

1996

Project Number: 96 ~~XXX~~ 012B
Project Title: Killer whale predation on Steller seals
Agency: NOAA

FORM 3B Contractual & Commodities DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
No charge year FY96			
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	N/C

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96 ~~xxx~~ 012B
Project Title: Killer whale predation on Sea otter stocks
Agency: NOAA

FORM 3B
Equipment
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996						
Personnel		$55.2						
Travel		$24.6						
Contractual		$5.0						
Commodities		$13.8						
Equipment		$6.3	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$104.9	Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Indirect								
Project Total	$0.0	$104.9	$94.5	$94.5	TBD	TBD	TBD	TBD
Full-time Equivalents (FTE)		12.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Future costs (beyond FY 99) are unknown.

1996

Prepared:

Project Number: 96213-BAA
Project Title: Alaska Native Harbor Seal Commission
Name: Alaska Native Harbor Seal Commission

FORM 4A
Non-Trustee
DETAIL

5/10/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1996
Currently Vacant	Executive Director		12.0	4.6		55.2
	Executive Director's salaray is $48,000					0.0
	and 15% fringe benefits to cover all required					0.0
	federal and stae payroll taxes,					0.0
	as well as workers comp. insurance.					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		12.0	5	0	
					Personnel Total	$55.2

Travel Costs:			Ticket	Round	Total	Daily	Proposed
Description			Price	Trips	Days	Per Diem	FFY 1996
Commissioners:							0.0
Four quarterly board meetings are required in accordance with the Commission's constitution and by-laws.							0.0
To Anchorage From:	Kodiak		176	4	8	150	1.9
	Juneau		311	4	8	150	2.4
	False Pass		1,000	4	8	150	5.2
	Seldovia		350	4	8	150	2.6
	Chenega Bay		200	4	8	150	2.0
							0.0
Staff (Executive Director)							0.0
Cordova to Anchorage			224	10	20	225	6.7
Cordova to Juneau			250	2	6	225	1.9
Cordova to Wash. DC			1,000	1	4	225	1.9
						Travel Total	$24.6

1996

Project Number: 96213-BAA
Project Title: Alaska Native Harbor Seal Commission
Name: Alaska Native Harbor Seal Commission

FORM 4B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed
Description	FFY 1996
As a beginning organization, professional services from a CAP firm and a legal firm will be required to ensure all regulations are being met and that the financial management system is developed in accordance iwht general accounting principles. An audit will also be performed at the end of the fiscal year.	
Accounting/Audit	3.0
Legal	2.0
Contractual Total	$5.0

Commodities Costs:	Proposed
Description	FFY 1996
Office Supplies: Covers the cost of miscellaneous office supplies necessary to operate the program, such as pens, copy paper, paper clips, computer supplies, stationery, envelopes, etc.	2.0
Telephone/Telefax: This lineiitem will cover the cost of two business lines at $50/month each ($1,200), long distance charges at approximately $166/month ($1,400), as well as six teleconference meetings of the commissioners, estimated at $200 per meeting x 6 meetings ($1,200).	3.8
Printing/Postage: Covers the cost of printing business cards, stationery, newsletters, and other materials necessary to the operation of the program. This line item will also cover the cost of mailing the newsletters and other daily business corespondence related to the program to other natural resource related agenceis and organizations.	5.0
Office Space/Utilities: Intitially, a portion of the office space is being provided by Dineega Specialty Furs as an in-kind contribution to the program. The funds in this line item will cover a portion of the office space and utilies est. at $250/month.	3.0
Commodities Total	$13.8

1996

Project Number: 96213-BAA
Project Title: Alaska Native Harbor Seal Commission
Name: Alaska Native Harbor Seal Commission

FORM 4B
Contractual & Commodities DETAIL

5/10/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases:	Number of Units	Unit Price	Proposed FFY 1996
Description			
As a newly developed organization, an initial purchase of office equipment will be required.			0.0
The funds in this line item will be utilized to purchase a computer, printer, copies, and fax			0.0
Commission office.			0.0
Computer & printer	1	4,500	4.5
Fax	1	1,000	1.0
Copier	1	750	0.8
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$6.3

Existing Equipment Usage:	Number of Units	
Description		
None		

1996

Project Number: 96213-BAA
Project Title: Alaska Native Harbor Seal Commission
Name: Alaska Native Harbor Seal Commission

FORM 4B
Equipment
DETAIL

FY 96 PROJECT PROPOSALS

Acronyms

ABR	ABR, Inc., Environmental Research and Services
ANHSC	Alaska Native Harbor Seal Commission
Alutiiq HF	Alutiiq Heritage Foundation
Chugach OSIR	Chugach Oil Spill Impacted Region Communities Consortium
Chugach RRC	Chugach Regional Resource Commission
Ck Inl Fish DC	Cook Inlet Fisheries Development Corporation
MBC	MBC Applied Environmental Sciences
NRC	Natural Resources Consultants, Inc.
OSU	Oregon State University
PES	Petroleum Environmental Services, Inc.
PWS Econ DC	PWS Economic Development Corporation
PWSSC	PWS Science Center
RCAC	Regional Citizens' Advisory Council
TXAM	Texas A & M University
UBC	University of British Columbia
UM	University of Montana
UW/UCD/SFU	University of Washington/University of California, Davis/ Simon Fraser University

FY 96 PROJI PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
Pink Salmon Projects						$2,950.4	$2,669.7	$1,844.5	$1,502.5	$8,967.1
96076	Effects of Oiled Incubation Substrate on Straying and Survival of Wild Pink Salmon	NOAA	NOAA	OUT	Cont'd	$393.8	$715.0	$525.0	$260.0	$1,893.8
		This project examines the effects of oil exposure during embryonic development on straying, marine survival, and gamete viability of pink salmon. The primary objectives are to conduct a related series of controlled experiments on straying of pink salmon to determine the role of oil and other factors on straying so that field studies of straying in PWS after the spill can be interpreted, and to evaluate the significance of straying on management and restoration strategies.								
96093A-BAA	Restoration of PWS Pink Salmon by Diversion of Harvest Effort: Quantitative Genetic Assessment of Early-Returning Pink Salmon Broodstock	Smoker/UAF	ADFG	PWS	NEW	$111.9	$198.4	$211.7	$475.3	$997.3
		Development of early-returning broodstock at hatcheries might beneficially reduce fishing on injured stocks. However, a risk is that early stock might interbreed wih local salmon and hurt their fitness. Risk might be reduced by stock selection or broodstock management. This research uses quantitative genetics to assess 1) genetics of run timing in donors (predicts effectiveness of stock selection and broodstock management) and 2) fitness loss from interbreeding (exposes loss by laboratory breeding experiment).								
96093B-BAA	Restoration of PWS Pink Salmon by Diversion of Harvest Effort: Population Genetic Assessment of Gene Flow from Early Return Stock	Smoker/UAF	ADFG	PWS	NEW	$121.0	$238.0	$228.1	$553.9	$1,141.0
		Development of early-returning broodstock at hatcheries might beneficially reduce fishing on injured stocks. However, a risk is that early stock fish might stray and interbreed with local salmon and reduce their fitness. The risk can be estimated by measuring gene flow experimentally. Potential early run pink salmon will be tagged with a natural gene marker and planted in a local stream, simulating straying. The effect will then be directly estimated over generations by measuring the genetic tag in the test stream and its gene flow to others.								
96093C	Restoration of Prince William Sound Pink Salmon by Diversion of Harvest Effort	PWSAC	ADFG	PWS	Cont'd					
		Pink salmon egg mortality attributed to oiling of anadromous steams has contributed to a reduction in adult pink salmon returns. Natural populations of pink salmon are harvested with large numbers of hatchery pink salmon in mixed stock fisheries, which may limit escapement to damaged streams and thereby delay recovery. This project will evaluate the feasibility of changes in hatchery production to reduce exploitation of injured wild stocks. Specific projects will focus on changing the location and timing of hatchery returns in western PWS.								
96139A1	Salmon Insream Habitat and Stock Restoration - Little Waterfall Barrier Bypass Improvement	ADFG	ADFG	KOD	Cont'd	$55.0	$35.0	$15.0	$0.0	$105.0
		This proposal will provide for continuation of Project 95139A including completion of barrier bypass improvement at Little Waterfall Creek. It will also provide for evaluation of the improvements as indicated by pink and coho salmon of the bypass once construction is complete. The project will facilitate increased spawning habitat use by pink and coho salmon by decreasing grades on an existing bypass structure, thus will increase salmon production to optimum levels in ensuing years.								

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96139A2	Spawning Channel Construction Project Port Dick Creek, Lower Cook Inlet	ADFG	ADFG	KEN	Cont'd	$223.1	$37.0	$23.2	$30.0	$313.3
		The proposed port Dick Pink Salmon Spawning Channel would restore the wild pink and chum salmon stocks. The proposed project would increase the spawning habitat available in Port Dick Creek by restoring formally used tributaries by excavating to stable water sources.								
96139C1	Montague Riparian Rehabilitation Monitoring Program	USFS	USFS	PWS	Cont'd	$43.1	$43.0	$0.0	$0.0	$86.1
		This project is a continuation of 94139 and 95139C. In FY 94, funding was granted to construct 25 to 30 structures in streams flowing through clearcut areas on Montague Island. These structures were designed to improve fish spawning and rearing habitat, prevent erosion, and help restore the natural flows and stream features that existed prior to logging. The 1994 work also included the improvement of 20 acres of riparian vegetation. This project is to continue evaluation of structures, repair any damage that may have occurred and assess changes in the aquatic habitat, stream channels, and substrates. The riparian vegetation work will also be evaluated.									
96139C2	Salmon Instream Habitat and Stock Restoration - Lowe River and Valdez Arm Drainages	ADFG	ADFG	PWS	Cont'd	$174.6				$174.6
		This project would provide an in-depth evaluation of in-stream habitat restoration possibilities in the Lowe River and Valdez Arm drainages. It continues a project halted when concerns were raised during review of an environmental assessment to construct habitat improvements in the Lowe River for chum and pink salmon.								
96139D	Supplemental Monitoring for the Proposed Spawning Channel Construction Project, Port Dick Creek, Lower Cook Inlet	Coble Geotech.	ADFG	KEN	NEW	$9.2	$16.5	$16.5	$49.5	$91.7
		A separate project (96139A2) to construct the proposed Port Dick Pink and Chum Salmon Spawning Channel would restore the wild pink and chum salmon stocks to pre-spill levels. This project would provide hydrologic monitoring for that proposal.								
96179	Relationships Between Stream Habitat and Stream Classification Within Prince William Sound	USFS	USFS	PWS	NEW	$218.1	$40.3	$0.0	$0.0	$258.4
		Channel types represent similar hydrological and geological reaches of stream. They should also be relatively good descriptions of what is present for in-stream fish habitat. Channel type interpretations should provide a quantitatively replicable measure for presence of in-stream spawning and rearing habitat. This project will further the understanding of the anadromous salmonid capability habitat relationships of the watersheds within PWS.								
96186	Coded Wire Tag Recoveries From Pink Salmon in Prince William Sound	ADFG	ADFG	PWS	Cont'd	$260.5	$260.5	$260.5	$85.0	$866.5
		This project funds recovery of coded-wire tags in PWS pink salmon. The recovered tags are used to help ADFG manage the commercial fishery to protect injured stocks. The project is part of a program to transition to a more precise in-season tool, otolith marking, with a permanent funding source other than the Trustee Council. (This project was formerly numbered 95320B.)								

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96188	Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon in Prince William Sound	ADFG	ADFG	PWS	Cont'd	$95.2	$100.5	$100.5	$48.8	$345.0
		This project will develop otolith mass marking as an inseason stock separation tool for pink salmon in PWS. Inseason stock composition data is used by fishery managers to protect damaged wild pink salmon stocks from overharvest in mixed-stock fisheries. Coded-wire tags are presently used for this purpose in the Sound. Transitioning to otolith marking will reduce costs and increase precision. (This project was formerly numbered 95320C.)								
96190	Construction of a Linkage Map for the Pink Salmon Genome	Allendorf/UM	ADFG	PWS	NEW	$240.0	$250.0			$490.0
		We propose to construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms. The ability to genetically map the location of oil induced lesions will allow the thorough identification, description, and understanding of oil induced genetic damage. This research will also aid other recovery efforts with pink salmon, including estimation of straying rates, description of stock structure, and testing if marine survival has a genetic basis.								
96191A	Oil-Related Embryo Mortalities in PWS Pink Salmon Populations	ADFG	ADFG	PWS	Cont'd	$474.6	$407.0	$246.0	$0.0	$1,127.6
		Elevated embryo motalities were detected in populations of pink salmon inhabiting oiled streams following the oil spill. The purpose of this project is to continue to monitor the recovery of pink salmon embryos in the field, to provide laboratory verification of the field results, and to verify and identify the occurrence of genetic damages. Results of these studies may provide the first evidence that the germline of fish exposed to chronic or acute sources of oil pollution can be damaged.								
96191B	Injury to Salmon Eggs and Pre-emergent Fry Incubated in Oiled Gravel (Laboratory Study)	NOAA	NOAA	PWS	Cont'd	$169.3	$75.0	$88.0	$0.0	$332.3
		This project will determine if oil can cause heritable damage to pink salmon reproductive capacity. This requires culturing three generations of pink salmon which provides opportunities to examine other immediate and long-term effects of incubating in oiled gravel. The project is underway; oil exposures were completed in 1994 , and this FY 96 proposal focuses on incubating eggs from maturing adults in 1995, and coded-wire tagging the second generation for release in Spring 1996.								
96194	Pink Salmon Spawning Habitat Recovery	NOAA	NOAA	PWS	NEW	$182.5	$75.0	$0.0	$0.0	$257.5
		This project would examine the level of oil contamination in pink salmon streams in 1989-90 and in 1995. Analyses would allow a better assessment of the oil exposure in 1989 and 1995 and would complement the elevated salmon egg mortalities measured since 1989. This study would also synthesize information from other Trustee studies to determine the likelihood of damage from oiled stream gravels. If restoration of contaminated stream gravels were contemplated, now or in future oil spills, the contamination levels in 1989 and 1995 would be valuable data for consideration, along with the synthesis effort for the three studies.								

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96196	Genetic Structure of Prince William Sound Pink Salmon	ADFG	ADFG	PWS	Cont'd	$178.5	$178.5	$130.0	$0.0	$487.0
		Previous workers found that wild-stock pink salmon suffered both direct lethal and sublethal injuries as a result of the oil spill. An understanding of the population structure of pink salmon in PWS is essential to assess the impact of these injuries on a population basis and to devise and implement management strategies for restoration. This project is designed to delineate the genetic structure of populations of wild pink salmon inhabiting the Sound. (This project was formerly numbered 95320D.)								
Herring Projects						$1,581.8	$1,265.4	$1,013.5	$1,169.2	$5,029.9
96074	Herring Reproductive Impairment	NOAA	NOAA	PWS	Cont'd	$347.7	$180.0	$0.0	$0.0	$527.7
		This study will examine long-term oil impacts on herring due to the oil spill using field and laboratory measurements. The field component will search for reproductive impacts in PWS stocks and the laboratory portion will determine if exposure of various life stages to oil causes genetic damage. This project began following the crash of populations in PWS and represents one of several projects focused on causes of the crash and prospects for recovery.								
96162	Investigations of Disease Factors Affecting Declines of Pacific Herring Populations in Prince William Sound, AK	UW/UCD/SFU	ADFG	PWS	NEW	$635.0	$510.6	$461.7	$0.0	$1,607.3
		Field and laboratory studies will focus on Viral Hemorrhagic Septicemia Virus (VHSV) and *Ichthyophonus hoferi*, a pathogenic fungus, to determine their role in the disease(s) and mortality observed in PWS herring since 1993. Herring in PWS will be monitored three times per year for signs of disease and immune status. Specific Pathogen-Free herring will be used to determine the degree of mortality, blood chemical changes and pathogenicity produced by these organisms alone and in combination with exposure to stressors such as petroleum hydrocarbons, temperature and crowding. (This project was formerly numbered 95320S.)								
96164	Pacific Herring Projects Coordination	ADFG	ADFG	PWS	NEW	$49.2	$49.2	$49.2	$49.2	$196.8
		The purpose of this project will be to enhance coordination, integration and critical review of projects that are designed to study different aspects of Pacific herring in the PWS ecosystem; to better understand the interactions of the components of the ecosystem; and to aid in the recovery of the injured resource and lost services.								
96165	Genetic Discrimination of Prince William Sound Herring Populations	ADFG	ADFG	PWS	Cont'd	$105.8	$120.0	$97.0	$0.0	$322.8
		The PWS herring fishery has been in catastrophic decline since 1992. The Alaska Department of Fish and Game recovery effort includes incorporating a knowledge of genetically derived population structure into harvest management. In this continuing project we are delineating the structure of PWS population(s) and related North Pacific populations using both nuclear and mitochondrial DNA analyses. Tests for temporal and spatial diversity within years and temporal stability across years will be done.								

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96166	Herring Natal Habitats	ADFG	ADFG	PWS	Cont'd	$444.1	$405.6	$405.6	$1,120.0	$2,375.3
		Studies documented damage from oil exposure in adult herring, hatching success of embryos, and levels of physical and genetic abnormalities in larvae. The PWS herring spawning population has drastically declined since 1993, and pathology studies implicated viral hemorrhagic septicemia (VHS) and ichthyophonus as potential sources of mortality as well as indicators of stress. The project will continue to provide estimates of spawning herring abundance through SCUBA and hydroacoustic studies, and to investigate the lethality of suspected pathogens and the role of environmental contaminants in disease transmission through laboratory and field studies.									
Sound Ecosystem Assessment (SEA)						$5,158.8	$3,897.1	$2,836.5	$170.0	$12,062.4
96054	Mass-Balance Model of Trophic Fluxes in Prince William Sound	Pauly/UBC	ADFG	PWS	NEW	$105.9	$75.0	$0.0	$0.0	$180.9
		A workshop is proposed where the invitees from various SEA plan projects and other experts would assemble the materials for a mass-balance model of trophic fluxes in PWS. Model construction would be prepared using the widely-used ECOPATH II approach. A graduate student would collate the results and prepare material for an evaluation meeting where the use of the ECOPATH II model will be considered. An educational video and interactive software for display in the Alaska Sealife Center will also be prepared.									
96193-BAA	Flux and Nutritional Quality of Particulate Organic Carbon: Relationship to Survival of Juvenile Pelagic Fish	Naidu/UAF	ADFG	PWS	NEW	$156.6	$129.8	$132.2	$0.0	$418.6
		Particulate organic carbon is the ultimate source of food and energy for marine organisms. Propose to test the EVOS-SEA Project's river-lake hypothesis for PWS by correlating the seasonal fluxes and nutritional quality of particulate organic carbon to the time-series variations in primary production and hydrodynamic conditions, with implication on the growth and survival of juvenile pink salmon and Pacific herring. This testing will help to clarify whether or not the yearly fluctuation in the two fish stocks is related to natural causes, and provide a basis in decision making for either restoration, or for optimizing the two fish stocks.									
96195	Pristane Monitoring in Mussels and Predators of Juvenile Pink Salmon & Herring	NOAA	NOAA	PWS	NEW	$112.7	$85.0	$85.0	$170.0	$452.7
		This project will measure pristane in predators of juvenile pink salmon and larval herring to determine the dietary dependence of these predators on alternative prey, *Neocalanus spp.* copepods. This project will also monitor pristane in mussels as an indirect index of potential year-class strength for pink salmon and herring. These results will be used to evaluate the prey-switching hypothesis of the SEA plan, and to identify critical marine nursery habitat in PWS.									
96320	Sound Ecosystem Assessment (SEA)	Cooney, et al	ADFG	PWS	Cont'd	$4,783.6	$3,607.3	$2,619.3		$11,010.2
		SEA is a multi-component, interdisciplinary study of factors controlling the production of pink salmon and Pacific herring in PWS. The study confines its investigative efforts to the early life stages of these important and non-recovering sport, commercial and subsistence species. Conjectures about how the physical environment (temperature, salinity and circulation) interacts with fish and plankton populations in the region are used to focus and guide the field sampling and modelling studies.									

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96320R	SEA Trophodynamic Modeling and Validation Through Remote Sensing	Eslinger/UAF	ADFG	PWS	NEW					
	This is a new SEA project in FY 96 as a result of an internal reorganization. Some of the work performed under 95320-G and J is to be done under this project in FY 96 and beyond. We propose to continue the trophodynamic modeling of phytoplankton and zooplankton begun in FY 95 and to add modeling of ichthyoplankton, herring larvae in particular. We will evaluate and verify the model against field data to be collected using a variety of remote sensing and in situ sampling platforms. Project is not an increase in the overall scope of work or funding of the SEA program. (Funds for this project are included in 96320.)									
96320Z1	Synthesis and Integration	Cooney/UAF	ADFG	PWS	NEW					
	This is a new SEA sub-project in FY 96. This project provides logistical and office support for synthesis and integration activities associated with the application of SEA field and modelling studies to the restoration of pink salmon and Pacific herring populations in PWS. (Funds for this project are included in 96320.)									
96320Z2-BAA	Sound Ecosystem Assessment (SEA): Coordination & Communications	PWSSC	NOAA	PWS	NEW					
	This is a new SEA sub-project in FY 96. The project is intended to provide coordination, logistical support, and personnel to assist the SEA scientists with coordination and incorporation of local knowledge; and to assist the Restoration Office with communication of project activities and results to communities in PWS. (Funds for this project are included in 96320.)									
Sockeye Salmon Program						$1,727.9	$647.0	$250.0	$200.0	$2,824.9
96048-BAA	Historical Analysis of Sockeye Salmon Growth Among Populations Affected by Overescapement in 1989	NRC, Inc.	ADFG	KENKOD	NEW	$86.7	$15.0	$0.0	$0.0	$101.7
	Overescapement of sockeye salmon in several areas of Alaska occurred in 1989 as a result of the oil spill. Overescapement appears to have reduced salmon growth, leading to reduced survival. However, few records of sockeye growth in these systems occurred before 1989. We propose to use adult sockeye scales to reconstruct the growth of sockeye salmon before, during, and after the oil spill event. These data will be used to document the effects of the spill and the subsequent recovery of the sockeye stocks.									
96254	Delight and Desire Lakes Fertilization Project	Ck Inl Fish DC	ADFG	KEN	NEW	$110.0				$110.0
	The project will directly rehabilitate/restore wild sockeye salmon stocks from Delight and Desire Lakes. Limnological and biological investigation will be conducted in the lake systems to determine the appropriate liquid fertilization formula and appropriate quantities. On site logistical support systems will be set-up in order to apply daily liquid fertilization. Evaluation studies will be conducted to determine the growth and age of subsequent smolt production. Adult sockeye returns will be monitored.									

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96255	Kenai River Sockeye Salmon Restoration	ADFG	ADFG	KEN	Cont'd	$244.7				$244.7
	Greatly reduced fishing time in the Upper Cook Inlet due to the presence of oil caused sockeye salmon spawning escapement levels in the Kenai River to exceed the desired amount by three times. The overescapement resulted in reduced survival of juvenile sockeye salmon. Careful monitoring and possible reduction of Kenai River sockeye salmon harvests may be necessary to ensure adequate escapements. The goal of this project is to restore Kenai River sockeye salmon through improved stock assessment capabilities and more accurate regulation of spawning levels.									
96256	Columbia Lake Sockeye Salmon Stocking	USFS	USFS	PWS	NEW	$40.6				$40.6
	Columbia Lake is a 2.8 km2 surface area lake located in Heather Bay near the southeast terminus of the Columbia Glacier. With recession of the glacier, the lake level dropped and the outlet now flows across a moraine, restricting access to salmon. Comparative data suggest that this lake could produce return of 10,000 to 29,000 adult sockeye salmon annually. This project would gather limnological data, transplant fry and monitor the outmigration of smolt and return of adult salmon.									
96257	Solf Lake Sockeye Salmon Stocking	USFS	USFS	PWS	NEW	$34.3				$34.3
	Solf Lake is a 0.61 km2 surface area lake located in Herring Bay on Knight Island. This lake had a run of sockeye salmon until an earthquake in the 1930's blocked the outlet. Limnological data suggest that this lake could produce returns of 19,000 to 22,000 adult sockeye salmon, annually. This project would open the lake to migrating salmon, monitor plankton abundance, transplant fry and monitor the outmigration of smolt and return of adult salmon.									
96258A	Sockeye Salmon Overescapement Project	ADFG	ADFG	KENKOD	Cont'd	$527.4	$150.0	$75.0	$150.0	$902.4
	This proposal provides for a close-out budget for the Kenai Lakes sockeye research program with a limited continued sockeye monitoring program for the Kodiak Island Lakes. If depressed adult returns from 1989 brood are observed in the Kenai River in 1995, continuation of the evaluation is proposed for the 1996 field season which would bring the FY 96 cost to $907,800. In addition, a separate proposal to experimentally evaluate the proposed mechanism leading to reduced production of smolt from the Kenai systems by mean of an in situ enclosure study is integrated into these investigations.									
96258B	Sockeye Salmon Skilak Lake Enclosure Project	ADFG	ADFG	KEN	NEW	$341.1	$175.0	$75.0	$0.0	$591.1
	This proposal will be initiated if the 5 year component of the 1995 Kenai sockeye return is very low. The proposed study examines experimentally 2 major questions about limits to sockeye salmon production. First, can reduced growth rates and subsequent reduced recruitment to fall fry and overwinter survival be explained by decreased availability of zooplankton? Second, are nutrient additions effective at improving zooplankton production and associated decreases in sockeye salmon? This study is a companion to 96258A.									

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96258C	Kenai River Ecosystem Restoration: Starvation-Temperature Study	DOI	DOI	KEN	NEW	$57.3	$30.0	$0.0	$0.0	$87.3
		This proposal is a companion to 96258A. It will only be initiated if the 5-year component of Kenai sockeye returns at a low level. It examines two questions: First, "Can the variability in overwintering survival of poorly conditioned fall fry be replicated in a laboratory simulation of the naturally observed conditions in Skilak and Kenai Lakes?"... Second, "Can the variability in overwintering survival be modeled with field data on length of winter and seasonal food availability?" The information will be useful in developing restoration plans and evaluating escapement goals for Kenai sockeye.									
96259	Restoration of Coghill Lake Sockeye Salmon	ADFG	ADFG	PWS	Cont'd	$285.8	$277.0	$100.0	$50.0	$712.8
		Coghill Lake has historically been a major sockeye producer for PWS. The current production is very low and could jeopardize the sustainability of this sockeye stock without restoration efforts. This project continues a program, begun in 1993 to fertilize Coghill Lake to restore the run. A restored sockeye salmon run would provide an important replacement resource for sport and commercial fisheries in PWS.								
Cutthroat and Dolly Varden Trout Projects						$565.1	$309.2	$152.7	$33.9	$1,060.9
96043A	Cutthroat Trout and Dolly Varden Char Population and Habitat Monitoring	USFS	USFS	PWS	Cont'd	$29.6	$21.5	$0.0	$0.0	$51.1
		Beginning in 1993, a weir has been operated at Mile 18 Creek near Cordova to monitor the populations of anadromous cutthroat trout and Dolly Varden char, determine population variability, estimate survival rates, and learn more about migration patterns and habitat requirements. Continued study at the weir in 1996 and 1997 will complete the data needed for determining survival rates for several year classes and will give a good indication of the population variability.								
96043B	Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures	USFS	USFS	PWS	Cont'd	$40.4	$27.7	$27.7	$26.4	$122.2
		This project provides for monitoring of habitat improvement structures and their effects on cutthroat trout and Dolly Varden populations. These structures were installed in 1995 under EVOS Restoration Project number 95043B. Additionally this proposal would provide for a project completion report of project number 95043B.								
96043C	Cutthroat Trout Habitat Improvement Structures	USFS	USFS	PWS	Cont'd	$100.2	$10.0	$5.0	$7.5	$122.7
		This project has the same focus as Project 94043/95043B. Its objective is to improve cutthroat trout rearing habitat in western PWS. In FY 95, the USFS will identify up to 4 streams with habitat enhancement opportunities. A detailed evaluation and environmental analysis would be conducted and finalized prior to the 1996 field season when implementation of the stream enhancements would take place.								
96145	Cutthroat Trout and Dolly Varden: the Relation Among and Within Populations of Anadromous and Resident Forms	USFS	USFS	PWS	NEW	$336.7	$250.0	$120.0	$0.0	$706.7
		Recovery of cutthroat trout is unknown. Restoration efforts have taken the form of instream habitat modification and stock supplementation. The usefulness of this approach in the longterm is unknown. This project would determine the relation between resident and anadromous forms of these fish within the same watershed and between watersheds. By examining genetic, meristic, and life-history features of each group. Results from this study will allow a longterm, comprehensive and ecologically sound restoration strategy for these fish to be developed.								

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96177A	Cutthroat Trout, Dolly Varden Char Habitat Restoration, Lake Elsner Area	USFS	USFS	PWS	NEW	$26.6				$26.6
		Timber harvests in the Lake Elsner watershed, 13 miles east of Cordova, may have affected cutthroat trout and Dolly Varden char habitat. The Cordova Ranger District proposes to work with the Eyak Corporation to survey the area and determine if there are any existing or potential impacts. If problems are identified, plans for restoration projects will be developed.								
96177B	Cutthroat Trout, Dolly Varden Char Habitat Restoration, Port Fidalgo and Port Gravina Area	USFS	USFS	PWS	NEW	$31.6				$31.6
		Timber harvests in the Port Fidalgo and Port Gravina area, 20 miles northwest of Cordova, may have affected cutthroat trout and Dolly Varden char habitat. The Cordova Ranger District proposes to work with the Tatitlek Corporation to survey the area and determine if there are any existing or potential impacts. If problems are identified, plans for restoration projects will be developed.								
Marine Mammal Program						$1,255.3	$943.1	$450.7	$202.0	$2,851.1
96001	Recovery of Harbor Seals from EVOS: Condition and Health Status	Castellini/UAF	ADFG	PWS	Cont'd	$187.4	$184.6	$46.2	$0.0	$418.2
		This project focuses on the health of harbor seals, a marine mammal species that is not recovering in Prince William Sound (PWS). Personnel from the University of Alaska in cooperation with the Alaska Department of Fish and Game will work with harbor seals to assess their health, blood and blubber chemistry and size in relation to their ecological and nutritional requirements. The project addresses potential health and nutritional problems that may be impeding harbor seal recovery.								
96012A-BAA	Comprehensive Killer Whale Investigation in Prince William Sound, Alaska	N Gulf Oceanic	NOAA	PWS	Cont'd	$167.5	$151.0	$85.0	$177.0	$580.5
		This project continues the monitoring of the damaged AB pod and other Prince William Sound killer whales that has occurred on a yearly basis since 1984. It develops a GIS database on killer whales that when coupled with genetic and acoustic data will help evaluate recovery, recognize changes in behavior and estimate killer whale impact on harbor seals.								
96012B	Impact of Killer Whale Predation on the Recovery of Injured Resources in Prince William Sound	NOAA	NOAA	PWS	Cont'd	$229.5	$0.0	$0.0	$0.0	$229.5
		The objective of the proposed project is to investigate the potential impact of killer whale predation on the recovery of PWS injured populations. We will collect biopsy samples from 80 killer whales from each of two putative populations (suspected resident and transient whale populations) from PWS. Killer whale skin and blubber samples will be examined through stable isotope and fatty acid analyses to determine the fraction of the PWS killer whale population that predates on marine mammals versus fish.								
96064	Monitoring, Habitat Use, and Trophic Ineractions of Harbor Seals in Prince William Sound	ADFG	ADFG	PWS	Cont'd	$381.1	$347.0	$100.0	$25.0	$853.1
		This project will monitor the status of harbor seals in PWS and investigate the possible causes for the ongoing decline. Aerial surveys will be conducted to determine whether the population continues to decline, stabilizes, or increases. Seals will be satellite-tagged to describe their movements, use of haulouts, and hauling out and diving behavior. Samples of blood, blubber, whiskers, and skin will be collected to study diet, health and condition, and genetic relationships to other harbor seal populations.								

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Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96170	Isotope Ratio Studies of Marine Mammals in Prince William Sound	Schell/UAF	ADFG	PWS	Cont'd	$146.6	$130.0	$110.0	$0.0	$386.6
		Stable isotope ratios are natural tracers of carbon and nitrogen transfers through food webs. Through a mix of captive animal studies, comparison of isotope ratios in archived and current marine mammal tissues and their potential prey species in the PWS, insight into environmental changes causing the decline of harbor seals may be possible. We also will supply the isotope ratio determinations for other projects using this technique in the PWS ecosystem. Over the 12 months of FY 96 funding we anticipate the analysis of approximately 10,000 samples in these related projects. (This project was formerly numbered 95320I2.)									
96211	Community-Based Harbor Seal Biological Sampling Program	ANHSC	ADFG	PWS/KEN	NEW	$44.0	$36.0	$15.0	$0.0	$95.0
		A pilot project for collecting biological samples from subsistence-taken harbor seals from six communities of PWS and lower Cook Inlet would be designed, implemented, and evaluated. "User-friendly" data collection forms and an instructional video would be produced. Village-based technicians would be trained for collecting samples taken by hunters and transporting these samples to Anchorage for further sampling and transport for analysis. Findings would be disseminated by the Alaska Native Harbor Seal Commission (ANHSC) through a newsletter network.									
96213-BAA	Alaska Native Harbor Seal Commission	ANHSC	ADFG	PWS	NEW	$99.2	$94.5	$94.5	$0.0	$288.2
		The overall goal is to involve Alaska Natives directly in the research and monitoring process, to help find solutions to restore the health of the injured resource: the harbor seal. At this time, goals of the Alaska Native Harbor Seal Commission (ANHSC) include: educating and informing the public and western scientists on the traditional and contemporary relationship between harbor seals and the Alaska Natives; informing western scientists about the type and extent of knowledge held by the local people about the harbor seal; involving Alaska Natives in the regulatory and management process.									
Nearshore Ecosystem Projects						$6,515.9	$5,142.4	$4,406.1	$3,255.7	$19,320.1
96025	Mechanism of Impact and Potential Recovery of Nearshore Vertebrate Predators	DOI	DOI	PWS	Cont'd	$1,669.4	$1,669.4	$1,669.4	$450.0	$5,458.2
		The project assesses trophic, health, and demographic factors across a suite of apex predators injured by the spill to determine mechanisms constraining recovery and improve knowledge of the status of recovery. Primary hypotheses: 1) Recovery of nearshore resources is limited by recruitment processes; 2) Initial and/or residual oil in benthic habitats and in or on benthic prey has had a limiting effect on the recovery of predators; and 3) EVOS induced changes in populations of benthic prey species have influenced the recovery of predators.									
96027	Kodiak Archipelago Shoreline Assessment: Monitoring Surface and Subsurface Oil	ADEC	ADEC	KOD	Cont'd	$35.1				$35.1
		This project completes work begun in FY 95 to determine the areal extent, toxicity and origin of oil on selected Kodiak Archipelago shorelines. Most of these shorelines were last surveyed in 1990. The information about the remaining oil is necessary to determine whether recovery is proceeding at an acceptable rate; to help local people assess whether the presence of remaining oil is still affecting shoreline activities; to determine the origin and toxicity of any remaining oil; and to determine if any beaches need additional treatment.									

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96037	Coastal Habitat Intertidal Monitoring	Highsmith/UAF	ADFG	ALL	NEW	$609.2	$931.9	$557.3	$0.0	$2,098.4
	The Coastal Habitat Injury Assessment study (CHIA) showed continued injury to intertidal algal and invertebrate populations as of the last sampling date in 1991. A limited number of sites were monitored in PWS and Kenai through 1994 and showed continued damage. This study proposes to revisit original CHIA sites to determine their recovery status. Intertidal communities are integral to the nearshore ecosystem and monitoring is critical for understanding long-term effects of the spill.									
96056	Sea Otter Transplantation/Clam Restoration	D. Warner	DOI	PWS	NEW					
	This project seeks to restore clam populations in the Cordova area by transplanting roughly 300 sea otters from Cordova to the central and southern portions of PWS, followed by restocking razor clam beds with stock from other areas. Restocking dungeness crab is also proposed.									
96067-BAA	Juvenile Fish Habitat Identification and Assessment	Mitchell/MBC	DOI	PWS	NEW	$467.4	$50.6	$0.0	$0.0	$518.0
	This study will sample nearshore habitats for juvenile fish. Embayments with eelgrass beds and shallow soft-bottomed coastal areas in PWS will be sampled in oiled and unoiled areas. The study will help define important nursery grounds as well as demonstrate the amount to which these areas have been degraded by oiling.									
96072	Status and Potential Recovery of the Black Oystercatcher: An Apex Predator in the Nearshore Environment	DOI	DOI	PWS	NEW	$157.7	$156.8	$151.7	$87.1	$553.3
	This proposal questions the current status of the black oystercatcher as a recovering species, and presents a plan of action for improved monitoring of the species and evaluation of factors (e.g., demography, oil toxicity, food, genetic variability) that may be limiting recovery of the population. The species' unique role as an apex predator in the nearshore environment demands an ecosystem approach to the study that will reveal interactions among predator and prey.									
96086	Herring Bay Monitoring and Restoration Studies	Highsmith/UAF	ADFG	PWS	Cont'd	$185.3	$0.0	$0.0	$0.0	$185.3
	In 1990, intertidal restoration studies were established in Herring Bay in response to the T/V *Exxon Valdez* oil spill. These studies have continued through the 1994 field season and show continued injury to *Fucus gardneri* and associated invertebrate population, especially in the upper intertidal. The data collected during the 1995 field season will be incorporated into the existing Herring Bay data base and the rates and extents of recovery determined for injured resources.									
96088	Fucus as Structure for Other Organisms	Stekoll/UAF	ADFG	PWS/KEN	NEW	$302.5	$328.2	$176.5	$0.0	$807.2
	The brown alga, *Fucus gardneri*, is the dominant organism in the upper intertidal community where it provides food, foraging areas, and shelter for a variety of other plants and animals. The goals of this project are to 1) define the factors which have limited the recovey of *Fucus* populations, 2) test various techniques to accelerate the recovery of *Fucus* populations in the upper intertidal, 3) determine the consequences for other organisms due to this slow recovery of *Fucus* and 4) define the geographical extent of upper intertidal habitat throughout PWS that has not recovered.									

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Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96090	Mussel Bed Restoration and Monitoring	NOAA	NOAA	PWS/KEN	Cont'd	$209.7	$0.0	$280.0	$910.0	$1,399.7
		In FY 96, a comprehensive report will be produced synthesizing and summarizing 4 years of studies on the persistence of oiling in mussel beds in PWS and the Gulf of Alaska and restoration of 12 of these beds. Chemical analyses of mussel and sediment samples collected in 1995 will be completed early in 1996. No new sample collection or site visits are proposed for FY 96.								
96094	Improving Recovery Rates on Shorelines in PWS Using Enhanced Bioremediation	ADEC	ADEC	PWS	NEW	$965.6	$600.0	$600.0	$0.0	$2,165.6
		This 3 year project will identify reasons why remaining subsurface oil on PWS shorelines has not biodegraded and assess the impact this is having on shoreline recovery. Based on site characterization and risk, the project will recommend and test, if appropriate, use of selected non-intrusive, non-commercial bioremediation enhancement methods to accelerate stalled biodegradation.								
96103-BAA	Whale Forestomach Anaerobic Microbes to Detoxify Oil Spills	Craig/OSU	NOAA	ALL	NEW	$170.7	$179.7	$0.0	$0.0	$350.4
		Complete microbial bioremediation of oil spills in the environment is currently limited by oxygen availability. We have preliminary evidence that anaerobic bacteria from the forestomach of bowhead whales have the unique ability to metabolize a range of fuel oil components anaerobically. This project is to: isolate anaerobic bacteria or bacterial consortia responsible for this activity from this habitat, assess their ability to detoxify fuel oil components, and optimize their growth for use in environmental bioremediation.								
96104	Avian Predation on Blue Mussels in Prince William Sound	USFS	USFS	PWS	NEW	$127.1	$130.0	$120.0	$60.0	$437.1
		The nearshore vertebrate predator project hypothesizes that prey availability and competition for prey such as blue mussels could be constraining recovery of sea otters and harlequin ducks. This project will document the impact of avian predators, including surf scoters, glaucous-winged gulls, black oystercatchers, and surfbirds on mussel populations at northwest Montague Island. This project will gather information on the numbers and distribution of avian predators, and how variable their use of mussels is.								
96106	Herring Bay Monitoring and Restoration Studies	Jewett	ADFG	PWS	Cont'd	$239.4	$0.0	$0.0	$0.0	$239.4
		This project would provide funds to write the final report for Project 95106. The budget reflects projected costs of sample analysis, data analysis, and report preparation. The final report will incorporate and compare all data collected since 1991.								
96108-BAA	Assessing the Effects of EVOS on Mussels and Fish: Using High Resolution Stable Isotope Records	Carpenter/UT	ADFG	PWS	NEW	$84.0	$84.9	$0.0	$0.0	$168.9
		Small portions of otoliths and mussel and barnacle shells will be sampled to provide a chemical record of the effects of EVOS on the mussel and fish populations of PWS. Findings will be used to assess the degree of initial and ongoing contamination of these resources. These new techniques will provide a detailed indicator of natural and anthropogenic stressors on these organisms and increase our knowledge of their physiological activity (e.g., growth rate, spawning, food source variations and disease).								

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96109-BAA	Decontamination and Restoration Process for Oil-Impacted Mussel Beds	Alter/PES	NOAA	ALL	NEW	$551.8	$325.6	$132.7	$0.0	$1,010.1
		This project's goal is to develop and validate for implementation a treatment process to decontaminate and restore oil-impacted mussel beds. The project includes toxicity tests of oil-removing agents and field evaluations of treatment processes.								
96160	Assessment of Recovery from Surface Oiling, Subsurface Oiling, and Subsurface Invertebrate Contamination by Oil on Gulf of Alaska Shorelines	DOI	DOI	KEN/AKP	NEW	$129.7	$130.0	$135.0	$380.0	$774.7
		Oil on the surface of Gulf of Alaska shorelines has disappeared relatively rapidly. However, poorly-known and perhaps substantial amounts of subsurface oil persist. We plan to assess and monitor surface and subsurface oil at 12 and 10 sites, respectively. We will document subsurface oil through excavations and monitor its weathering using an innovative system of collection wells. Amphipods, widespread invertebrates living within the beach substrate, will be monitored for tissue contamination by buried hydrocarbons.								
96161	Harlequin Duck - Indicator Species for Ecological Monitoring and Recovery	DOI	DOI	AKP	NEW	$230.4	$184.3	$213.5	$378.6	$1,006.8
		The harlequin duck is an important ecological indicator in intertidal systems affected by the oil spill. This proposal will address the hypotheses that harlequin duck population distribution and abundance, productivity and physiological condition have been impacted in oiled areas of the Gulf of Alaska.								
96290	Hydrocarbon Data Analysis, Interpretation, and Database Maintenance	NOAA	NOAA	ALL	Cont'd	$119.8	$121.0	$120.0	$470.0	$830.8
		This project is a continuation of the NRDA and Restoration database management, hydrocarbon interpretation and sample storage service. Subsistence response and restoration data will continue to be incorporated into the Trustee hydrocarbon database. A summary report for investigators and managers will be produced with an electronic copy of the database, that will allow easier access to this information. New user groups of the database will be identified, and tailored user interfaces will be generated.								
96427	Harlequin Duck Recovery Monitoring	ADFG	ADFG	PWS	Cont'd	$261.1	$250.0	$250.0	$520.0	$1,281.1
		This project will compare population parameters between oiled and unoilded areas based on population structure, behavior, production, and growth rates. Shoreline boat surveys will be conducted simultaneously. Changes in population size, structure, and production in oiled and unoiled areas and between years will be compared. Continued population monitoring and brood surveys will allow us to assess trends and suggest factors limiting recovery.								
Seabird/Forage Fish and Related Projects						$3,718.6	$3,392.9	$3,052.6	$3,829.0	$13,993.2
96021	Seasonal Movements and Pelagic Habitat Use by Common Murres and Tufted Puffins	DOI	DOI	KEN	Cont'd	$166.3	$166.3	$20.0	$0.0	$352.7
		Common murres were the bird species most heavily impacted by the *Exxon Valdez* oil spill. The failure to recover documented in this species 5 years after the oil spill may be related to a long-term decline in the availability of suitable forage. Elsewhere in the restoration program, tufted puffins are being used as samplers of the forage fish community and as indicators of changes that may be affecting murres and other injured resources. Tests of hypotheses concerning food limitation on murre population recovery and the application of puffins as fish samplers require information on the foraging ranges and feeding areas of birds from specific colonies.								

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96031	Development of a Productivity Index to Monitor the Reproductive Success of Marbled and Kittlitz's Murrelets in Prince William Sound, Alaska	DOI	DOI	PWS	Cont'd	$254.6	$254.6	$39.9	$0.0	$549.1
		We propose to develop a means to monitor the productivity of marbled and Kittlitz's murrelets. The reproductive success of these two non-colonial seabirds can not be monitored using standard techniques. To develop a productivity survey protocol, we will survey murrelets at sea to determine the timing and abundance of juveniles, the ratio of juveniles to adults and the coastal and marine features that best predict juvenile abundance. We will also determine the post-fledging movement of juveniles. By monitoring murrelet productivity in relation to population trends, this index can eventually be used to determine what factors influence murrelet recovery.									
96038	Publication of Seabird Restoration Workshop	Pac Seabird Gr	DOI	ALL	Cont'd	$31.0	$0.0	$0.0	$0.0	$31.0
		To further the emerging discipline of seabird restoration, the Pacific Seabird Group (PSG) is holding a workshop in September 1995. The workshop will bring together experts in seabird biology and restoration. It will include discussions of the theoretical and practical aspects of seabird restoration and provide recommendations to allow the establishment of restoration plans founded on the best available scientific information and opinion. This proposal seeks funds for the writing and publishing of manuscripts summarizing the workshop discussions.									
96101	Removal of Introduced Foxes From Islands	DOI	DOI	AKP	NEW	$88.9	$53.7	$0.0	$0.0	$142.6
		Populations of three species of birds injured by the oil spill will be allowed to recover by removing introduced arctic foxes from Seguam Island. The injured species are black oystercatcher, pigeon guillemot and common murre. Although it is outside the area directly affected by the oil spill, Seguam Island has a particularly high potential for restoring populations of the three injured species because it contains substantial amounts of habitat and remnant populations of all three species are present.									
96120-BAA	Proximate Composition and Energetic Content of Selected Forage Fish Species in Prince William Sound, AK	Worthy/TXAM	NOAA	PWS	NEW	$40.9	$40.9	$0.0	$0.0	$81.8
		This study will provide the data necessary for interpreting food web dynamics and ecology of the apex predators of PWS. In any long-term study of foraging ecology, especially those investigating the recovery of impacted species, knowledge of prey species composition and energetic value is critical in the interpretation of consumption rates and therefore the impact of consumer species upon prey species stocks. Compositional analysis will also yield important information on the general quality of the environment by assessing the condition of important prey species.									
96121-BAA	Stable Isotope Ratios and Fatty Acid Signatures of Selected Forage Fish Species in Prince William Sound, AK	Worthy/TXAM	NOAA	PWS	Cont'd	$51.0	$35.0	$0.0	$0.0	$86.0
		This study will examine the feeding ecology of killer whales and their possible impact on harbor seals within PWS. Evidence suggests that the non-recovering status of harbor seals may be due to predation by killer whales. Traditional methods of food web analysis cannot determine whether this is true, but the combination of stable isotope tracer techniques and fatty acid signature analysis will allow us to estimate the degree of interaction between these two injured species.									
96122	Mapping Potential Nesting Habitat of the Marbled Murrelet in Prince William Sound Using Habitat Models Linked to Geographic Databases	USFS	USFS	PWS	Cont'd	$168.8	$20.0	$0.0	$0.0	$188.8
		This project would identify potential habitat of the marbled murrelet in PWS by linking habitat models to geographic databases of vegetation and physical site characteristics. Areas identified as having a high probability of containing nesting habitat could become focal areas for adjusting management prescriptions to favor habitat maintenance.									

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96142-BAA	Status and Ecology of Kittlitz's Murrelet in Prince William Sound	ABR, Inc.	DOI	PWS	NEW	$110.2	$142.6	$149.8	$360.8	$763.4
		This project would investigate the status and ecology of Kittlitz's Murrelet, a rare seabird breeding in glaciated fjords of Prince William Sound (PWS). The study will evaluate the abundance, distribution, and productivity of this little known seabird and assess its habitat use and feeding habits in northwestern PWS. Given uncertainty about the effects of the oil spill on this species, a better understanding of its status and ecology is required to ensure its long-term conservation.								
96143-BAA	Recovery of Bird and Mammal Populations in Prince William Sound After the *Exxon Valdez* Oil Spill	ABR, Inc.	DOI	PWS	Cont'd	$321.2	$452.4	$474.9	$139.7	$1,388.2
		This study will assess the status of recovery of bird and mammal populations injured in the aftermath of the Exxon oil spill and is an extension of a study conducted in Prince William Sound in 1989 - 1991. The project proposes to conduct three surveys each year during 1996 - 1998 in nearshore and offshore habitats and will assess recovery based on wildlife use of oil-affected habitats and population status relative to prespill levels.								
96144	Common Murre Population Monitoring	DOI	DOI	KEN	Cont'd	$101.7	$125.3	$44.0	$458.5	$729.5
		The project is designed to determine whether common murre populations at a series of index colonies within the area affected by the oil spill are recovering. This objective will be accomplished by counting murres at all five locations to document the presence or absence of post-spill population trends. Each location will be surveyed every 3 years, but the field work is planned so that a portion of it will be accomplished annually (i.e. colonies in the western portion of the spill zone will be surveyed in FY 96, central colonies will be counted in FY 97, and the eastern-most colonies will be visited in FY 98). This cycle will be repeated through FY 02.								
96148	Kittlitz's Murrelet: Biology, Abundance, and Population Genetics	DOI	DOI	ALL	NEW	$99.8	$100.0	$100.0	$100.0	$399.8
		This project will i) compile and analyze available unpublished and published data to assess the abundance and distribution of Kittlitz's Murrelet in Alaska, and, ii) conduct original research on the breeding biology, pelagic distribution and population genetics of Kittlitz's Murrelet in Alaska.								
96159	Surveys to Monitor Marine Bird Abundance In Prince William Sound During Winter and Summer 1996	DOI	DOI	PWS	Cont'd	$262.9	$25.0	$260.0	$570.0	$1,117.9
		We propose to conduct small boat surveys to monitor abundance of marine birds and sea otters in PWS during March and July 1996. Previous surveys have observed >65 bird and 8 marine mammal species in PWS. We will use data collected in 1996 to examine trends from summer 1989-96 and from winter 1990-96 by determining whether populations in the oiled zone changed at the same rate as those in the unoiled zone. We will also examine overall population trends for the Sound from 1989-96.								
96163	APEX: Apex Predator Ecosystem Experiment in Prince William Sound and the Gulf of Alaska	Duffy, et. al.	NOAA	PWS	Cont'd	$1,982.6	$1,964.0	$1,964.0	$2,200.0	$8,110.6
		This study will use seabirds as probes of the trophic environment of PWS and compare their reproductive and foraging biologies with similar measurements from the Barren Islands, an area with more suitable food. Measurements will be compared with hydroacoustic and net samples of fish to calibrate seabird performance with fish distribution and abundance. The project will use fish samples to compare diet, energetics and reproductive parameters of different forage-fish species to determine whether competitive and predatory interactions or different responses to the environment may be favoring the abundance of one fish species over another.								

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Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96175	Remote Video System Seabird Monitoring Project	DOI	DOI	KEN	NEW	$38.7	$13.1	$0.0	$0.0	$51.8
	The project will test the ability of a robotically controlled video monitoring system to remotely collect real-time productivity, nesting chronology, adult time budget, and chick feeding rate data on common murres and other seabirds more accurately and at lower costs than current methods allow at colonies with difficult access. The proposal is based on a prototype system that was designed and successfully tested in Kachemak Bay and the Barren Islands in FY 94. Data will be collected both remotely and manually on the same sets of plots using the same basic methods in conjunction with Project 96163J. The collected data will be tested for significant differences.									
Subsistence Projects						$3,326.6	$1,882.8	$1,432.4	$2,609.1	$9,250.9
96009D-BAA	Survey of Octopuses in Intertidal Habitats	Scheel/PWSSC	NOAA	PWS	Cont'd	$134.0	$40.9	$0.0	$0.0	$174.9
	This project addresses concerns that octopus and chiton have been depleted by EVOS and that subsistence uses are impaired. The first year (FY95) is to establish the feasibility of working on octopus in the Sound, identify suitable study sites, and evalutate techniques. The second year (FY96) will focus on the vertical distribution of octopus in the nearshore where they are harvested. Close-out costs are requested in the third year (FY97).									
96052A	Community Involvement & Use of Traditional Knowledge	Chugach OSIR	DOI	ALL	Cont'd	$210.0	$215.0	$215.0	$627.0	$1,267.0
	This proposal provides for the assumption of Project 95052 responsibilities by a consortium of Oil Spill Impacted Region (OSIR) communities and the transfer of lead agency responsibilities from ADFG to DOI. DOI is the recognized and utilized cognizant agency for the Alaska Native communities within the oil spill area. Project responsibilities would be carried out through a community service office established for the purposes of this project. The project's long-term purposes would be integrated and continued under P.L. 638 - Tribal Compacting Agreements.									
96052B	Community Interaction/Traditional Knowledge	ADFG	ADFG	ALL	Cont'd	$298.3	$298.0	$298.0	$1,192.0	$2,086.3
	This project will continue a program to encourage and facilitate communication between the Trustee Council, researchers working on oil spill restoration projects, regional organizations and residents of communities impacted by the oil spill. The goal is to make optimal use of the complementary nature of scientific data and traditional knowledge.									
96127	Tatitlek Coho Salmon Release	Tatitlek IRA	ADFG	PWS	Cont'd	$52.7	$42.8	$40.3	$161.2	$297.0
	Project will create a coho salmon return to Boulder Bay near Tatitlek village. Enough coho eggs to produce 20,000 smolts will be collected from an ADF&G approved stream, incubated and reared to smolt at the Solomon Gulch Hatchery, transported and held for two weeks in net pens in Boulder Bay before release. Release will produce a 2,000 to 3,000 adult return to Boulder Bay for harvest in a subsistence fishery.									

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96131	Chugach Native Region Clam Restoration	ADFG	ADFG	ALL	Cont'd	$405.6	$413.6	$417.4	$417.4	$1,654.0
		Subsistence clam populations near the Native villages of Port Graham, Nanwalek, Chenega Bay, Tatitlek, Eyak and Ouzinkie will be established. The Qutekcak hatchery in Seward will annually provide about 800,000 juvenile littleneck clams, cockles and, if possible, butter clams for seeding. Historical information, local and agency expertise, and research will be used to identify areas to seed and methods used. Total seeded area will not exceed 5 hectares.								
96201	Port Lions Public Safety Building/Emergency Operations Center	Port Lions	ADFG	KOD	NEW	$800.0	$0.0	$0.0	$0.0	$800.0
		This project would construct a new building to house the fire engine and ambulance with space for the VPSO office, training conference room, holding facility and VPSO housing. The building would also serve as a permanent Emergency Operations Center.								
96202	Port Lions Community Hall	Port Lions	ADFG	KOD	NEW	$150.0	$0.0	$0.0	$0.0	$150.0
		Funds would match $175,000 requested from the State Legislature for a community hall. Funds for the community hall were received prior to the oil spill but were lost, as no manpower was available for construction.								
96203	Port Lions Waste Oil/Garbage Collection System for Boat Harbor	Port Lions	ADFG	KOD	NEW	$150.0	$0.0	$0.0	$0.0	$150.0
		To prevent indiscriminate dumping of waste oil and refuse into the harbor, this project would fund a waste oil tank with a pumping system so that the oil could be transferred to an existing waste oil burner system. The project would also find a new garbage collection and recycling station for the harbor, as well as a vehicle to haul refuse from the harbor to the landfill .								
96204	Kodiak Subsistence Resource Restoration Planning	ADFG	ADFG	KOD	NEW	$39.4	$0.0	$0.0	$0.0	$39.4
		The project would implement a more intensive subsistence resource restoration planning effort in Kodiak Island Borough communities as a follow-up to Projects 94428 and 95428. The goal would be to develop a coordinated set of resource restoration proposals for consideration in the FY 97 work plan. Methods will include several workshops and a series of community meetings.								
96205	Eyak Subsistence Recovery Camp Planning Project	Eyak Nat Vill	DOI	PWS	NEW	$40.8	$0.0	$0.0	$0.0	$40.8
		This project would plan for a Subsistence Recovery Camp for Alaska Native subsistence users affected by the oil spill. As identified by Picou and Gill (1992), Post-traumatic Stress Syndrome is directly linked to the environmental damage done by the oil spill and the subsistence way of life. With the results of the oil spill still being felt by the communities through lack of or reduced abundance of specific species there has been an upsurge of addictive behaviors.								

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96206	Old Harbor Lagoon (Midway Culvert) Salmon Enhancement Feasibility Study	Old Harbor	ADFG	KOD	NEW	$28.8	$0.0	$0.0	$0.0	$28.8
		As a step towards restoring subsistence uses and resources at the community of Old Harbor, this project will determine the feasibility for coho and chum salmon enhancement for the Old Harbor lagoon system, by evaluating the potential for improving the early marine rearing opportunities for chum and coho salmon. It will evaluate the utility of raising the culvert through which this system empties into Sitkalidak Straits to a level which would provide increased water retention in the lagoon and thus increase the rearing area.								
96207	Ocean Beach Sockeye Enhancement Feasibility Study	Old Harbor City	ADFG	KOD	NEW	$92.7	$8.0	$0.0	$0.0	$100.7
		As a step towards restoring subsistence uses and resources at the community of Old Harbor, this project will determine the feasibility for sockeye salmon enhancement for the Ocean Beach Lake System, located on the east side of Sitkalidak Island. Feasibility determination efforts would focus on collecting stock status data, identifying minimum and optimum escapement requirements for natural production, and investigating the feasibility of enhancing wild production from this system.								
96208	Kempff Bay Sockeye Enhancement Feasibility Study	Akhiok City	ADFG	KOD	NEW	$70.7	$8.0	$0.0	$0.0	$78.7
		As a step towards restoring subsistence uses and resources at the community of Akhiok, this project will determine the feasibility for sockeye salmon enhancement for the Akhiok Village Lake System, located at Kempff Bay on southern Kodiak Island. Feasibility determination efforts would focus on collecting stock status data, identifying minimum and optimum escapement requirements for natural production, and investigating the feasibility of enhancing wild production from this system.								
96210-BAA	Prince William Sound Youth Area Watch	Chugach RRC	ADFG	PWS	NEW	$233.4	$200.0	$175.0	$0.0	$608.4
		Students from Chenega Bay, Tatitlek and some outlying areas will participate in research projects identified by PWSSC. The objective is to increase the awareness of youth regarding the effects of the oil spill and encourage their involvement in research/restoration. The students will gain the techniques necessary to implement change in both onshore and offshore research. Students will be involved in oceanographic testing, fish monitoring, bird and mammal observations, pristane/mussel analysis and octopus studies. By the second year, students will begin applying the research skills and knowledge that they have gained to local restoration efforts.								
96212	PSP Shellfish Restoration Testing Program	Kodiak Tribal	ADFG	KOD	NEW	$84.9	$137.5	$41.8	$0.0	$264.2
		Subsistence users in the Kodiak Island Borough probably consume more shellfish (clams and crabs) per capita than any other region of Alaska. Since the oil spill, numerous cases of severe paralytic shellfish poisoning (PSP) have created fear about the safety of consuming these traditional foods. This proposal addresses the health concerns of subsistence users through active participation in a systematic testing program. Faster lab results should curtail the number of cases of PSP and save lives.								

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96214	Documentary on Subsistence Harbor Seal Hunting in PWS	Tatitlek Village	ADFG	PWS	NEW	$74.5	$50.0	$50.0	$50.0	$224.5
	The purpose of this project is to make a documentary on subsistence hunting of harbor seals in PWS. This video will document all facets of harbor seal hunting including the ecological and biological knowledge hunters use to hunt harbor seals. By documenting this knowledge, the project will enhance the restoration of the seal population by providing an indigenous hunter's perspective on harbor seal ecology.									
96218	Ouzinkie Clam Restoration Project	Ouzinkie Tribe	ADFG	KOD	NEW					
	This project will begin to reestablish local clam populations for subsistence use in the Ouzinkie area. Clams were once a major subsistence food in the community of Ouzinkie, but local clam populations have decreased to low levels since the oil spill. Additionally, due to food safety concerns, clams no longer contribute to this community's subsistence harvest.									
96220-BAA	Eastern PWS Wildstock Salmon Habitat Restoration	Eyak Nat Vill	USFS	PWS	NEW	$77.2	$115.0	$12.0	$0.0	$204.2
	This project will replace lost subsistence services resulting from the oil spill by increasing wild salmon production in eastern Prince William Sound. Instream fisheries habitat improvement techniques, primarily the installation of log structures, will be employed by local subsistence users to increase the capability of selected streams to produce additional salmon.									
96222	Chenega Bay Salmon Restoration	Chenega IRA	USFS	PWS	NEW	$17.1	$56.4	$0.0	$0.0	$73.5
	This project will open up additional spawning areas for pink and coho salmon, and rearing habitat for coho salmon, in Anderson Creek through placement of a fish pass on a six foot barrier falls located about one quarter of the way up the stream. Anderson Creek is located adjacent to Chenega Bay village. Additional salmon produced from increased spawning habitat will help replace lost subsistence opportunities in the village.									
96225	Port Graham Pink Salmon Subsistence Project	Port Graham	ADFG	KEN	NEW	$88.9	$83.1	$77.2	$161.5	$410.7
	This project will help supply pink salmon for subsistence use in the Port Graham area during the broodstock development phase of the Port Graham hatchery. Because local runs of coho and sockeye salmon, the more traditional salmon subsistence resource, are at low levels, pink salmon are heavily relied on for subsistence This project will help ensure that pink salmon remain available for subsistence use until the more traditional species are rejuvenated.									
96226	Resurrection Bay Salmon Stock Enhancement	Qutekcak Tribe	ADFG	KEN	NEW	$45.0	$50.0	$40.0	$0.0	$135.0
	This project would enhance Salmon Resources and provide employment at the tribal level. By FY 98, the project should be self supporting by providing a means of value added marketing to purchase salmon fry. The plan would entail the hiring of a Processor/Marketer, the purchase of a smoker, the purchase of fresh salmon to be smoked and dried.									

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96244	Harbor Seal Cooperative Assistance	ANHSC	ADFG	ALL	NEW	$70.0	$45.0	$12.0	$0.0	$127.0
	The goal of the project is to facilitate the involvement of subsistence users of harbor seals in the restoration of this species through two workshops, collection and application of traditional knowledge and the development of a traditional knowledge database. A subcontract with the Alaska Native Harbor Seal Commission (ANHSC) will contribute to developing a meaningful role for subsistence hunters in research and resoration activities.									
96272	Chenega Chinook Release Program	PWSAC	ADFG	PWS	Cont'd	$42.1	$47.8	$53.7	$0.0	$143.6
	Chinook salmon incubated and reared at the Wally Noerenberg Hatchery will be released in Crab Bay, adjacent to the native community of Chenega. Adult salmon returning to the site of release will provide replacement resources and associated services injured by the oil spill. Two releases have taken place (1994, 1995) as part of this multi-year project. Adult salmon will begin returning in 1996 and 1997, with larger numbers projected at nearly 1,000 adult fish, returning in 1998 and thereafter.									
96279	Resource Abnormalities Study	ADFG	ADFG	ALL	Cont'd	$71.7	$71.7	$0.0	$0.0	$143.4
	Many subsistence users in the oil spill area have reported abnormalities in resource species. There has been a loss of confidence among hunters and fishermen in their abilities to determine if their traditonal foods are safe to eat. This project would provide continued support for a project under which they can send samples of abnormal resources to be examined by biologists or pathologists, and receive information back on the possible causes for the deformities.									
96428	Subsistence Restoration Planning and Implementation	ADFG	ADFG	ALL	Cont'd	$48.8	$0.0	$0.0	$0.0	$48.8
	This project would fund the final reporting for the two year long Subsistence Restoration Planning and Implementation Project. Reporting includes community meetings to report back on project results to the participating communities and write up, revision, production and distribution of a final report to the Trustee Council.									
Archaeological Resources						$3,737.9	$3,149.2	$4,108.2	$1,100.3	$12,095.6
96007A	Archaeological Index Site Monitoring	ADNR	ADNR	ALL	Cont'd	$146.5	$135.0	$145.0	$810.0	$1,236.5
	Monitoring of archaeological sites on public land injured by vandalism and oiling will concentrate on a sample of index sites in the three regions of the spill. Oiled sites will be tested for re-introduced oil. The ten year project will end at five years if monitoring shows no continued injury.									
96007B	Site Specific Archaeological Restoration	USFS	USFS	PWS	Cont'd	$78.4	$0.0	$0.0	$0.0	$78.4
	Funding is requested for the final phase of the Forest Service's archaeological restoration at sites SEW-440 and SEW-488. Project 96007B, is a continuation of projects 95007B. Analysis and interpretation of data gathered during previous field work will result in a peer reviewed final report, prepared and distributed according to Trustee Council procedures. This will complete the restoration process initially prescribed for these sites in 1991.									

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96149	Archaeological Site Stewardship, Kachemak Bay, Shelikof Strait, and Chignik	ADNR	ADNR	ALL	NEW	$74.4	$60.0	$50.0	$100.0	$284.4
		The archaeological site stewardship program will provide training and coordination for a cadre of volunteers to monitor vandalized archaeological sites in the oil spill area beyond the ability of agency monitoring. Volunteer site stewards will protect damaged sites in Kachemak Bay, Uganik Bay, Uyak Bay and the Chignik area of the Alaska Peninsula. Further protection will come from increased local awareness of harm from site vandalism.								
96150	Expansion of Alutiiq Archaeological Repository	Alutiiq HF	ADNR	PWS/KEN	NEW	$535.0	$0.0	$0.0	$0.0	$535.0
		Many communities within the EVOS area have expressed interest in museums. The cost of constructing such facilities in all these locations is prohibitive. The new Alutiiq Museum and Archaeological Repository, designed to hold collections from the Kodiak area, suggests expanding its existing facilities to hold collections from the remainder of the oil spill area. Selected artifacts would be displayed in other spill communities, where facilities or display areas could exist without the necessity of funding the staff and physical plant needed for large collections.								
96152	Community Museum, Repository, Archaeological, Site Stewardship, Co-Management Training & Human Resource Development Project	Chugach OSIR	DOI	PWS/KEN	NEW	$190.3	$190.3	$190.3	$190.3	$761.2
		This project would provide a comprehensive and cost effective/efficient approach to the provision and delivery of museum, repository, archaeological, site stewardship and resource co-management training and career development for 14 - 21 local residents, or 2 - 3 participants from each Chugach Oil Spill Impacted Region (OSIR) community engaged in the development of a cultural center, or a subsistence restoration, site stewardship, and/or resource co-management facility, or attendant local service enterprises. Provision for training personnel is a prerequisite to local contracting assumption under P.L. 638 and attendant CFR regulations of the US DOI.								
96153	Community Cultural Centers, Repositories and Subsistence Restoration Facilities - Comprehensive Design, Engineering, Financing, and Construction Development Project	Chugach OSIR	ADEC	PWS/KEN	NEW	$2,588.3	$2,588.9	$3,622.9	$0.0	$8,800.1
		This project would provide a consolidated, coordinated and cost effective/efficient approach to the progressive development, financing, and construction of local community and region-wide service facilities. Completed construction of such facilities, scaled to the local needs and capacity of each community, is considered fundamental to achieving and maintaining the region-wide long-term restoration of injured resources, subsistence services, and assuring provision for local and regional repository and site stewardship services. The project is proposed by the Chugach Oil Spill Impacted Region Communities Consortium.								
96154	Chugach OSIR Community Repositories, Cultural Centers, Subsistence Restoration Facilities Comprehensive Services Development Planning Project	Chugach OSIR	DOI	PWS/KEN	NEW	$125.0	$175.0	$100.0	$0.0	$400.0
		This project would provide coordinated and cost effective/efficient approach to the provision and delivery of technical assistance planning services to each of the Chugach Oil Spill Impacted Region (OSIR) communities engaged in the development of a cultural center or subsistence restoration facility. The project is designed to facilitate a region-wide effort, coordinate and provide for the various technical service elements associated with and essential to the planning and development of community cultural centers or subsistence restoration facilities and their attendant long-term programs.								

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96219	Ouzinkie Archeological Culture Center Project	Ouzinkie Tribe	ADEC	KOD	NEW					
	The Ouzinkie Archeological Culture Center will preserve and protect artifacts and the associated data that would otherwise be lost to vandals, looters and erosion or that have been recovered from looters and will preserve local cultural resources and traditional Native culture. This facility will also provide an opportunity for neighboring communities to participate in mini-conferences focusing on issues such as archeological history and the effects of the *Exxon Valdez* oil spill on declining subsistence resources, life skills and native culture.									
Reducing Marine Pollution						$164.6	$135.0	$0.0	$0.0	$299.6
96091	Monitoring for Current and Potential Environmental Impacts of Oil Industry Activities in Cook Inlet	Cook Inl RCAC	ADEC	KEN	NEW	$135.0	$135.0	$0.0	$0.0	$270.0
	This proposal requests assistance in funding the Cook Inlet Environmental Monitoring Study. For two years, Cook Inlet RCAC has devoted its entire environmental research budget as sole supporter of this critical program. Goals of the program: 1) establishing baseline hydrocarbon and biological data; 2) evaluating potential hydrocarbon accumulation in Cook Inlet sediments; 3) evaluating potential environmental impacts of crude oil production and transportation in the Inlet.									
96115	Sound Waste Management Plan	PWS Econ DC	ADEC	PWS	Cont'd	$29.6				$29.6
	The Sound Waste Management Plan is a comprehensive plan to identify and remove the major sources of marine pollution and solid waste in PWS that may be affecting recovery of resources and services injured by the Exxon Valdez Oil Spill. This request completes the first phase -- planning begun in FY 95. The following phases of the plan will be to implement these solutions using funds from a variety of sources, possibly including the Trustee Council.									
Habitat Protection/Acquisition						$1,919.0	$1,151.0	$835.0	$475.0	$4,380.0
96058	Landowner Assistance Project	USFS	USFS	ALL	Cont'd	$205.9				$205.9
	Landowners in the oil spill area have expressed an interest in receiving assistance and advice on how to do a better job of protecting and/or enhancing habitat during resource development activities. Impacts often occur because landowners and development contractors lack an awareness of resource sensitivities during pre-project planning. The project, on an as needed basis, will attempt to make development and restoration objectives compatible so that land use activities do not impede natural recovery.									
96126	Habitat Protection and Acquisition Support	ADNR	ADNR	ALL	Cont'd	$841.8	$170.0	$115.0	$115.0	$1,241.8
	Project 96126 provides negotiation support to the Trustee Council in order to reach closure on habitat protection priorities. This support includes those services such as title reports, appraisals, on site inspections, hazardous materials surveys, surveys, timber cruises and reviews, and other services necessary for the successful completion of habitat protection negotiations.									

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96141	Afognak Island State Park - Habitat Restoration Survey	ADNR	ADNR	KOD	NEW	$45.0	$0.0	$0.0	$0.0	$45.0
		The objective of this project is to recommend ways to restore habitat in logged areas and along logging roads in Afognak Island State Park. The park was established in 1994 on land (Seal Bay and Tonki Cape parcels) purchased by the Trustee Council. A private contractor would conduct a regeneration survey that would document the density of seedlings that have returned to the 1200 acres that have been logged, and recommend ways to improve habitat (e.g., tree planting or thinning). The contractor would also recommend cost-effective ways to improve habitat along the 12 miles of logging roads within the park.									
96176	Restoration of Essential Wetland Habitat at San Juan Bay on Montague Island	USFS	USFS	PWS	NEW	$67.5	$90.5	$60.0	$180.0	$398.0
		Project has the potential to create wetland habitats used by waterfowl and anadromous fish impacted by the oil spill. Study in FY 96 will determine project feasibility from hydrologic, soils, geomorphology, fisheries, wildlife and engineering perspectives. Detailed project plan will be developed if findings warrant. Environmental analysis will be conducted in FY 97. If project is implemented, succession will be reversed in the uplifted lake at San Juan Bay on Montague Island. Flooding of the uplifted area will maintain the wetland component. Pools/ponds will be created in riparian and floodplain areas to restore associated aquatic vegetation.									
96178	Second Growth Forest Habitat Enhancement for Injured Wildlife Species	USFS	USFS	PWS	NEW	$84.3	$90.5	$60.0	$180.0	$414.8
		The PWS area has several watersheds on National Forest System lands where timber harvest occurred in the early 1970's. These were done without an understanding of optimum stand structure for wildlife populations. This project has the potential to improve habitat for river otter, marbled murrelet, harlequin duck and bald eagle by accelerating succession and developing forest stand structure beneficial to wildlife species faster than natural forest succession. Habitat for old-growth dependent species such as river otter, marbled murrelet, harlequin duck, and bald eagle, whose populations were proven to be damaged by the 1989 Oil Spill, can be improved with this project.									
96180	Kenai Habitat Restoration & Recreation Enhancement Project	ADNR	ADNR	KEN	NEW	$674.5	$800.0	$600.0	$0.0	$2,074.5
		Adverse impacts to the banks of the Kenai River total approximately 19 miles of the river's 166 mile shoreline. Included in this total are 5.4 river miles of degraded shoreline on public land. Riparian habitats have been impacted by trampling, vegetation loss and structural development. This riparian zone provides important habitat for pink salmon, sockeye salmon and Dolly Varden, species injured by the *Exxon Valdez* oil spill. The project's objectives are to restore injured fish habitat, protect fish and wildlife habitat, enhance and direct recreation and preserve the values and biophysical functions that the riparian habitat contributes to the watershed.									
Public Info/Science Mgt/Administration						$3,200.0	$3,200.0	$2,800.0	$7,200.0	$16,400.0
96100	Public Information, Science Management, and Administration	Exec Director	ALL	ALL	Cont'd	$3,200.0	$3,200.0	$2,800.0	$7,200.0	$16,400.0
		DPD and detailed budget under development. This project includes funding for the former 95089 (Information Management System/OSPIC).								

FY 96 PROJECT PROPOSALS

Proj. No.	Title	Proposer	Lead Agency	Location	New or Cont'd.	Cost FY 96	Cost FY 97	Cost FY 98	Cost FY 99 to End	Total FY 96 to End
96155	Prince William Sound Information Service	Fairweather	ADNR	PWS	Cont'd					
		The proposed Fairweather integrated information system is designed to accept, process and store scientific and other information from studies and environmental data collection programs from PWS and then allow easy access for manipulation and display of the data. Basic information from PWS studies will be converted to a common data format and stored on computer disk accessible to all researchers, government officials and other interested parties. Users would have a variety of access and display options.								
Research Facilities						$3,000.0	$6,000.0	$2,000.0	$1,000.0	$12,000.0
96151-BAA	Expansion of the Prince William Sound Science Center/Oil Spill Recovery Institute	NOAA	NOAA	PWS	NEW	$3,000.0	$6,000.0	$2,000.0	$1,000.0	$12,000.0
		This project addresses the need for basic marine research infrastructure important to the long-term restoration effort in PWS. It will expand currently overcrowded research facilities and provide new capacity for research and monitoring of ocean processes, marine plankton and nekton, and interrelationships between physics and the biology of the region. The laboratories will emphasize remote sampling (underwater acoustics and optics), data communication, visualization and numerical modeling.								

Number of Proposals Received	128
Total Requested for FY 96	$38,821.9
Total Requested for FY 97	$33,784.8
Total Requested for FY 98	$25,182.2
Total Requested for FY 96 to End	$120,535.7

1996 DRAFT WORK PLAN -- LIST OF PROJECT PROPOSALS RECEIVED

PROJECT #	PROJECT TITLE	PROPOSER	COST FY 96
96001	Recovery of Harbor Seals from EVOS: Condition and Health Status	Castellini/UAF	$187.4
96007A	Archaeological Index Site Monitoring	ADNR	$146.5
96007B	Site Specific Archaeological Restoration	USFS	$78.4
96009D-BAA	Survey of Octopuses in Intertidal Habitats	Scheel/PWSSC	$134.0
96012A-BAA	Comprehensive Killer Whale Investigation in Prince William Sound, Alaska	N Gulf Oceanic	$167.5
96012B	Impact of Killer Whale Predation on the Recovery of Injured Resources in Prince William Sound	NOAA	$229.5
96021	Seasonal Movements and Pelagic Habitat Use by Common Murres and Tufted Puffins	DOI	$166.3
96025	Mechanism of Impact and Potential Recovery of Nearshore Vertebrate Predators	DOI	$1,669.4
96027	Kodiak Archipelago Shoreline Assessment: Monitoring Surface and Subsurface Oil	ADEC	$35.1
96031	Development of a Productivity Index to Monitor the Reproductive Success of Marbled and Kittlitz's Murrelets in Prince William Sound, Alaska	DOI	$254.6
96037	Coastal Habitat Intertidal Monitoring	Highsmith/UAF	$609.2
96038	Publication of Seabird Restoration Workshop	Pac Seabird Gr	$31.0
96043A	Cutthroat Trout and Dolly Varden Char Population and Habitat Monitoring	USFS	$29.6
96043B	Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures	USFS	$40.4
96043C	Cutthroat Trout Habitat Improvement Structures	USFS	$100.2
96048-BAA	Historical Analysis of Sockeye Salmon Growth Among Populations Affected by Overescapement in 1989	NRC, Inc.	$86.7
96052A	Community Involvement & Use of Traditional Knowledge	Chugach OSIR	$210.0
96052B	Community Interaction/Traditional Knowledge	ADFG	$298.3
96054	Mass-Balance Model of Trophic Fluxes in Prince William Sound	Pauly/UBC	$105.9
96056	Sea Otter Transplantation/Clam Restoration	D. Warner	
96058	Landowner Assistance Project	USFS	$205.9
96064	Monitoring, Habitat Use, and Trophic Ineractions of Harbor Seals in Prince William Sound	ADFG	$381.1
96067-BAA	Juvenile Fish Habitat Identification and Assessment	Mitchell/MBC	$467.4
96072	Status and Potential Recovery of the Black Oystercatcher: An Apex Predator in the Nearshore Environment	DOI	$157.7
96074	Herring Reproductive Impairment	NOAA	$347.7
96076	Effects of Oiled Incubation Substrate on Straying and Survival of Wild Pink Salmon	NOAA	$393.8
96086	Herring Bay Monitoring and Restoration Studies	Highsmith/UAF	$185.3
96088	Fucus as Structure for Other Organisms	Stekoll/UAF	$302.5
96090	Mussel Bed Restoration and Monitoring	NOAA	$209.7

1996 DRAFT WORK PLAN -- LIST OF PROJECT PROPOSALS RECEIVED

PROJECT #	PROJECT TITLE	PROPOSER	COST FY 96
96091	Monitoring for Current and Potential Environmental Impacts of Oil Industry Activities in Cook Inlet	Cook Inl RCAC	$13
96093A-BAA	Restoration of PWS Pink Salmon by Diversion of Harvest Effort: Quantitative Genetic Assessment of Early-Returning Pink Salmon Broodstock	Smoker/UAF	$111.9
96093B-BAA	Restoration of PWS Pink Salmon by Diversion of Harvest Effort: Population Genetic Assessment of Gene Flow from Early Return Stock	Smoker/UAF	$121.0
96093C	Restoration of Prince William Sound Pink Salmon by Diversion of Harvest Effort	PWSAC	
96094	Improving Recovery Rates on Shorelines in PWS Using Enhanced Bioremediation	ADEC	$965.6
96100	Public Information, Science Management, and Administration	Exec Director	$3,200.0
96101	Removal of Introduced Foxes From Islands	DOI	$88.9
96103-BAA	Whale Forestomach Anaerobic Microbes to Detoxify Oil Spills	Craig/OSU	$170.7
96104	Avian Predation on Blue Mussels in Prince William Sound	USFS	$127.1
96106	Herring Bay Monitoring and Restoration Studies	Jewett	$239.4
96108-BAA	Assessing the Effects of EVOS on Mussels and Fish: Using High Resolution Stable Isotope Records	Carpenter/UT	$84.0
96109-BAA	Decontamination and Restoration Process for Oil-Impacted Mussel Beds	Alter/PES	$551.8
96115	Sound Waste Management Plan	PWS Econ DC	$29.6
96120-BAA	Proximate Composition and Energetic Content of Selected Forage Fish Species in Prince William Sound, AK	Worthy/TXAM	$4(
96121-BAA	Stable Isotope Ratios and Fatty Acid Signatures of Selected Forage Fish Species in Prince William Sound, AK	Worthy/TXAM	$51.0
96122	Mapping Potential Nesting Habitat of the Marbled Murrelet in Prince William Sound Using Habitat Models Linked to Geographic Databases	USFS	$168.8
96126	Habitat Protection and Acquisition Support	ADNR	$841.8
96127	Tatitlek Coho Salmon Release	Tatitlek IRA	$52.7
96131	Chugach Native Region Clam Restoration	ADFG	$405.6
96139A1	Salmon Insream Habitat and Stock Restoration - Little Waterfall Barrier Bypass Improvement	ADFG	$55.0
96139A2	Spawning Channel Construction Project Port Dick Creek, Lower Cook Inlet	ADFG	$223.1
96139C1	Montague Riparian Rehabilitation Monitoring Program	USFS	$43.1
96139C2	Salmon Instream Habitat and Stock Restoration - Lowe River and Valdez Arm Drainages	ADFG	$174.6
96139D	Supplemental Monitoring for the Proposed Spawning Channel Construction Project, Port Dick Creek, Lower Cook Inlet	Coble Geotech.	$9.2
96141	Afognak Island State Park - Habitat Restoration Survey	ADNR	$45.0
96142-BAA	Status and Ecology of Kittlitz's Murrelet in Prince William Sound	ABR, Inc.	$110.2
96143-BAA	Recovery of Bird and Mammal Populations in Prince William Sound After the *Exxon Valdez* Oil Spill	ABR, Inc.	$32
96144	Common Murre Population Monitoring	DOI	$101.7

1996 DRAFT WORK PLAN -- LIST OF PROJECT PROPOSALS RECEIVED

PROJECT #	PROJECT TITLE	PROPOSER	COST FY 96
96145	Cutthroat Trout and Dolly Varden: the Relation Among and Within Populations of Anadromous and Resident Forms	USFS	$336.7
96148	Kittlitz's Murrelet: Biology, Abundance, and Population Genetics	DOI	$99.8
96149	Archaeological Site Stewardship, Kachemak Bay, Shelikof Strait, and Chignik	ADNR	$74.4
96150	Expansion of Alutiiq Archaeological Repository	Alutiiq HF	$535.0
96151-BAA	Expansion of the Prince William Sound Science Center/Oil Spill Recovery Institute	NOAA	$3,000.0
96152	Community Museum, Repository, Archaeological, Site Stewardship, Co-Management Training & Human Resource Development Project	Chugach OSIR	$190.3
96153	Community Cultural Centers, Repositories and Subsistence Restoration Facilities - Comprehensive Design, Engineering, Financing, and Construction Development Project	Chugach OSIR	$2,588.3
96154	Chugach OSIR Community Repositories, Cultural Centers, Subsistence Restoration Facilities Comprehensive Services Development Planning Project	Chugach OSIR	$125.0
96155	Prince William Sound Information Service	Fairweather	
96159	Surveys to Monitor Marine Bird Abundance In Prince William Sound During Winter and Summer 1996	DOI	$262.9
96160	Assessment of Recovery from Surface Oiling, Subsurface Oiling, and Subsurface Invertebrate Contamination by Oil on Gulf of Alaska Shorelines	DOI	$129.7
96161	Harlequin Duck - Indicator Species for Ecological Monitoring and Recovery	DOI	$230.4
96162	Investigations of Disease Factors Affecting Declines of Pacific Herring Populations in Prince William Sound, AK	UW/UCD/SFU	$635.0
96163	APEX: Apex Predator Ecosystem Experiment in Prince William Sound and the Gulf of Alaska	Duffy, et. al.	$1,982.6
96164	Pacific Herring Projects Coordination	ADFG	$49.2
96165	Genetic Discrimination of Prince William Sound Herring Populations	ADFG	$105.8
96166	Herring Natal Habitats	ADFG	$444.1
96170	Isotope Ratio Studies of Marine Mammals in Prince William Sound	Schell/UAF	$146.6
96175	Remote Video System Seabird Monitoring Project	DOI	$38.7
96176	Restoration of Essential Wetland Habitat at San Juan Bay on Montague Island	USFS	$67.5
96177A	Cutthroat Trout, Dolly Varden Char Habitat Restoration, Lake Elsner Area	USFS	$26.6
96177B	Cutthroat Trout, Dolly Varden Char Habitat Restoration, Port Fidalgo and Port Gravina Area	USFS	$31.6
96178	Second Growth Forest Habitat Enhancement for Injured Wildlife Species	USFS	$84.3
96179	Relationships Between Stream Habitat and Stream Classification Within Prince William Sound	USFS	$218.1
96180	Kenai Habitat Restoration & Recreation Enhancement Project	ADNR	$674.5
96186	Coded Wire Tag Recoveries From Pink Salmon in Prince William Sound	ADFG	$260.5
96188	Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon in Prince William Sound	ADFG	$95.2
96190	Construction of a Linkage Map for the Pink Salmon Genome	Allendorf/UM	$240.0

1996 DRAFT WORK PLAN -- LIST OF PROJECT PROPOSALS RECEIVED

PROJECT #	PROJECT TITLE	PROPOSER	COST FY 96
96191A	Oil-Related Embryo Mortalities in PWS Pink Salmon Populations	ADFG	$474
96191B	Injury to Salmon Eggs and Pre-emergent Fry Incubated in Oiled Gravel (Laboratory Study)	NOAA	$169.-
96193-BAA	Flux and Nutritional Quality of Particulate Organic Carbon: Relationship to Survival of Juvenile Pelagic Fish	Naidu/UAF	$156.6
96194	Pink Salmon Spawning Habitat Recovery	NOAA	$182.5
96195	Pristane Monitoring in Mussels and Predators of Juvenile Pink Salmon & Herring	NOAA	$112.7
96196	Genetic Structure of Prince William Sound Pink Salmon	ADFG	$178.5
96201	Port Lions Public Safety Building/Emergency Operations Center	Port Lions	$800.0
96202	Port Lions Community Hall	Port Lions	$150.0
96203	Port Lions Waste Oil/Garbage Collection System for Boat Harbor	Port Lions	$150.0
96204	Kodiak Subsistence Resource Restoration Planning	ADFG	$39.4
96205	Eyak Subsistence Recovery Camp Planning Project	Eyak Nat Vill	$40.8
96206	Old Harbor Lagoon (Midway Culvert) Salmon Enhancement Feasibility Study	Old Harbor	$28.8
96207	Ocean Beach Sockeye Enhancement Feasibility Study	Old Harbor City	$92.7
96208	Kempff Bay Sockeye Enhancement Feasibility Study	Akhiok City	$70.7
96210-BAA	Prince William Sound Youth Area Watch	Chugach RRC	$233.4
96211	Community-Based Harbor Seal Biological Sampling Program	ANHSC	$44
96212	PSP Shellfish Restoration Testing Program	Kodiak Tribal	$84.9
96213-BAA	Alaska Native Harbor Seal Commission	ANHSC	$99.2
96214	Documentary on Subsistence Harbor Seal Hunting in PWS	Tatitlek Village	$74.5
96218	Ouzinkie Clam Restoration Project	Ouzinkie Tribe	
96219	Ouzinkie Archeological Culture Center Project	Ouzinkie Tribe	
96220-BAA	Eastern PWS Wildstock Salmon Habitat Restoration	Eyak Nat Vill	$77.2
96222	Chenega Bay Salmon Restoration	Chenega IRA	$17.1
96225	Port Graham Pink Salmon Subsistence Project	Port Graham	$88.9
96226	Resurrection Bay Salmon Stock Enhancement	Qutekcak Tribe	$45.0
96244	Harbor Seal Cooperative Assistance	ANHSC	$70.0
96254	Delight and Desire Lakes Fertilization Project	Ck Inl Fish DC	$110.0
96255	Kenai River Sockeye Salmon Restoration	ADFG	$244.7
96256	Columbia Lake Sockeye Salmon Stocking	USFS	$40.6
96257	Solf Lake Sockeye Salmon Stocking	USFS	$34.3
96258A	Sockeye Salmon Overescapement Project	ADFG	$527.4
96258B	Sockeye Salmon Skilak Lake Enclosure Project	ADFG	$341
96258C	Kenai River Ecosystem Restoration: Starvation-Temperature Study	DOI	$57.-
96259	Restoration of Coghill Lake Sockeye Salmon	ADFG	$285.8

1996 DRAFT WORK PLAN -- LIST OF PROJECT PROPOSALS RECEIVED

PROJECT #	PROJECT TITLE	PROPOSER	COST FY 96
96272	Chenega Chinook Release Program	PWSAC	$42.1
96279	Resource Abnormalities Study	ADFG	$71.7
96290	Hydrocarbon Data Analysis, Interpretation, and Database Maintenance	NOAA	$119.8
96320	Sound Ecosystem Assessment (SEA)	Cooney, et al	$4,783.6
96320R	SEA Trophodynamic Modeling and Validation Through Remote Sensing	Eslinger/UAF	
96320Z1	Synthesis and Integration	Cooney/UAF	
96320Z2-BA	Sound Ecosystem Assessment (SEA): Coordination & Communications	PWSSC	
96427	Harlequin Duck Recovery Monitoring	ADFG	$261.1
96428	Subsistence Restoration Planning and Implementation	ADFG	$48.8

TOTAL COST FY 96 **$38,821.9**

NUMBER OF PROJECTS PROPOSED **128**

PROPOSAL 96001

SFOS 95-231

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

FROM: Institute of Marine Science
School of Fisheries and Ocean Sciences
P.O. Box 757220
University of Alaska Fairbanks
Fairbanks, AK 99775-7220

TITLE: Recovery of harbor seals from EVOS: Condition and health status.

PRINCIPAL INVESTIGATORS: Dr. Michael Castellini
Associate Professor

NEW/CONTINUING: Continuing

DURATION: 3 Years

PROPOSED START DATE: October 1, 1995 to September 30, 1998

AMOUNT REQUESTED: $418,200

Dr.Michael Castellini /Date
Principal Investigator
(907)474-6825

Joan Osterkamp /Date
Executive Officer
School of Fisheries and Ocean Sciences

A. V. Tyler /Date
Associate Dean
School of Fisheries and Ocean Sciences

Donald M. Schell /Date
Director
Institute of Marine Science

Ted DeLaca /Date
Director, Office of Arctic Research
University of Alaska Fairbanks

May, 1995

Recovery of harbor seals from EVOS: Condition and health status.

Project Number:	96001
Restoration Category:	Research
Proposer:	University of Alaska, Fairbanks
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	NONE
Expected Duration:	3 Years
Cost FY 96:	$187,400
Cost FY 97:	$184,600
Cost FY 98:	$ 46,200
Geographic Area:	Prince William Sound
Injured resource:	Harbor seals

ABSTRACT

This project focuses on the health of harbor seals, a marine mammal species that is not recovering in Prince William Sound (PWS). Personnel from the University of Alaska in cooperation with the Alaska Department of Fish and Game will work with harbor seals to assess their health, blcod and blubber chemistry and size in relation to their ecological and nutritional requirements. The project addresses potential health and nutritional problems that may be impeding harbor seal recovery.

INTRODUCTION

This proposal is a multi-year combination and extension of projects 95001 and 95117-BAA which were approved for funding in FY 1995. It deals with body condition and health indices of harbor seals (Phoca vitulina) in Prince William Sound in relation to their non-recovery status. The central hypothesis of the proposal is that given the poor population status of harbor seals in the impacted area, do the animals show signs of health, nutritional or body condition deterioration that could be contributing to their poor recovery?

The project is written with significant logistical and scientific collaboration from project /064 which deals with monitoring population levels, habitat use and trophic interactions of harbor seals. Project /064 provides access to the animals and a broad based ecological view relevant to harbor seals in this

geographic area. The goals of the combined collaborative projects are to investigate ecosystem wide questions addressing the recovery of harbor seals. These issues include the direct impact of oil spills, human interactions, food, competition, climatic factors, disease and habitat loss. The enclosed proposal deals with the issues of body condition and health status of harbor seals with the resulting data applying directly to issues of disease and food limitation. It specifically addresses the health and food limitation hypotheses as outline in the marine mammal section of the the FY 1996 Draft Restoration Program.

Project 95001 was approved to begin funding on January 1, 1995. It deals with body condition and blood chemistry indicators of nutritional problems, disease and growth for harbor seals inside and outside of PWS. This project works in critical collaboration with project 95064 and other non-Trustee Council funded programs. The University of Alaska provides personnel to take blood and blubber samples and to measure and weigh the seals. Blood and blubber samples are analyzed at UAF and models of body shape, blubber thickness and body condition are generated and tested. Appropriate control samples in time and space have always been a concern for this project. In an effort to control for this, we have set up identical sampling protocols in collaboration with ADF&G for working with harbor seals OUTSIDE of PWS. Thus, we have harbor seal data from southeast Alaska and from around Kodiak for control purposes. Since initiation of 95001 we have worked with harbor seals on the west coast of Kodiak and are preparing to receive samples from the Juneau area in late April and to work with 95064 in PWS in early May.

Project 95117-BAA was approved by the Trustees in October, but will not begin funding until May, 1995. This was a special project to examine blubber chemistry in harbor seals both inside and outside of PWS as noted above and to examine historical samples of blubber collected from before the *Exxon Valdez* (EVOS) event. The central hypothesis of this project is that since seals utilize fat and blubber as their primary energy source, then alterations in blubber chemistry should reflect nutritional problems in the seals. Because this project has not yet received funding, no work has been done to date.

Finally, it is critical to understand that our laboratory is involved in general determinations of seal and sea lion health in pinniped populations from around the world. We work on similar questions in regions far removed from PWS and on many different species in an effort to understand relationships between ecological health, nutrition and body condition of marine mammals. For UAF, the PWS/EVOS question is part of a broad study about adaptations of marine mammals to their ecosystem. We test theories on blood chemistry and body condition in marine mammals on a daily basis from a host of different species collected from a wide geographic area. These EVOS projects provide opportunities for us to test our comparative theories of marine mammal health and to provide the Trustee Council with the data they need for issues concerning recovery in PWS.

NEED FOR THE PROJECT

A. Statement of problem

Harbor seal (Phoca vitulina) populations in Alaska show evidence of decline over portions of their range. Prior to the EVOS event, population declines of 85% had been reported from Tugidak Island (Pitcher 1990), and declines may also have occurred in the eastern Bering Sea and Aleutian Islands

(Hoover-Miller 1994). Prince William Sound harbor seal populations, further impacted by EVOS (Frost and Lowry 1994a), have essentially stabilized at decreased levels, but have shown no signs of population recovery (Frost and Lowry 1994b). Trend-site counts in PWS indicated that declines occurred both in pup and non-pup portions of the population (Frost and Lowry 1994b). Assessment and interpretation of harbor seal body condition, blubber chemistry and nutritional status data can help resolve multiple hypotheses proposed to explain these declines, and to help focus future studies.

B. Rationale

Changes in ecosystems or in prey availability due to natural or anthropogenic causes can be reflected in the body condition or nutritional status of top trophic-level consumers, such as harbor seals. However, indices used to assess body condition may also vary with season, age, or sex (Pitcher 1986; Trites and Bigg 1992; Beck et al. 1993; Renouf et al. 1993) independent of foraging ability or prey availability. Therefore, normal ranges of body size, shape and blubber chemistry distribution must be quantified before useful inter-annual comparisons can be performed. Likewise, blood chemical and hematological parameters also change significantly in response to environmental or nutritional effects (Seal et al. 1975; Geraci et al. 1979; McConnell and Vaughan 1983; Kuiken 1985; Roletto 1993). Chemical profiles and complete blood counts can identify potential imbalances in organ systems or metabolic pathways if the effects of non-health related variation can be quantified (Payne and Payne 1987; Kerr 1989; Castellini et al. 1993).

C. Summary of major hypotheses and objectives

This proposal specifically addresses the Draft Restoration Plan hypotheses that harbor seals are not recovering in the EVOS impacted area due to nutritional and health related problems.
The working hypothesis is that either the EVOS-impacted seals are different in their health status compared to non-EVOS animals, or they are not. If the PWS harbor seals are compromised, then we will know some of the directions that should be followed towards potential restoration. If they are not compromised, then we can focus our attention into other areas that may better explain their current recovery status. The objectives are to assess health and body condition from animals inside and outside of the EVOS region and to examine historical samples to analyze potential differences over time.

D. Completion Date

This project is scheduled to finish field work by the fall of 1997 (FY 1997) with close out during 1998 (FY 1998).

COMMUNITY INVOLVEMENT

Results of this study will be presented at appropriate EVOS workshops, as well as at professional meetings such as the Biennial Conference on the Biology of Marine Mammals to be held in winters of 1995 and 1997. There are no sections of the project that would easily involve residents of the spill-area communities. The work is either at-sea collection of seals or laboratory and computer analysis of data.

FY 96 BUDGET

The costs noted below involve the unification of projects 95001 and 95117BAA on a continuing basis. Some costs are additive (such as supplies specific to each original project) and some are combined (such as travel to the EVOS workshops). Some projections involve switch-overs from 95001 beginning on a calendar year to 96001 beginning on the FY. University of Alaska Fairbanks indirect costs are calculated at 20%.

Personnel	116.0
Travel	4.8
Contractual	11.1
Commodities	24.3
Equipment	0.0
Subtotal	156.2
Indirect costs	31.2
Total	187.4

PROJECT DESIGN

A. Objectives

Given the combination of projects /001 and /117BAA in this continuing proposal, the objectives have been combined as follows:

1. Collect hematological data to establish reference ranges of blood chemistries and hematologies of harbor seals inside and outside of PWS and determine variation attributable to sampling technique, age, sex, or season and location of capture.

2. Estimate our ability to detect changes in body condition using morphometric measurements.

3. Assess body condition using morphometric measures of body shape, density and fat content, and determine the effects of age, sex, season and location.

4. Compare blood and morphological indices of health and condition in light of the above to examine interannual changes, potential EVOS-related impacts, and to help interpret changes in population status.

5. Obtain blubber samples from contemporary animals inside and outside of PWS for energy analysis and compare these findings with archived samples.

B. Methods

Seals will be captured during spring and fall of each year. Laboratory analyses and statistical analysis will be conducted throughout the remainder of the year.

Field Techniques. Harbor seals will be live-captured by net entanglement, in conjunction with EVOS Project Number \064, using methods previously described by Frost and Lowry (1994b). Once captured, seals will be transported to shore or ship, anaesthetized if required (using Ketamine and Diazapam), weighed with an electronic hanging scale, and morphometric measurements gathered. Blood will be drawn from the extradural vein into Vacutainer® blood collection tubes.

Body Condition. Linear and curvilinear length, a series of girths at 7 locations, and mass will be collected from each animal. Blubber depths at 2-3 sites at each girth ring will be measured using a portable ultrasound unit (Scanoprobe II, Model 7310, Scanco, Inc.). These measurements are quickly and easily carried out in the field. In the laboratory, the data will be fit into models of how length, girth and mass are related for harbor seals and will be used to evaluate body condition. Additionally, measurements of total body impedance (BIA) will be made opportunitsically by recording the resistance across two pairs of electrodes placed near the seal head and tail, allowing estimation of body fat. Condition indices will be compared using a database of morphometric measurements and corresponding body and sculp masses collected during 1972-1978 by Alaska Department of Fish and Game, and previously presented in Pitcher and Calkins (1979) and Pitcher (1986).

Hematology. Blood hematocrit (% red blood cells by volume) will be measured in the field using a portable centrifuge. Samples will be transported to the ship/lab and examined microscopically to determine red and white cell counts. Samples of whole blood will be pipetted into Drabkin's reagent for hemoglobin analysis. Subsamples of blood will be centrifuged to prepare plasma and plasma, serum and whole blood samples will be frozen in liquid nitrogen for later laboratory analyses. Plasma samples will be sent to a veterinary laboratory for assessment of "standard" health indices (such as cholesterol level, salts, and enzymes characteristic of tissue damage) and also analyzed at our lab for indicators of dehydration (water content), malnutrition (BUN, ketones), acute phase reactions (haptoglobin), hormone imbalance (angiotensin, ANP) and stress proteins (samples sent to collaborators at Stanford Research Institute). Standard panels that assay plasma sodium, potassium, chloride, phosphorous, creatinine, cholesterol, direct and total bilirubin, total protein, albumin, globulin, alkaline phosphatase, glucose, lactate dehydrogenase, gammaglobulin transferase (GGT), creatinine phosphokinase (CPK), aspartate aminotransferase (SGOT) and alanine aminotransferase (SGPT) will be performed by automated machine analysis at the Fairbanks Memorial Hospital (FMH) using an Ektachem Analyzer. Additionally, concentrations of free fatty acids (FFA), ketones (β-HBA), uric acid, iron, blood urea nitrogen (BUN) and hemoglobin will be determined using standard kits from Sigma Chemical Co. and performed in our laboratory. Complete blood counts of white and red blood cells, platelet and differential white blood cell counts will be performed by technicians at FMH from blood collected in EDTA vacutainers using a Coulter Model S-Plus-4 Counter, and from blood smears produced in the field.

It should be emphasized that the above methods are routine for the marine mammal group at UAF and that we conduct similar assays hundreds of times/year on seal and sea lion species from around the world. Thus, we have the expertise, the databases and the consistency to best analyze these samples from the PWS and non-EVOS animals. Statistical comparisons of hematological values, body condition and shape will be performed using PC-based software. The ultimate goal is to derive useful indices of condition and hematology, that when controlled for other sources of variation such as sex, age and season of capture, will enable interannual comparisons of nutritional and health

status.

Blubber chemistry. Additional testing of the food limitation hypothesis will be accomplished by comparison of blubber quality between archived, historical blubber samples collected during the mid-late 1970's, to blubber samples biopsied during current research projects inside and outside of PWS. The determinations described below completely quantify the energetic state of blubber in terms of its potential as a fuel source. Our hypothesis is that since blubber is a major component of the body tissues of seals (27-30% of body mass (Pitcher 1986)), contains 90% of the lipid fuel sources in seals (Beck et al. 1993), and lipid utilization makes up approximately 85% of the energy utilized by seals (Ryg et al. 1990), then changes in the lipid content, blubber density and energy content should reflect seasonal and interannual changes in body condition of the seals. It is known that the blubber content of an animal and the lipid content of blubber varies with season, age and sex (Pitcher 1986; Ryg et al. 1990; Beck et al. 1993). The archived historical blubber samples have complete data sets on animal condition associated with them, and these data are also collected for the contemporary animals.

Collection of historical samples. Alaska Department of Fish and Game has archived, frozen samples of harbor seal blubber collected well before the EVOS event that are available for this analysis. They have given us permission to utilize this collection if personnel from UAF can travel to Anchorage to transfer and collate the samples. About 250-300 samples are archived.

Collection of contemporary samples. Blubber samples will be acquired from live animals captured in conjunction with Project No. 95064 and other non-oil spill related projects. Blubber samples will be collected by tissue biopsy using standard techniques already being employed. In the field, biopsy samples will be placed in cryovials and frozen at -80 °C in liquid nitrogen dry-shippers for transport to the laboratory.

Analysis of blubber. Samples of blubber will be analyzed for quality and density of energy. Four specific tests will be conducted on each sample:

1. Density of blubber.
2. Total lipid content of blubber.
3. Hydration state of blubber.
4. Total energy content of blubber.

Blubber density will be determined by simple mass and volume measurements of blubber samples. Total lipid content of blubber is determined by organic extraction of lipids using a Soxhlet apparatus and standard extraction techniques. Blubber hydration state is determined by mass difference between wet and dry weights of samples dried in a drying oven. Finally, the total energy content of blubber is determined by bomb calorimetry of the sample to determine calories available. Historical specimens will be closely examined for signs of dehydration or oxidation (freezer-burn), and either subsampled from acceptable sites, or rejected. Because phocid blubber lipid content is homogenous both in location on the body and depth of sampling (Jangaard and Ke 1974; Beck et al. 1993), variability in sampling site should not confound analyses. One-way and multi-factorial analyses of variance will be performed to assess the affects of age, sex, season and year on these measures of blubber quality. Morphometric data available from the historical animals and from those sampled currently will enable calculation of total blubber energy stores for these same comparisons.

Potential analytical difficulties. Blubber samples store for long periods may be subject to deterioration and oxidation, depending on storage techniques and temperature. Dehydration would directly impact water content and density analysis, but should not alter the lipid analysis or bomb calorimetry since samples are freeze-dried for those procedures. However, interpretation back to a wet-weight basis would be problematic. Historical samples will be examined for sign of dehydration and subsamples taken as far away from the edges as technically feasible. Significantly dehydrated samples will be rejected. We will also use control samples of recently collected blubber from harbor seals and other species to determine wet-mass to dry-mass ratios, and compare these to values measured from archived samples to index hydration. If some of the samples are dehydrated, then lipid and energy content will be compared to recent samples on a dry-weight basis only. It is also possible that because phocid blubber is typically less than 3% water (Beck et al, 1993), minor dehydration will not significantly effect results.

Oxidation of samples during storage can alter lipids by reducing molecular chain length. This would prohibit fatty acid identification, and we are not attempting these assays. However, oxidation of lipid chains also reduces the energy content by a percentage of the chain length that has been lost. We will minimize this problem by utilizing close inspection and rejecting blubber samples that appear massively oxidized and from which we cannot sample in undamaged areas.

When project 95117 was originally reviewed, there was considerable discussion between the referees, the Chief Scientist and our laboratory about how to handle the sample deterioration problem. We consulted with lipid and tissue specialists around the country and the world and defined the protocol listed above. Unfortunately, the start date of 95117 occurs after this proposal was written and preliminary data are not yet available.

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C. Contracts and other agency assistance.

No contracts with other agencies are anticipated. Collaborative work with project \064 is critical to this project, but this is not on a contract basis. Bomb calorimetry of the blubber samples is on a per-sample basis to another lab at UAF.

D. Location.

Harbor seals will be captured from haul-out locations within PWS including sites which varied from non-oiled to heavily-oiled during the EVOS. Our laboratory also collects data from harbor seals outside of PWS for comparative purposes.

SCHEDULE

A. Measurable project tasks for FY 96

Generally, field work occurs in the spring and fall seasons with laboratory and statistical analysis occuring year round.

For FY 1996 and FY 1997:

October:	Analysis and statistical study of fall blood samples.
November:	Collection of archived blubber samples.
December:	Analysis of blubber water content.
January:	Winter EVOS workshop.
January:	Preparation of blubber samples for bomb calorimetry.
February:	Modeling of body morphometrics.
March:	First collection of field samples outside of PWS.
April:	Analysis and statistical study of blood samples.
April:	Second collection of field samples outside of PWS.
April:	Annual report.
May:	First collection of field samples inside PWS.
June:	Analysis of all blood samples.
June:	Summer EVOS workshop.
July:	Modeling of body morphometrics and blubber data.
August:	Modeling of body condition indices.
September:	Second collection of field samples inside PWS.
October:	Third collection of field samples outside PWS.

For FY 1998:

October:	Analysis and statistical of fall blood samples.
Nov - Dec:	Modeling of body condition.
January:	Winter EVOS workshop.
Feb-closing:	Publication preparation, final reports, presentations.

B. Project milestones and endpoints

Each project objective involving field work is an ongoing operation inside the time-frame of this proposal. However, the section dealing with collection of archived blubber samples should be finished by the end of FY 1996. Each field season is of a specific duration and has very controlled beginning and end points, but analysis of the data is continually updated with information on other species and other locations. Results of each field season will be presented in annual reports as noted

below.

C. Project reports

We assume that annual reports will be due each April, just before the major field season for work inside PWS commences. This should allow maximum time for determination of field work that started the year before. We will work with the chief scientist to determine if publications in peer-reviewed journals will act in the place of a separate report. We also assume that a final report will be submitted at the end of FY 1998.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As noted before in the body of the proposal, this project has a critical collaboration with project \064 and with other ADF&G projects outside of PWS. Without \064, we would not have access to seals and would not have the ecological based data necessary for successful interpretation of our results. The work by other ADF&G projects outside of PWS are also essential for our comparative work with harbor seals so that we can model changes in oiled vs non-oiled areas. Collaboration with ADF&G to obtain the archived blubber samples is also essential to the project.

We are currently finishing a National Science Foundation project looking at health indices of seals that utilizes many of the same analytical and statistical techniques as this proposal. This project should finish by December, 1995. We have also submitted a large Alaska Sea Grant proposal (to initiate February 1996) to look at the health status of harbor seals, Steller sea lions and ringed seals in Alaskan waters. We will be working in Alaskan waters with National Marine Fisheries Service support on Steller sea lions to examine health issues relative to the severe decline in this species. We will be collaborating with post-doctoral staff at the National Marine Mammal Laboratory on issues of blood chemsitry values in seals and sea lions.

As noted above, we are a comparative laboratory that has a broad interest in the physiology, bio-medicine and ecolological physiology of seals and sea lions. The opportunity to work with EVOS impacted animals expands our abilities to look at specific instances of pinniped health, nutritional and to provide the Trustee Council with the data they need for restoration purposes.

ENVIRONMENTAL COMPLIANCE

This issue has already been covered by the initiation of 95001 and the potential initiation of 95117.

PERSONNEL

Michael Castellini, Ph.D., specializes in metabolic chemistry problems associated with marine mammals. He is a tenured Associate Professor of Marine Science at UAF and has worked in this field for over 20 years.

J.M. Castellini, M.Sc., is a UAF Research Associate and has worked on marine mammal

biochemistry/physiology projects since 1986. She is currently the laboratory director and provides for daily project monitoring.

B.S. Fadely, M.Sc., a Ph.D. student involved in this project, has previously performed studies involving nutritional physiology of northern fur seals and California sea lions. Currently he has been involved in assessing the health status of harbor seals in the Gulf of Alaska using morphometric and hematological techniques.

T. Zenteno, M.Sc., is a Ph.D. student with a background in biochemistry and zoology. She will be performing all assays related to hormonal balance and haptoglobin levels.

Publications relevant to this proposal:

Castellini, M.A. and G.N. Somero. Buffering capacity of vertebrate muscle: Correlations with potentials for anaerobic function. Journal of Comparative Physiology. 143:191-198. 1981.

Castellini, M.A., G.N. Somero and G.L. Kooyman. Glycolytic enzymes activities in tissues of marine and terrestrial mammals. Physiological Zoology. 54(2):242-252. 1981.

Castellini, M.A., D.P. Costa and A.C. Huntley. Hematocrit variation during sleep apnea in elephant seal pups. American Journal of Physiology. 251: R429-R431. 1986.

Castellini, M.A., D.P. Costa and A.C. Huntley. Fatty acid metabolism in fasting elephant seal pups. Journal of Comparative Physiology B. 157(4):445-449. 1987.

Castellini, M.A., R.W. Davis and G.L. Kooyman. Blood chemistry regulation during repetitive diving in Weddell seals. Physiological Zoology. 61(5):379-386. 1988.

Castellini, M.A. and J.M. Castellini. Influence of hematocrit on whole blood glucose levels: new evidence from marine mammals. American Journal of Physiology . 256:R1220-R1224. 1989.

Castellini, M.A. and G.L. Kooyman. Length, girth, and mass relationships in Weddell seals (Leptonychotes weddellii). Marine Mammal Science. 6(1): 75-77. 1990.

Castellini, J.M., Castellini, M.A. and M.B. Kretzmann. Circulatory water balance in suckling and fasting northern elephant seal pups. Journal of Comparative Physiology B. 160(5):537-542. 1990.

Castellini, M.A. and D.P. Costa. Relationships between plasma ketones and fasting duration in neonatal elephant seals. American Journal of Physiology. 259:R1089-R1090. 1990.

Castellini, M.A., J.M. Castellini and V.L. Kirby. Blood glucose handling methods can compromise analytical results: Evidence from marine mammals. Journal of the American Veterinary Association. 201(1): 145-148. 1992.

Castellini, M.A., D.P. Costa and J.M. Castellini. Blood glucose distribution, brain size and diving in small odontocetes. Marine Mammal Science. 8(3): 294-298. 1992.

Castellini, M.A. and L.D. Rea. The biochemistry of natural fasting at its limits. Experientia. 48: 575-582. 1992.

Castellini, M. and D. Calkins. Mass estimates using body morphology in Steller sea lions. Marine Mammal Science. 9: 48-54. 1993.

Castellini, M.A., R.W. Davis, T.R. Loughlin and T.M. Williams. Blood chemistries and body condition of Steller sea lion pups at Marmot Island, Alaska. Marine Mammal Science. 2: 202-208. 1993.

Meeting presentations relevant to proposal:

Rea, L.D. and M.A. Castellini. Plasma fuel levels during prolonged fasting in elephant seal pups (Mirounga angustirostris). International Union of Biological Sciences. Third International Congress of Comparative Physiology and Biochemistry. 1991.

Rea, L.D. and M.A. Castellini. Assessing nutritional health status of Alaskan pinniped populations. Ninth Biennial Conference on the Biology of Marine Mammals. 1991.

Rea, L.D. and M.A. Castellini. Plasma metabolite levels during prolonged fasting in pinnipeds. FASEB Journal. 6(5): A1748. 1992.

Castellini, M.A. Physiological health status of Steller sea lions and other pinnipeds in Alaskan waters: program objectives. Tenth Biennial Conference on the Biology of Marine Mammals. 1993.

Davis, R.W., Brandon, E.A.A., Kanatous, S., Adams, T., Brandon, D.W., Williams, T.M., Castellini, M.A., Loughlin, T.R., Calkins, D.G. and J. Sease. Female reproductive effort and pup growth in Steller sea lions. Tenth Biennial Conference on the Biology of Marine Mammals. 1993.

Williams, T.M., Davis, R.W., Castellini, M.A., Loughlin, T.R., Calkins, D.G. and J. Sease. The relationship between body condition and thermoregulatory costs in Steller sea lion pups. Tenth Biennial Conference on the Biology of Marine Mammals. 1993.

Castellini, M.A., Zenteno-Savin, T. and L.K. Duffy. Haptoglobin concentration in plasma from Steller sea lions at Forrester Island and the Aleutian Islands, Alaska. Tenth Biennial Conference on the Biology of Marine Mammals. 1993.

Rea, L.D., Castellini, M.A. and R.L. Merrick. Body condition and metabolic chemistry of Steller sea lion pups in the Aleutian Islands and Gulf of Alaska. Tenth Biennial Conference on the Biology of Marine Mammals. 1993.

Fadely, B.J. and M.A. Castellini. Modelling effects of hydrodynamic constraints on the use of morphometric condition indices in pinnipeds. Physiologist. 37(5): A-52.

Rea, L.D. and M.A. Castellini. Weaning mass determines how stored fuels are utilized during prolonged fasting in elephant seal pups. Physiologist. 37(5): A-53.

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Phone: 907-344-0541

Date prepared

1996 EXXON VALDEZ TRU_ _ _E COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel	$0.0	$5.2						
Travel	$0.0	$0.0						
Contractual	$0.0	$194.5						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$0.0	$199.7						
General Administration	$0.0	$14.4						
Project Total	$0.0	$214.1	$192.3	$48.1				
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

This budget was revised on 7-19-1995 to incorporate revisions to the budget described in the letter from Molly McCammon to Michael Castellini. In his response, Dr. Castellini provided an explanation and justification for his budget and incorporating the newly negotiated 25% overhead rate. Please note that this budget has not officially gone through the University budget office for signature.

In addition, ADF&G program manager cost now meet the one month per project program manager charge.

8/25/95 Version

1996

Prepared:

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Agency: ADF&G

FORM 3A
AGENCY
PROJECT
DETAIL

7/19/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1996
							0.0
*	11-7064	Fishery Biologist III	18C	1.0	5,203		5.2
*	11-6110	Librarian II	17J		5,530		0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		1.0	10,733	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$5.2

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1996
						0.0
	None					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					**Travel Total**	$0.0

1996

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

7/19/95

1996 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Contractual Costs:		Proposed FFY 1996
Description		
Contract with non-trustee agency		194.5
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$194.5

Commodities Costs:		Proposed FFY 1996
Description		
None		
	Commodities Total	$0.0

1996

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Agency: ADF&G

FORM 3B
Contractual & Commodities DETAIL

7/19/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
None		

1996

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Agency: ADF&G

FORM 3B
Equipment
DETAIL

7/19/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996						
Personnel	$0.0	$116.0						
Travel	$0.0	$4.2						
Contractual	$0.0	$11.1						
Commodities	$0.0	$24.3						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$155.6	Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Indirect	$0.0	$38.9						
Project Total	$0.0	$194.5	$192.3	$48.1				
Full-time Equivalents (FTE)		5.9						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Indirect Costs: Indirect costs are calculated at the newly negotiated 25% rate of the TDC.

1996

Prepared:

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Name: Contractor

FORM 4A
Non-Trustee
DETAIL

7/19/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1996
M. Castellini	Principal Investigator		5.0	7,873		39.4
J. Castellini	Research Associate		12.0	2,490		29.9
B. Fadely	PhD Student		12.0	1,423		17.1
T. Zenteno-Savin	PhD Student		6.0	1,423		8.5
	Master's Student		6.0	1,271		7.6
						0.0
Student Aid	PhD Student- 2 semesters		12.0	450		5.4
Student Aid	PhD Student- 2 semesters		12.0	450		5.4
Student Aid	Master's Student- 1 semester		6.0	450		2.7
						0.0
						0.0
						0.0
	Subtotal		71.0	15,830	0	
					Personnel Total	$116.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1996
EVOS workshop summer 1995 - Principal Investigator- Fbks/Anch	128	1	3	187	0.7
EVOS workshop January 1995 - Principal Investigator- Fbks/Anch	128	1	4	121	0.6
EVOS workshop January 1995 - Student- Fbks/Anch	128	1	4	121	0.6
					0.0
Airfare for 3 students to and from the field - Fairbanks/Anchorage	416	3			1.2
					0.0
Marine Mammals Meeting in Orlando- Principal Investigator and one student			12	94	1.1
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$4.2

1996

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Name: Contractor

FORM 4B
Personnel
& Travel
DETAIL

7/12/95

1996 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed
Description	FFY 1996
Veterinary laboratory analysis for blood samples collected in PWS - 120 samples @ $30-$40 (depending on analysis)	4.1
Bomb calorimetry to analyze blubber samples 175 samples @ $20	3.5
Long distance phone charges	1.0
Postage (FedEx, DHL) of samples to the lab	0.4
Cargo shipping equipment to and from the field	2.1
Contractual Total	$11.1

Commodities Costs:	Proposed
Description	FFY 1996
Blood metabolites for chemical analysis of blood samples	8.1
Hormone assays for chemical analysis of blood samples	10.1
Organic solvents for lipid extraction of blubber samples	0.5
Freezer inventory supplies for storing and archiving blood and blubber samples	1.0
Laboratory expendables necessary for chemical analysis of blood and blubber samples	0.4
Computer supplies necessary for database management and analysis	3.1
Field gear- including foul weather gear, shipping crates, barrels	1.1
Commodities Total	$24.3

1996

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Name: Contractor

FORM 4B
Contractual & Commodities DETAIL

7/19/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description		Number of Units	Unit Price	Proposed FFY 1996
	None			0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.			**New Equipment Total**	$0.0

Existing Equipment Usage:		Number of Units	
	Description		
	None		

1996

Project Number: 96001
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Name: Contractor

FORM 4B
Equipment
DETAIL

Archaeological Index Site Monitoring, FY 96

Project Name:	96007A
Restoration Category:	Monitoring, continuation
Proposer:	Alaska Office of History and Archaeology, ADNR
Lead Trustee Agency:	Alaska Department of Natural Resources, ADNR
Cooperating Agencies:	U. S. Fish and Wildlife Service, DOI-FWS U. S. Forest Service, USFS
Duration:	Ten years, FY 94 - FY 2004
Cost FY 96:	$138,000
Cost FY 97:	$135,000
Cost FY 98:	$145,000
Cost FY 99:	$135,000
Cost FY 00:	$135,000
Cost FY 01:	$135,000
Cost FY 02:	$135,000
Cost FY 03:	$135,000
Cost FY 04:	$135,000
Geographic Area:	Prince William Sound, Kenai Peninsula, Kodiak Island
Injured Resource/Service:	Archaeological Resources

ABSTRACT

Monitoring of archaeological sites on public land injured by vandalism and oiling will concentrate on a sample of index sites in the three regions of the spill. Oiled sites will be tested for re-introduced oil. The ten year project will end at five years if monitoring shows no contimued injury.

INTRODUCTION

Damage to archaeological sites as a result of cleanup activities after the Exxon Valdez Oil Spill has been amply documented in damage assessment studies performed since the spill. Damage from vandals has continued to be documented at several sites on public lands during the past several seasons. Although other sites have not suffered damage, vandals are still active in the area and their level of activity needs to be monitored. Monitoring of damaged sites as a gauge of vandal activities in the spill area was identified as a primary strategy for site restoration during 1995 and is being continued to provide a long term assessment of the problem. A consensus was reached among agency archaeologists that the most efficient way to monitor vandalized sites would be to select "index" damaged sites to provide an indication of the level of vandal activity in the spill area.

A recommendation of the Trustee's archaeological peer reviewer during the January 1995 science workshop was to continue to monitor oiled sites on an intermittent basis. His concern was that subsurface oil would move into archaeological deposits and compromise possible data recovery.

Monitoring of archaeological sites injured by the spill or spill related activities will target a small number of sites on public lands which are determined to represent those that are most vulnerable to looting or oiling. Those index sites will serve as a gauge for levels of vandalism in the spill area. The index sites oiled during the early time immediately after the spill in March 1989 will be re-checked during 1996 and subsequent years to detect recent infiltration of subsurface oil from surrounding sediments. Sites in the Prince William Sound area include SEW-469 and SEW-077. Outer Kenai Peninsula sites are SEL-129 and SEL-025. Sites in the Kodiak Island archipelago include KOD-171, AFG-129, AFG-097, and AFG-046.
See attached site locations map.

NEED FOR THE PROJECT

A. Statement of Problem

Sites monitored under project 96007 are index archaeological sites thought to be representative of archaeological sites on the public lands in the spill area which have been oiled or are being vandalized. Some sites were oiled during the spill and are being monitored to check for recent movement of subsurface oil into site deposits.

Vandalism during cleanup appears to have been associated with people placed near sites while living on chartered boats. Circumstantial evidence indicates that some crew members, many

of whom were residents of coastal communities, were involved in looting of sites. Agency resource managers fear that looting associated with cleanup continued on and spread to other sites of the area.

Oil was found in beach sediments at several of the sites selected as index localities although none was initially documented in site deposits. A goal of this project is to monitor those sites to detect movement of the persistent oil into cultural deposits from the surrounding sediments.

B. Rationale

Loss of sites to vandals and pollution of sites from remaining oil removes the ability of archaeologists to recover data about the prehistory from those sites. The number of sites in the area is finite and will not increase. Reasonable efforts must be made to protect the cultural heritage data base from degradation. Sites in the area continue to be lost to erosion, making loss from this human degradation more critical.

Monitoring and testing for oil contamination is the most efficient way to gain knowledge about continuing data loss. Through knowledge gained over a period of observation, land managers can devise methods of saving the data or at least slowing the rate of loss.

C. Summary of Major Hypotheses and Objectives

The major objective of the index site monitoring project is to protect sites in the spill area from loss to looters and encroaching subsurface oil. The continuation of both processes has been well documented in earlier studies. The method of achieving that protection is to monitor a sample of known area sites so that management plans can be devised to insure protection of the remaining sites. Continued monitoring is thought to be the most cost effective way to identify critical developments and respond.

D. Completion Date

Monitoring oiled and vandalized years has been proposed to continue for a period of ten years, FY 95 through FY 2004. Funding during FY 95 for monitoring was provided to land managing agencies to begin the process. Funding during FY 96 will allow return to three sites visited during 1995 for continuous monitoring and visits to five other sites to be monitored on an intermittent basis. A report of annual activities is projected with a cumulative progress report proposed for FY 98. A final assessment report will be prepared after the ten year monitoring program ends in FY 2004. The project could be terminated at the progress report in FY 98 if injuries have diminished to an insignificant level.

COMMUNITY INVOLVEMENT

The sites identified for attention in this proposal are remote from most communities with the exception of the SEW-077 site near Chenega Bay Village. The Forest Service which has

proposed monitoring at that site will be coordinating with the Chenega people. Communication with other Native groups will include sharing information about findings. Communication with most community groups about the project will be minimal because of the sensitive nature of site locations.

FY 96 BUDGET

The project expenses proposed for FY 96 are only slightly below estimates for FY 95 and reflect visits to different sites and the decision by the National Park Service to delay returning to the McArthur Pass Site for a year.

Personnel	$76.5
Travel	24.4
Contractual	25.7
Commodities	6.5
Equipment	0.0
Subtotal	133.1
Gen. Admin.	13.4
Total	$146.5

PROJECT DESIGN

A. Objectives

The overall intent of the archaeological site monitoring program is to maintain a current assessment of the status of vandalized sites in the oil spill area and sites oiled during the spill. Continuing and current site status is required to protect the sites from degradation. The objectives of the FY 96 project are:

1. Monitor vandalized sites to identify continuing vandal activity in order to protect the sites. Information about index sites will be projected for management planning to the larger inventory of sites in the spill area.
2. Monitor sites contaminated by oil during the Exxon Valdez Oil Spill to identify any encroachment of subsurface oil into the cultural deposits from surrounding sediments.

The intent of the project at its conclusion is to have maintained a presence at the vandalized sites for a long enough period of time to gauge levels of vandalism and discourage that activity by our presence. The long range intent by FY 2004 is to reduce that activity to zero. Oiled sites will be considered restored when they have remained oil free for the life of the project. Oil in surrounding sediments will be considered stable or immobile by that time.

B. Methods

A strategy was identified during a 1994 restoration workshop of designating index sites vulnerable to looting which will be monitored on an annual basis. A second group of four sites were identified which are to be monitored biannually as a check over a broader area. The second group of sites may vary over time in order to maintain flexible response to new information such as fresh reports of vandalism or new findings on patterns of looting. The second group of sites provides a cross-check to monitoring data collected at the index sites. Focusing annual monitoring on 4 index sites and using a 2-year monitoring schedule on the additional 4 sites, expenditures will be significantly reduced while maintaining continuity of tracking levels of vandalism over the years. Vulnerability to looting will be the primary criteria of selection with managerial jurisdiction a secondary concern. Sites which were oiled will be monitored for oil so the behavior and effect of oiling can be observed over the long term in archaeological deposits.

Testing for presence of oil in site sediments will be done with the HNU-Hanby field test kit which can identify the presence of petroleum hydrocarbons and give an estimate of the relative concentration of the contaminants in the soil. Once the field tests show positive for oil, plans will be made to obtain funding so that the Auke Bay lab can send personnel to collect suitable samples for identifying the source of the oil and more accurately determine the amount present. This procedure was suggested by Auke Bay lab representatives at the 1995 workplan session so that suitable samples could be properly collected and processed.

Documentation of site status at the localities monitored for vandalism will include re-locating previously established reference points and referring all observations to those points. Field maps will be drawn or surveyed as appropriate. Photo and video documentation will be referenced to datum points and will duplicated earlier perspectives as closely as possible. Test localities will be mapped in reference to site reference points.

SEL-025 The historic cabin site near the head of the West Arm of Port Dick will be returned to in FY 96 to assess the current status of oiling and effect of bioremediation on the site. Beach deposits immediately adjacent to the cultural remains were treated during 1990 at which time DNR archaeologists thoroughly mapped the site.

SEL-129 The house depressions of the Gore Point Village Site were impacted by erosion of the vegetation cover through establishment of trails during cleanup activities. Trails were worn into the vegetation cover by workers traveling from the west beach at Gore Point to the east beach. The site will be visited by DNR during FY 96 to assess the current status of the site and see if the eroding depression walls have degraded further.

SEW-077 The Forest Service will monitor at the SEW-077 Site which was oiled during the Exxon Valdez Oil Spill. The beach sediments at the site will be tested with the HNU-Hanby Field Test Kit to measure for presence of subsurface oil. The Chenega Village Corporation will be contacted by the Forest Service to establish cooperation on the activities.

SEW-469 The SEW-469 Site will be returned to during FY 96 to be examined for any additional vandalism. The site is scheduled for monitoring during 1995 by U. S. Forest Service archaeologists. Human remains were disturbed by vandals during cleanup and were re-interred.

Perevalnie Passage Site, AFG-046 A return visit to this site will have two objectives. First, the site will be examined to detect whether vandal activity has continued or accelerated over past levels. To that end, a map detailing location of artifacts and bone exposed along with areas of disturbance will be taken into the field to compare with current findings. Photographic reference points will be re-established, and photographs comparable to 1993, 1994, and 1995 will be taken. A detailed map locating the erosional face will be made to detect rates of erosion and vandalism for future monitoring visits.

Second, a series of test excavations will be made in the intertidal area where the SUNY-Binghampton field team documented peat deposits. That will allow re-testing for subsurface oil to check for migration of the contaminant. The HNU-Hanby field test kit will be used to screen for the presence of petroleum hydrocarbons and provide some measure of concentrations. If petroleum hydrocarbons are present then the location will be recorded with reference to a permanent datum point. The location will then be re-visited during the next season to obtain proper samples to identify the source.

AFG-097 Reports have been received that this site has been vandalized and the damage should be monitored as part of the oil spill vandalism monitoring. The site has experienced significantly increased use since the Exxon Valdez Oil Spill. The site is very near the vandalized AFG-081 which is slated for monitoring in 1995. A quick field map will be prepared and reference points selected to measure developments.

AFG-129 The Ban Island Site was vandalized during presence of the cleanup fleet in the area during 1989. Exxon personnel recorded the injury and monitored the site for a brief period at that time. A map was prepared which documented the extent of injury. The site will be re-visited during FY 96 to monitor any recent vandal activity.

Chief Cove Site, KOD-171

The US Fish and Wildlife Service archaeologist will visit the Chief Cove Site to document the present condition of the site as a check for continued vandalism. The agency plans to contact local set net fishermen and other local residents with cabins on private lands nearby to try to educate them about the need for protecting the site. They plan to attempt recruiting the local people to watch the site for them as protection against site vandalism.

C. Contracts and Other Agency Assistance

No major contracts are anticipated in this project. The only contractual activity will be aircraft or boat charters on per hour basis and processing of radiocarbon samples and sediments at commercial labs. Other agency assistance will be in coordination of transportation and field housing by field personnel. Such coordination will be developed as

necessary when field activities allow.

D. Location

The sites will be located throughout the spill area. The sites in Prince William Sound are in the area around the north end of Knight Island and on Evans Island. The outer Kenai Peninsula sites are in the Port Dick area. In the Kodiak area, the sites to be investigated are on Shuyak Island, Afognak Island, and in the Spiridon Bay area.

SCHEDULE

A. Measurable Project Tasks for FY 96

Startup (October 1, 1995) - March 1, 1996	Complete requirements for final approval of project including any additional peer review, NEPA compliance (a categorical exclusion expected).
March 1 - June 1	Finalize arrangements for coordination with field people, obtain field supplies, schedule field trips.
June 1 - September 1	Conduct field visits to sites and preliminary reports of activities.
September 1 - October 1	Prepare annual report to Trustees.

B. Project Milestones and Endpoints

The first milestone to be reached in this project will be the visit to the sites identified for FY 96 visits. The second significant FY 96 milestone will be preparation of the agency field reports to be combined into the annual report. The final FY 96 milestone will be submittal of the FY 96 annual report to the Trustees.

Overall project milestones will be completion of annual reports, preparation of a mid-project report in 1998 and preparation of a final report for the 10 year project in FY 2004. The project could be terminated at the proposed mid-point if vandalism and oil damage have diminished to the point of insignificance.

C. Project Reports

Project reports for the FY 96 archaeological site monitoring project will be the annual report submitted at the end of the federal fiscal year, September 30, 1996. During the life of the report, a series of annual reports are proposed with a cumulative report to be submitted at the half way point in 1998. If the project continues beyond that date, annual reports will continue and a final compilation will be prepared in 2004.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The agency index site monitoring project will be coordinated with the proposed Site Stewardship program in the Kodiak and Outer Kenai Peninsula areas as possible. Travel for the projects will coincide on some occasions and can be combined. The monitoring effort in Prince William Sound will be coordinated with proposed project expected from the Native communities nearby. Duplication of effort will be avoided.

ENVIRONMENTAL COMPLIANCE, PERMITTING AND COORDINATION STATUS:

The U.S. Fish and Wildlife Service has agreed to file the necessary finding of a categorical exclusion for project 96007. No other permits are necessary as the agency archaeologists will be working on land managed by their agencies.

PERSONNEL

The personnel for Project 96007 are Judith E. Bittner, Project Manager, and Douglas R. Reger, Project Leader. Agency representatives are from the U.S. Forest Service, Linda Finn Yarborough, and from the U.S. Fish and Wildlife Service, Charles E. Diters. Professional resume's for those individuals are attached.

Douglas R. Reger

Douglas R. Reger, Project Leader
Office of History and Archaeology
Division of Parks and Outdoor Recreation
Alaska Department of Natural Resources
3601 "C" Street, Suite 1278
Anchorage, AK 99503-5921
(907) 762-2622
FAX (907)762-2628

Judith E. Bittner

Judith E. Bittner, Project Manager
State Historic Preservation Officer
Office of History and Archaeology
Division of Parks and Outdoor Recreation
Alaska Department of Natural Resources
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4/27/95

Date prepared

Douglas R. Reger
Archaeologist II
Office of History and Archaeology
Alaska Division of Parks and Outdoor Recreation
3601 C Street, Suite 1278
Anchorage, AK 99510-7001

1981 PhD.- Anthropology, Washington State University

PROFESSIONAL EXPERIENCE:

1964-65	Field and museum assistant, Univ. of Alaska, Fairbanks
1966	Field assistant, Alaska Methodist Univ.
1966-67	Laboratory/research assistant, Alaska Methodist Univ.
1969	Short field surveys, Cordova and Katmai, AK
1970	Field School instructor, Alaska Methodist U., Tangle Lakes
1970-71	Excavated site 49KEN-029, near Kenai, AK
1971	Salvage archaeologist, Alyeska Pipeline Project
1971-74	Teaching assistant, Washington State Univ.
1972	Assistant Highways archaeologist, Washington State Univ.
1973	Project Archaeologist, Homer Society for Natural History
1974-75	Regional archaeologist, USDA Forest Service, Alaska Region
1975-82	Alaska State archaeologist, Alaska Division of Parks
1978-82	Deputy State Historic Preservation Officer, Alaska
1982-86	Archaeologist, Alaska Division of Geological and Geophysical Surveys
1986-	Archaeologist, Alaska Division of Parks and Outdoor Recreation

PUBLICATIONS/REPORTS:

1972	*An archaeological survey in the Utopia area, Alaska,* **Anthropological Papers of the University of Alaska**, 15(2), with R.D. Reger
1974	*Prehistory of the northern Kenai Peninsula,* In **Prehistory of the North American Subarctic: the Athapaskan Question**, edited by J.W. Helmer, S. VanDyke, and F.J. Kense, Univ. of Calgary, p. 16-21
1977	*An Eskimo Site near Kenai, Alaska,* **Anthropological Papers of the University of Alaska**, 18(2): 37-52
1983	*Norton: a changing southeastern boundary,* **Arctic Anthropology** 19(2): 93-99, with Joan B. Townsend
1987	*Archaeology of a late prehistoric subsistence locality, the Clam Gulch Site (49KEN-045),* **Anthropological Papers of the University of Alaska** 21:89-103
1992	Effect of crude oil contamination on some archaeological sites in the Gulf of Alaska, 1991 investigations. Office of History and Archaeology Report No. 30. Alaska Division of Parks and Outdoor Recreation, with J. David McMahan and C. E. Holmes

Charles E. Diters
Regional Archaeologist/ Regional Historic Preservation Officer
Alaska Regional Office
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, AK 99503

1971	A.B. - Anthropology, Dartmouth College
1977	A.M. - Anthropology, Brown University

Field Experience

1970	Excavation, Healy Lake Village Site, University of Alaska
1970	Archaeological Survey, Alyeska Pipeline Project, University of Alaska
1971	Archaeological Survey, Aniginigurak and Mosquito Lake Sites, University of Alaska
1977	Archaeological Survey, National Petroleum Reserve, Alaska, National Park Service
1978	Archaeological Survey, National Petroleum Reserve, Alaska, National Park Service
1978	Excavation, Russian Bishop's House, Sitka National Historic Park, Alaska, National Park Service
1980-82	Archaeological survey and project clearances, Chugach National Forest, Alaska
1982-Present	Archaeological survey and project clearances, National Wildlife Refuges throughout Alaska

Other Appointments

1989	Alaska State Museum Collections Advisory Committee, Vice-Chair, 1989-91, Chair, 1991
1991-92	Board of Directors, Alaska Anthropological Association
1991	Iditarod National Historic Trail Advisory Committee

Professional Affiliations

Society for American Archaeology
Alaska Anthropological Association
Arctic Institute of North America

Linda Finn Yarborough
Archaeologist
Chugach National Forest
U.S.D.A. Forest Service
3301 C Street, Suite 300
Anchorage, AK 99503-3998

1973	B.A., Anthropology, State University of New York
1974	M.A., Anthropology, University of Toronto
Present	PhD. Program, Anthropology, University of Wisconsin, Madison

Field Experience

Archaeological survey, testing, and excavations throughout many regions of Alaska
Specialty interest areas: Pacific Rim prehistory, prehistory of Prince William Sound and southcentral Alaska, faunal analysis

Current Position

1992-Present	Assistant Forest Archaeologist and Cooperative Education Student, Chugach National Forest, Anchorage, Alaska

Publications / Reports

Numerous papers, reports, and articles. List available

Judith E. Bittner
State Historic Preservation Officer
Office of History and Archaeology
Department of Natural Resources
3601 C Street, Suite 1278
Anchorage, Alaska 99503-5921

University of Wisconsin, Madison: M.S, Anthropology, ABD, 1973
University of Arizona, Tucson: B.A. Anthropology, with Honors, 1969
George Washington University, Washington, D.C.: 1965-1967
Several management and supervisory training courses

WORK EXPERIENCE

1984 to present:	State Historic Preservation Officer and Section Chief of the Office of History and Archaeology, Division of Parks and Outdoor Recreation, Alaska Department of Natural Resources
1983 to 1984:	Historian, Division of Geological and Geophysical Surveys, Department of Natural Resources
1982 to 1983:	Director, Division of Parks, Department of Natural Resources
1974 to 1981	Instructor, part-time, Anchorage Community College and University of Alaska. Anthropology and Native American courses.
1976 to 1977	Consultant, Cultural Relations
1974 to 1982	Administrative Manager, part-time, Chamer Company, Inc., a general contracting firm.

COMMISSION MEMBERSHIP/PROFESSIONAL

National Conference of State Historic Preservation Officer
- Vice President, 1994 to present
- Treasurer, 1992 to 1994
- Board of Directors, 1990 to 1992
- Chair, Advisory Council on Historic Preservation Committee

National Trust for Historic Preservation
- Board of Advisors, 1989 to present
- Chair, Western Regional Advisors, 1991 to 1993
- Member, Trustee's Property Committee, 1991 to 1993
- Administrative Committee, 1991 to 1993

Iditarod National Historic Trail Advisory Council, Dept. of Interior
- Member, 1982-1983; 1985 to present

Historic Sites Advisory Committee
Chair, 1984 to 1993
Alaska Historical Commission
Ex-officio member, 1984 to present
Alaska Historic Records Advisory Board
Member, 1984 to present
Chair, 1993 to 1994
Alaska Association for Historic Preservation
Board of Directors, 1983 to present
Anchorage Historic Properties, Inc.
Board of Directors and Secretary, 1986 to 1991
Alaska Historical Society
Board of Directors, 1984 to 1987
Museums Alaska, Inc.,
Board of Directors, 1983 to 1986; Vice President, 1984 to 1986
Historic Anchorage, Inc.
Board of Directors and Treasurer, 1982 to 1985
Anchorage Historical and Fine Arts Commission
Commission member, 1981 to 1988

1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	PROPOSED FFY 1996 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
					$96.4	$28.9	$21.2	
Personnel	$68.2	$72.3						
Travel	$21.4	$24.4						
Contractual	$22.6	$25.7						
Commodities	$5.4	$6.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$117.6	$128.9	Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
General Administration	$11.8	$12.7						
Project Total	$129.4	$141.6	$135.0	$145.0	$135.0	$135.0	$135.0	$135.0
Full-time Equivalents (FTE)	0.9	1.1						
			Dollar amounts are shown in thousands of dollars.					
Other Resources	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Comments: Radiocarbon dating, sediment chemical analysis, and curation costs for all agencies are funded under the AK Dept. of Natural Resources budget for cost effectiveness.

8/25/95 Revision

1996

Prepared:

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Lead Agency: AK Dept. of Natural Resources

FORM 2A
PROJECT
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
	77.7							
Personnel	$50.0	$51.3						
Travel	$13.0	$12.1						
Contractual	$17.3	$19.4						
Commodities	$3.5	$4.5						
Equipment	$0.0	$0.0						
Subtotal	$83.8	$87.3	Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
General Administration	$8.7	$9.1						
Project Total	$92.5	$96.4	$90.0	$100.0	$90.0	$90.0	$90.0	$90.0
Full-time Equivalents (FTE)	0.7	0.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1996

Prepared:

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: AK Dept. of Natural Resources

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1996
*	Judith e. Bittner	Project Manager	21	1.0	7,100		7.1
	Douglas R. Reger	Archaeologist II	18	6.0	6,500		39.0
	J. David McMahan	Archaeologist I	16	1.0	5,200		5.2
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		8.0	18,800	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$51.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1996
	Travel to Kodiak to monitor archaeological sites.	386	4	28	115	4.8
	Travel to Homer to monitor archaeological sites.	180	6	38	115	5.5
	Travel to Fairbanks for collection curation.	416	2	8	115	1.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					**Travel Total**	$12.1

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: AK Dept. of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed FFY 1996
Description	
Air Charters (Kodiak area, 12 hours, Homer area 10 hours, @ $275/hour)	6.1
Curation costs, estimated.	5.0
Sediment Sediment chemical analysis (6 samples @ $500/sample)	3.0
Radiocarbon dating (5 samples @ $265/samples)	1.3
Film Processing	2.5
Report Duplication	1.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$19.4

Commodities Costs:	Proposed FFY 1996
Description	
Field Supplies	2.5
Office Supplies	2.0
Commodities Total	$4.5

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: AK Dept. of Natural Resources

FORM 3B
Contractual & Commodities DETAIL

1996 EXXON VALDEZ TRUS . _ _ COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: AK Dept. of Natural Resources

FORM 3B
Equipment
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel	$9.9	$9.0						
Travel	$5.9	$7.3						
Contractual	$5.3	$4.1						
Commodities	$1.9	$2.0						
Equipment	$0.0	$0.0						
Subtotal	$23.0	$22.4						
General Administration	$1.9	$1.6						
Project Total	$24.9	$24.0	$25.0	$25.0	$25.0	$25.0	$25.0	$25.0
Full-time Equivalents (FTE)	0.1	0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1996

Prepared:

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Agriculture, Forest Service

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1996
	Linda Yarborough	Archaeologist	11	2.0	4,513		9.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		2.0	4,513	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$9.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1996
	Travel to Cordova to monitor archaeological sites.	224	2	10	225	2.7
	Travel to Chenega Bay to monitor archaeological sites.	350	4	14	225	4.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					**Travel Total**	$7.3

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed FFY 1996
Description	
Air charters in Prince William Sound area (10 hours @ $275/hour)	2.8
Film processing.	0.5
Report processing.	0.8
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$4.1

Commodities Costs:	Proposed FFY 1996
Description	
Field Supplies	1.0
Office Supplies	1.0
Commodities Total	$2.0

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Contractual & Commodities DETAIL

1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Equipment
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$8.3	$12.0						
Travel	$2.5	$5.0						
Contractual	$0.0	$2.2						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$10.8	$19.2	Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
General Administration	$1.2	$2.0						
Project Total	$12.0	$21.2	$20.0	$20.0	$20.0	$20.0	$20.0	$20.0
Full-time Equivalents (FTE)	0.1	0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1996

Prepared:

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1996
	Charles E.Diters	Archaeologist	12	2.0	6,000		12.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		2.0	6,000	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$12.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1996
						0.0
	Travel to Kodiak to monitor sites.	386	6	12	225	5.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					**Travel Total**	$5.0

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed FFY 1996
Description	
Film processing	0.5
Air charters in Kodiak area (6 hours @ $275/hour)	1.7
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.2

Commodities Costs:	Proposed FFY 1996
Description	
Commodities Total	$0.0

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Contractual & Commodities DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96007
Project Title: Archaeological Index Site Monitoring
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Equipment
DETAIL

Site Specific Archaeological Restoration

Project Number:	96007B
Restoration Category:	Restoration management actions; archaeology
Proposer:	Chugach National Forest
Lead Trustee Agency:	USFS
Duration:	1 year
Cost FY 96:	$78,400
Cost FY 97 and future years:	none
Geographic area:	Prince William Sound
Injured Resource/Service:	Archaeological resources

ABSTRACT

Funding is requested for the final phase of the Forest Service's archaeological restoration at sites SEW-440 and SEW-488. Project 96007B, is a continuation of projects 95007B and 94007B. Analysis and interpretation of data gathered during previous field work will result in a peer reviewed final report, prepared and distributed according to Trustee Council procedures. This will complete the restoration process initially prescribed for these sites in 1991.

INTRODUCTION

The proposed phase is the final portion of restoration project previously funded as 94007B and 95007B Field work accomplishments during summer of 1994 include assessment of the damage documented in 1991 and commencement of the prescribed restoration measures. Restoration was not completed at SEW-488 due to reassignment of the work crew to an urgent Forest Service project towards the end of the field season. That restoration work is scheduled to be completed during the FY95 field season. The work proposed for FY 96 will complete the restoration project for these two sites. The final portion of the project consists of completing the analysis of various samples, interpretating the data collected, completing the final report through the peer review process, and publishing and distributing the final report.

NEED FOR THE PROJECT

A. Statement of Problem

Project 94007 provided for restoration of two archaeological sites damaged during the Exxon Valdez Oil Spill and its subsequent cleanup program. The restoration measures were recommended by a multi-agency panel of experts in archaeology of the region, chaired by Martin McAllister (1992). The project was designed to effect the proposed restoration measures for each of these two sites. These included a full field site damage assessment, and recovery, analysis, and curation of artifacts for both SEW-440 and SEW-488, with additional backfilling and surface stabilization at SEW-440. Both sites have been treated as being eligible for inclusion in the National Register (Mobley et al. 1990:230), although no formal determination of eligibility has been made for either site. In order to protect and preserve the remaining cultural deposits it is necessary to understand the nature of each site, and the extent to which the identified damage has compromised or destroyed information contained in the sites.

Injury to SEW-440 was described as severe oiling, an increase in erosion of the prehistoric midden component as a result of foot traffic and high pressure water treatment during the cleanup response, displacement of archaeological resources during geological testing, and an un-backfilled excavation in the horizontal surface of the site (Jesperson and Griffin 1992; McAllister 1992). Injury to SEW-488 consisted of oiling, and displacement of archaeological resources during high pressure water treatment and unmonitored cleanup activities (Jesperson and Griffin 1992; McAllister 1992). Erosion along three portions of the site was evident in 1991 (Dekin et al. 1993).

Field work undertaken at SEW-440 in 1994 virtually completed the prescribed restoration field work at the site. A sample taken for monitoring purposes on the southeast shore of SEW-440 in the intertidal zone indicated that fluid oil is still present under 20 to 30 cm of gravel. Despite careful observation, no un-backfilled excavation could be located in the horizontal surface of the site. Erosion is occurring along the pre-1964 beach, and could easily be exacerbated by foot traffic. However, it does not appear to be occurring currently at a high rate, and indeed, it appears that the eroding areas are experiencing natural revegetation. In general, this site seems to have undergone little further disturbance since the cleanup period. Final analysis of the data recovered during testing has not yet been completed, however no further field testing is anticipated during the FY 95 field season.

A beach sample taken for hydrocarbon analysis at SEW-488 showed no obvious evidence of oil in the intertidal zone at this site. However, erosion of the intertidal zone component continues at this time, and several prehistoric cultural items were recovered from the surface of the ITZ. There appears to have been no disturbance of the upland portion of the site beyond what may have occurred during cleanup activities, and during the course of testing for damage assessment. Testing for restoration purposes was not completed during the FY 94 field season and is scheduled for completion during the FY95 field season.

B. Rationale

Funding is sought at this time for the final analysis, interpretation, report writing, publication and distribution to complete this restoration project as originally proposed. The Secretary of the Interior's Standards and Guidelines for Archaeological Documentation are specific regarding the necessity for a written report to conclude the documentation process, the contents of the report, and its publication and distribution.

C. Summary of Major Hypotheses and Objectives

The major objectives of the project are to ameliorate and halt the deterioration and destruction of the sites to protect and preserve the remaining cultural deposits, and to gain scientific and cultural knowledge which will add significantly to the understanding of the prehistory of Prince William Sound. The results of the project include evaluation of the damaged sites for their inclusion on the National Register of Historic Places, and separate reports geared appropriately for professional archaeologists and for members of the general public.

D. Completion Date

The project will be completed during FY 96.

COMMUNITY INVOLVEMENT

No community involvement in the final report phase of the project is anticipated at this time. However, information which is not considered confidential in nature will be made available to the public as part of the final reporting process.

FY 96 Budget

Personnel	37.4
Travel	3.8
Contractual	29.2
Commodities	0.0
Equipment	0.0
Subtotal	70.7
Gen. Admin.	7.7
Total	78.4

PROJECT DESIGN

A. Objectives

Project 96007B, is a continuation of projects 95007B and 94007B. The project was designed with two main objectives:

1. Ameliorate and halt the deterioration and destruction of damaged archaeological sites SEW-440 and SEW-488, as prescribed in the McAllister assessment (1991).

2. Protect and preserve the remaining cultural deposits.

B. Methods

The methods used to address the objectives include field work and reporting on the results of the field work. The field work funded under 94007B and 95007B included a full field site damage assessment for each site. This assessment included documentation of the condition of each site through mapping and photography, documentation of the current status of injury, drawing profiles of stratigraphic exposures, and conducting scientific test excavations. This work is completed for SEW-440, and will be completed for SEW-488 during FY95. Site surface stabilization as necessary will be completed during FY95, including backfilling of archaeological tests. During FY 96, final analysis of the results of field work will take place, a final report will be written and published, and artifacts will be curated at a Federally approved facility for materials from National Register eligible sites.

C. Contracts and Other Agency Assistance

Specialized professional analysis of archaeological material will be obtained through contracting with private firms which provide such services. This includes analysis of tephra (air-born volcanic ash), pollen, radiocarbon samples, and bone. The printing and binding of the final report will also be contracted to a private firm.

D. Location

The field portion of this project has been and will be western Prince William Sound. Interpretation of results and report writing will take place in Anchorage.

SCHEDULE

A. Measurable Project Tasks for FY 96

October-December:	Analysis of field data and specialists reports
January:	Draft final report to Peer Reviewer and Chief Scientist for review
February:	Revision of final report and resubmission for review
March:	Submission of final report to Oil Spill Public Information Center (OSPIC) for review
April - May:	Modification of final report (if necessary), reproduction, and submission to OSPIC for distribution

B. Project Milestones and Endpoints

Objective 1, amelioration and stopping of the deterioration and destruction of damaged archaeological sites will be complete by the end of the FY95 field season. The portion of objective 2 which will be met by test excavations will also be completed at that time, as will part of the analysis. Special analysis reports are expected to be complete by the end of November, and the draft report is expected to be complete by the end of December 1995.

C. Project Reports

As indicated above, a draft final report will be submitted to the Peer Reviewer and the Chief Scientist for review in January 1996. Upon receipt of their comments, the report will be modified as necessary, and resubmitted, as necessary. The finished report will be submitted to the Oil Spill Information Center (OSPIC) in March for format review. After any necessary modifications, the report will be reproduced and bound according to Trustee Council procedures, and submitted to OSPIC for distribution.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Project 96007B is a continuation of projects 95007B and 94007B. The existing Forest Service heritage program does not dovetail with this project. The Forest archaeologists perform fieldwork and related analysis and report writing on a project funded basis.

ENVIRONMENTAL COMPLIANCE

A NEPA review was conducted for project 94007B, which resulted in a categorical exclusion (CE).

PERSONNEL

The personnel used for this project will meet the professional qualifications standards specified under the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation. See attached qualifications descriptions.

Project Leader:
Linda Finn Yarborough

Acting Forest Archaeologist
Chugach National Forest
3301 C Street, Suite 300
Anchorage, AK 99503-3998

Education:

1973	B.A., Anthropology, State University of New York at Binghamton
1974	M.A., Anthropology, University of Toronto
present	Ph.D. program, Anthropology, University of Wisconsin at Madison

Field Experience:
1974-present: Archaeological survey, testing and excavations throughout many regions of Alaska.

Specialty interest areas:
pacific Rim prehistory, prehistory of Prince William Sound and Southcentral Alaska, faunal analysis

Current Position:
Acting Forest Archaeologist and Cooperative Education Student, Chugach National Forest, Anchorage, Alaska

Publications/Reports
Numerous papers, reports, and articles. List available.

Linda Finn Yarborough, Project Leader
Acting Forest Archaeologist
Chugach National Forest
USDA Forest Service
3301 C St.
Anchorage, AK 99503-3998

Ray Thompson, Project Manager
Chugach National Forest
USDA Forest Service
3301 C St.
Anchorage, AK 99503-3998

Date Signed

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel	67.0	$37.7						
Travel	2.2	$3.8						
Contractual	32.0	$29.2						
Commodities	1.5	$0.0						
Equipment	1.0	$0.0						
Subtotal	103.7 ~~$0.0~~	$70.7						
General Administration	12.3	$7.7						
Project Total	116.0 ~~$0.0~~	$78.4						
Full-time Equivalents (FTE)		0.9						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
Previously funded under 94007 and 95007
Funding for FFY96 is for project completion, including report publication

1996

Prepared:

1 of 4

Project Number: 96007 - B
Project Title: Site Specific Archaeological Restoration
Agency: USFS

FORM 3A
AGENCY
PROJECT
DETAIL

5/1/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1996
	L. Yarborough	Principal Investigator (Archaeologist)	GS-11	2.8	4,513	0	12.6
	D.Vinson	Archaeological Assistant	GS-9	5.5	2,717	0	14.9
	K.Sarns	Graphic Artist	GS-11	1.0	4,320	0	4.3
*	R. Thompson	Program Manager*	GS-13	1.0	5,928		5.9
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		10.3	17,478	0	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$37.7

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1996
	Anchorage-Victoria, for analysis of archaeological specimens, 1 person	700	2	20	98	3.4
	Anchorage-Fairbanks, research and analysis of data, 1 person	128	1	5	55	0.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$3.8

1996

Project Number: 96007 - B
Project Title: Site Specific Archaeological Restoration
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

5/1/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:		Proposed
Description		FFY 1996
Tephra analysis	analysis of 4 samples @ $250 each	1.0
Pollen analysis	analysis of 50 samples @ 200 each	10.0
Bone analysis	6 samples @ $500 each, 20 samples @ $50 each	4.0
C14 analysis	50 samples @ $223 each	11.2
Publication costs, final report		3.0
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$29.2

Commodities Costs:	Proposed
Description	FFY 1996
Commodities Total	$0.0

1996

Project Number: 96007 - B
Project Title: Site Specific Archaeological Restoration
Agency: USFS

FORM 3B
Contractual & Commodities DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96007 - B
Project Title: Site Specific Archaeological Restoration
Agency: USFS

FORM 3B
Equipment
DETAIL

5/1/95

96009-D BAA

RESEARCH PROPOSAL

TO: BAA #50ABNF500082
NOAA, WASC Procurement Division
Attn: WC33
7600 Sand Point Way NE, Bin C15700
Seattle, WA 98115-6349

and

EVOS Trustees Council, Restoration Office
645 G Street, Anchorage Alaska 99501
(907) 276-8012, -7176 facsimile

FROM: Prince William Sound Science Center (Science Center)
P.O. Box 705, Cordova, Alaska 99574
(907) 424-5800, -5820 facsimile

TITLE: Survey of octopuses in intertidal habitats

PRINCIPAL INVESTIGATOR:

Dr. David Scheel
Prince William Sound Science Center

NEW OR CONTINUING: Continuing

PROPOSED STARTING DATE: October 1, 1995

PROPOSED DURATION: Two years

AMOUNT REQUESTED: FY96 - Total $135 K
FY96 - Total $40 K

D A Scheel 24 April '95
David Scheel Date
Principal Investigator
(907) 424-5800

Gary Thomas 24 April '95
G.L. Thomas Date
President, PWS Science Center
(907) 424-5800

Survey of octopuses in intertidal habitats. Submitted under the BAA #50ABNF500082

Project Number:	96009-D BAA
Restoration category:	Research
Lead Trustee Agency:	NOAA
Cooperating Agencies:	Prince William Sound Science Center
Duration:	Three (Beginning in FY95)
Cost FY96:	$135,000
Cost FY97:	$40,000
Cost FY98:	$0
Cost FY99:	$0
Cost FY00:	$0
Cost FY01:	$0
Cost FY02:	$0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Subsistence resources, intertidal & subtidal organisms, octopus

ABSTRACT

This project addresses concerns that octopus and chiton have been depleted by EVOS and that subsistence uses are impaired. The first year (FY95) is to establish the feasibility of working on octopus in the Sound, identify suitable study sites, and evaluate techniques. The second year (FY96) will focus on the vertical distribution of octopus in the nearshore where they are harvested. Close-out costs are requested in the third year (FY97).

INTRODUCTION

The proposal requests funding for a second year of field work to survey octopus and chiton in nearshore habitats. Work completed during the first year (FY95) should provide an evaluation of survey techniques, identify suitable study sites through initial surveys and use of local knowledge, and establish the feasibility of working with octopus in Prince William Sound. The second year of field work is necessary to provide useful data about the dynamics of nearshore populations about which very little is known. The design of the second year survey is left flexible to allow follow-up on findings from the first year.

NEED FOR THE PROJECT

A. Statement of problem

Nearly 90% of the residents of Tatitlek, Chenega Bay, and Cordova used marine invertebrate subsistence resources prior to the *Exxon Valdez* oil spill (EVOS. Seitz, unpublished MS; data on individual species were not presented). Surveys and interviews in Tatitlek and Chenega Bay conducted during the 1980s prior to EVOS indicate that between 50 and 90% of households use octopus as a subsistence resource, while 25 - 50% used gumboot or bidarki chiton. Use of octopus was greater in Tatitlek, where over 1600 lbs of octopus (approximately two octopus per person in the village) were reported harvested in the 1988-89 survey. However, use of chiton appeared larger in Chenega Bay (53% of households vs. approximately 25% in Tatitlek used chiton, Stratton & Chisum 1986, Stratton 1990). A similar survey in Cordova indicated that 1-5% of households use octopus or chiton. Most octopus in Cordova were harvested in conjunction with other subsistence or commercial fisheries, i.e. crab or shrimp pots (Stratton 1989). Harvest is not particularly restricted in season. Chenega Bay harvested chiton primarily from February through April and octopus occasionally from February through August while Tatitlek harvested both these resources in all months of the year (Stratton & Chisom 1986, Stratton 1990).

Octopus and chiton are included as injured, non-recovering species under the general headings of Subtidal Organisms and Intertidal Organisms. Subsistence use of these resources in Prince William Sound has resulted in the knowledge that these species have declined in apparent abundance. Reduced octopus availability comprises a part of the decline in subsistence services. The extent, severity, and cause of octopus and chiton declines are unknown. It is not known if changes in the abundance of these animals will adversely affect the recovery of other injured resources (e.g. sea otters, harbor seals, intertidal organisms). Without information of this type, the course of recovery cannot be predicted, nor can these resources be managed effectively.

B. Rationale

Restoration goals for subsistence services include healthy populations of subsistence resources, subsistence harvest of those resources, as well as involvement of subsistence users in the Trustee

Council's restoration process. This project will provide information regarding the current health of octopus and chiton populations. The project will provide opportunities for the involvement of subsistence users in determining study areas and conducting sampling during minus tides in the intertidal. Information on the results of the research will be provided to Chenega Bay and Tatitlek through community visits by the principal investigator or by other suitable means.

This project will provide an estimate of the availability of octopus in nearshore habitats, the variability of octopus density both between years and among sites, and the status of the octopus population as measured by indicators such as the size distribution of octopus, the frequency of injuries and the turnover rates in different habitats, and the characteristics of occupied habitats and dens in Prince William Sound. The first year of the study (FY95) is focused on establishing the feasibility of the techniques and identifying suitable study sites. Hence, a second year of field work is necessary in order to provide useful data. This is particularly true for data on interannual variability in density, and for relating turnover and injury rates to habitat types or characteristics.

C. Summary of Major Hypotheses and Objectives

The primary objective is to provide information on the status of octopus as a subsistence resource to subsistence users and resource managers. Study design is targeted on octopus, but data will be collected on chiton as opportunity permits. Data will be collected to address whether continued exposure to oil or predation are impacting octopus populations. The status of octopus in Prince William Sound is unknown. Their biology is poorly understood. There is little doubt that octopus were affected by the *Exxon Valdez* oil spill. This study is to collect information on how to approach the restoration or management of this important subsistance resource.

Objectives for the project are to 1) estimate of the density of octopus in nearshore habitats and the variability of octopus density between years and among sites; 2) provide an indication of status of the octopus population as measured by the size and sex distribution of octopus, the frequency of injuries and the turnover rates in different habitats, and the characteristics of occupied habitats and dens in Prince William Sound; 3) collect incidental data on chiton during octopus surveys; and 4) convey results of the project to subsistence users on an annual basis.

D. Completion date

The project will be completed when the final report is finished in April 1997.

COMMUNITY INVOLVEMENT

This proposal is a direct result of public input received via the EVOS Trustee Research Priorities workshop (April 1994) and conversations about subsistence use of the nearshore with Jody Seitz, Martha Vlasoff, and Tatitlek residents. The project is designed to solicit and support

collaboration with subsistence users and area fisherman to sample sites with a historical harvest of octopus. We will provide opportunity for subsistence users to contribute to decisions about study design and sampling location. We welcome further public input, and anticipate opportunities to talk with members of the public at EVOS-sponsored workshops and community visits in Tatitlek and Chenega Bay.

FY96 BUDGET

Personnel	46.4
Travel	7.5
Contractual	55.1
Commodities	2.7
Equipment	0
Subtotal	112.2
Indirect costs	22.4
PWSSC total	134.0

PROJECT DESIGN

A. Objectives

1. Regularly survey intertidal beaches historically harvested for subsistence use to determine the density of octopus and chiton above the water line at minus tides, and estimate injury and turnover rates;

2. At selected subtidal survey sites, use SCUBA to search subtidal areas judged to be good microhabitat. In these areas, record 1) the local density of octopus, 2) the age and sex distribution of octopus; 3) the number of brooding female octopus, 4) the species composition of feeding litter, and 5) injury and turnover rates;

3. Identify features of substrate, flora, and fauna typical of areas where octopus are captured. As far as possible using existing data, estimate the extent and location of good nearshore octopus habitat in Prince William Sound;

4. Report survey results to subsistence users in Tatitlek and Chenega Bay on an annual basis.

B. Methods

Each of the possible methods for surveying octopus has limitations. For this reasons, a survey combining several techniques seems likely to yield the most complete information. We will utilize the results from the initial field surveys (FY95) to select the most suitable sampling techniques. The largest changes anticipated from last year are that the results of the first field season will be used to select one or two promising survey sites. Focusing on fewer sites will then allow repeated sampling at a site. Repeated sampling and the use of tags to mark octopus will allow the estimation of turnover rates. Regular surveys of beaches utilized by octopus will be conducted during minus tides, similar to the design for FY95.

Analysis of the SCUBA data will provide estimates of octopus densities in the microhabitats searched. We will use existing sources of underwater habitat data (e.g. ADF&G herring spawn deposition dives, Coastal habitat project) to indicate the regional abundance of habitat features associated with the presence of octopus.

1. Intertidal surveys - Techniques used to survey intertidal dens in FY95 will be used again in FY96. Local knowledge of subsistence harvesters is used to identify historically harvested sites and candidate sites judged likely to be good octopus habitat. At each site, we will look for octopus and chiton during beach walks conducted during minus tides. Areas will be searched by looking in likely octopus dens (e.g. crannies along the ocean side of big boulders) and searching for octopus sign (e.g. feeding litter).

2. SCUBA surveys - Nearshore shallow subtidal areas at each site will be surveyed using SCUBA dives. Pairs of divers will search using method similar to those described for intertidal surveys. We will record the extent and defining characteristics of each patch of habitat searched

intensively. If long-line pots sampling proved useful in FY95, we will employ this technique again this year. When the bottom is not too deep, divers will survey the pot lines to record the habitat type in which each pot landed. Lair-pots will not be deployed if, in the opinion of the fishermen, dive survey sites are not suitable for pot fishing (e.g. too rocky).

For each octopus found on both intertidal and SCUBA surveys, we will record location, species, size, sex, den characteristics, whether eggs are present, and whether the octopus has been tagged. Octopus will be tagged the first time that they are captured, except that octopus brooding eggs will not be captured or handled. If feeding litter is present, we will sample this to identify prey. The substrate and characteristics of the den location will be recorded. While surveys are designed to find octopus, we will also collect data on the abundance of chiton, particularly when surveying intertidal habitats. For each chiton located, we will record location, species, size and substrate type.

Discussion of survey techniques: Three methods were considered for use in this survey. Lair pots were initially considered as a means of surveying using trap-grid methodologies. However, in Alaska, SCUBA sampling modeled after methods generally used for behavior observation and hand capture of octopus in the subtidal may be more effective. Finally, at minus tides, beach surveys were considered as an indication of the availability of octopus to intertidal harvesters, a technique used for subsistence harvest. Octopus are cryptic and mobile marine predators, and as such are difficult to survey accurately. Each of these three techniques has advantages and shortcomings.

Trapping grids are a common method of surveying small cryptic animals. Traps are usually baited to attract the animal, and the survey's reliability depends on the trap results providing an unbiased sample of the population (Seber 1982). As described above, the octopus' need for shelter supports a fishery using unbaited lair pots. A survey based on lair-pots is particularly attractive in this study because there is some evidence that artificial den placement may also provide a means to locally enhance octopus density under certain circumstances (see above). However, experiments with pot fisheries for octopus in Alaska have revealed that per-pot capture rates can be exceedingly low (Paust 1988), and that pot success is extremely variable depending upon the age of the octopus (Hartwick 1983), the distribution of food, and the availability of natural dens (Paust 1988). For these reasons, a pot-based survey of nearshore octopus may not be the best technique available.

SCUBA survey methods include fixed-width transect survey and area-search survey. Transect surveys provide greater statistical validity, precise estimates of the area surveyed and a careful, regulated sampling of the environment. While they are successful in enumerating abundant, stationary, and visible organisms (e.g. herring spawn, sea cucumbers) transect surveys are less successful when animals are scarce, mobile and cryptic. The linear miles of transect surveys necessary to locate and count reasonable numbers of octopus in Prince William Sound would likely be unmanageably large.

Area-search surveys focus intensively on the best microhabitats to find the target organism. As only prime microhabitats are searched, a greater area can be surveyed and the chances of locating organisms that occur at low densities are increased. Such surveys are non-random with respect to habitat type. Their design prevents precise calculations of the area surveyed and counts are not provided for sub-optimal habitats. However, area-search surveys are ideal for determining the peak local abundance of an animal.

Area-search SCUBA surveys may sample octopus at about the rate of lair-pot lines with less than 100 pots. SCUBA surveys on Titlow beach (Puget Sound) involving a thorough search of the study area by multiple divers (research dive classes) yielded on average less than eight octopus found per survey (unpublished data in Kyte 1994). Of 96 octopus tagged and released in the same study, only 11.5% were recaptured. In another study (Kyte 1979), divers on the Edmunds artificial reef (Puget Sound) located 50 individuals over 75 dives (<1 per survey). In both cases, a given individual may have been repeatedly captured. These results may be compared to lair-pot capture rates. At pot occupancy rates of 12-18% reported for Alaska (Paust 1988), from 50-66 lair-pots would be required to catch the same number of octopus per site as were found by divers in Kyte 1994. No comparison of these techniques at the same time, location and depth has been made however.

Surveying at minus-tides above the water line may be modeled after either transect or area-search methods. Foot surveys follow the methods of traditional subsistence harvest and hence reveal that portion of the population available for subsistence use by this method. While these areas might also be sampled at high tides during the dive surveys, this would not indicate to what extent the octopus remain in these areas as the tides retreat.

Lair-pot trapping grid, SCUBA surveys using area searches, and intertidal foot surveys were all incorporated into the sampling design for the first field season, providing both a comparison of methods, and a broad sampling base should some methods be unsuitable. Some of these techniques may be discarded in FY96 if they prove unsuitable. In the second field season, repeated visits are planned to each study site. The number and location of sites will be determined by the results of the FY95 field work. However, repeated visits allow the use of tagging to estimate turnover rates.

Octopus can be marked either by injecting a dye under the skin or by attaching a small tag through the web between the arms. In either case, the marks are expected to last about 30 to 90 days. We will use tags rather than dye-marking. Tags will be marked or positioned to differentiate octopus from different capture sights. If possible, tags will be unique to identify individuals. Tagging studies of octopus have been very successful in Japanese waters where a commercial fishery for octopus is available to assist with tag recovery. Tagging studies have also been successful in indicating turnover rates when repeated site visits can be made.

We will recover tags by re-visiting sites anywhere from a few days to three months after tagging. In addition, although few recoveries are expected, we will encourage area fishermen and subsistence harvesters to watch for and return tags on animals they harvest.

3. Octopus habitat - For each octopus located on dive and intertidal surveys, a description of the habitat will be recorded including substrate type, slope, nearby vegetation or prominent invertebrate patches (e.g. mussel beds), and depth. The dive surveys will result only in an estimate of octopus density in areas judged *a priori* to be good habitat, as only these areas are to be searched intensively. *A priori* definitions of good habitat will be developed from results of the first survey, expert consultation and descriptions available in the literature. These *a priori* indicators and characteristics of areas where octopus were located will be used to develop a description of the habitat sampled during dives. If available, existing data will then be used to estimate the regional abundance of this habitat.

To be suitable, data on habitat distribution must provide information on substrate and other bottom characteristics, be of similar scale to dive surveys, contain descriptors relevant to octopus distribution, be collected in an unbiased manner, and already be computerized. We are currently looking for existing data that meets these criteria. Candidates include data from ADF&G herring spawn deposition dives, the Coastal habitat project and from shoreline sensitivity indices. Analysis will also include reference to sea otter densities (J. Bodkin, NBS, has provided preliminary aerial survey data).

4. Community visits at the end of FY95 and FY96 will be used to report results to Chenega Bay and Tatitlek. Community visits and the involvement of subsistence harvesters are an important part of this project, so that reports to these communities can be accomplished with little additional cost.

References:

Hartwick, E. B., P. A. Breen, and L. Tulloch. 1978. A removal experiment with Octopus dofleini (Wulker). J. Fish. Res. Board Can. 35:1492-1495.

Kyte, M. A. 1979. A summary report of a field study of Puget Sound Octopus dofleini martini. Presented 28 April 1979 to the Pacific Estuarine Research Society, Port Angeles, Washington.

Kyte, M.A. 1994. A study plan to determine the importance of the Titlow Beach area in the Tacoma Narrows to the Puget Sound octopus *Octopus dofleini martini*. Unpublished proposal.

Paust, B. C. 1988. Alaska Sea Grant Report, 88-3: Fishing for octopus. A guide for commercial fisherman. University of Alaska Fairbanks, Fairbanks, AK.

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters, 2nd ed. Charles Griffin & Co. Ltd.: London.

Stratton, L. 1989. Resource uses in Cordova, a coastal community of Southcentral Alaska. No. 153. Alaska Department of Fish & Game, Division of Subsistence, Technical Paper Series.

Stratton, L. 1990. Resource harvest and use in Tatitlek, Alaska. No. 181. Alaska Department of Fish & Game, Division of Subsistence, Technical Paper Series.

Stratton, L., E. B. Chisum. 1986. Resource use patterns in Chenega, Western Prince William Sound: Chenega in the 1960s and Chenega Bay 1984-1986. No. 139. Alaska Department of Fish & Game, Division of Subsistence, Technical Paper Series.

C. Contracts and other Agency Assistance

Funds are allocated for charter of a vessel to support survey dives, beach access and possibly pot surveys. This vessel will likely be a privately-owned fishing or research vessel from a community in the EVOS-impacted area. A smaller vessel may also be needed for a short period of time to conduct preliminary beach surveys. A contract to conduct monthly low-tide beach surveys at historical harvest sites is also needed. It is anticipated that a subsistence harvester from a community located near each of the survey sites would contract for this work. Vessel and survey contracts will be awarded to the most suitable bidders responding to advertisement.

Equipment rental and services may also be needed to support short term use of small equipment in the field. In particular, we anticipate renting dive equipment and a field computer, as well as contracting for diver training and equipment repair and maintenance. Rental of dive equipment will likely be through R. Trani, Cordova Water Sports, who is providing negotiated rates in support of this project and is the only provider of such equipment in Cordova. Contracts will be awarded as needed to local businesses or individuals who can provide the necessary equipment or service at a reasonable rate.

Expertise of R. Highsmith (UAF) will be administered via contract between UAF and the Science Center. Dr. Highsmith will provide direction and consultation based on his experience with nearshore invertebrate communities. The contract budgeted for Dr. Highsmith is for this consultation and to assist with data interpretation on completion of the survey and related analyses. Travel funds are budget for travel between Cordova and Fairbanks.

D. Location

Prince William Sound.

SCHEDULE

A. Measurable Project Tasks for FY96

Start up to six weeks: Advertise and award contract for regular surveys of intertidal harvest sites, and vessel charters.

At three months: Train contractor for intertidal surveys in data collection standards, begin monthly intertidal surveys at minus tides. Report results of FY95 to subsistence users in Tatitlek and Chenega Bay. Conduct first field cruise including SCUBA and intertidal survey. Tag all octopus captured.

At six months: Conduct second field cruise including SCUBA and intertidal survey. Recover tagged octopus and tag octopus captured for the first time.

At nine months: Conduct third field cruise including SCUBA and intertidal survey. Recover tagged octopus and tag octopus captured for the first time.

At twelve months: Conduct last field cruise including SCUBA and intertidal survey. Recover tagged octopus.

Dates for SCUBA surveys would be scheduled depending on start-up date, dates of minus tides and weather. If project start-up was in October as currently planned, surveys would likely be scheduled for December or January, April, July, and August or September. Coordinating SCUBA surveys with minus tides allows intertidal surveys to be conducted at the same time.
Conduct SCUBA survey 3.

B. Project Milestones and Endpoints

FY95: Design surveys; conduct initial survey at several sites across Prince William Sound. Identify most suitable sites for continued work in FY96 and report on size and sex distributions of octopus, descriptions of typical den sites, and typical prey, difference among sites surveyed in 1995. Compare sampling techniques.

FY96: Conduct repeated surveys at selected sites; conduct tag-and-release studies; monitor harvest sites near Tatitlek and Chenega Bay through monthly intertidal surveys; assess variability in octopus density between sites and between the two years. Make community visits to Tatitlek and Chenega Bay to discuss results of first year.

FY97: Complete analyses; present data on octopus turnover rates in typical habitat; and assess evidence for and against the hypotheses that octopus are impacted by continuing exposure to oil or by high levels of predation. Write final report, and make results of project available to residents of Tatitlek and Chenega Bay through community visits or educational video.

C. Project Reports

By April 15th of each year, an annual report will be submitted on the milestones reached in the previous funding year. The FY95 report will discuss initial survey results (including size and sex distributions of octopus, descriptions of typical den sites, and typical prey), difference among sites surveyed in 1995, and will compare techniques used. The FY95 report will also identify the most promising sites for the field work in 1996. The FY96 report will discuss the variability in octopus density between sites and between the two years; present data on octopus turnover rates in typical habitat; and assess evidence for and against the hypotheses that octopus are impacted by continuing exposure to oil or by high levels of predation.

provide a completed inventory and present an analysis of search per unit effort. The FY97 report will present the analysis of long-term behavioral changes and an analysis of dietary overlap based on behavioral data. The FY98 report will provide the analyses of prey availability and estimates of predation rates on killer whales.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project, based at the Science Center will make every effort to share logistics, personnel and study sites with other restoration research, particularly projects with a base in Cordova (e.g. SEA research).

Air and boat transportation necessary to get researchers to remote locations in Prince William Sound will be shared with other restoration projects having similar needs. Cost sharing for transportation to and from field sites will likely occur with SEA projects and possibly with subsistence community outreach projects and has already been accounted for in the proposed budget.

Several of the analyses proposed in this project will rely on data collected under the restoration effort, including habitat data from ADF&G herring spawn deposition dives, the Coastal habitat project and from shoreline sensitivity indices. Analysis will also include use of sea otter density data (J. Bodkin, NBS).

ENVIRONMENTAL COMPLIANCE

The FY96 portion of this project is expected to qualify for a NEPA categorical exclusion. A categorical exclusion has been obtained through the USFS for field work in FY95.

PERSONNEL

David Scheel: Principle Investigator. See attached C.V. for qualifications.

David Scheel, Principal Investigator
Prince William Sound Science Center
Box 705, Cordova AK 99574
(907) 424-5800; fax (907) 424-5820
dls@grizzly.pwssc.gen.ak.us

Project Manager

Prepared: April 24, 1995

David Scheel
P.O. Box 2113
Cordova, Alaska 99574
(907) 424-7437 (home), -5800 (office), -5820 (fax)

Education

B.S. 1984, Renesselaer Polytechnic Institute; Troy, N.Y.
M.S. 1986, University of Minnesota, Minneapolis, M.N.
Ph.D. 1992, University of Minnesota, Minneapolis, M.N.

Professional Experience

1995 to present - University of Alaska Fairbanks, Institute of Marine Science
(Affiliate Assistant Professor)
1993 to present - Prince William Sound Science Center
(Associate Scientist)
1984 to 1994 - University of Minnesota
(Graduate Student, Post-doctoral Associate, Consultant)
1992-1993 - University of Houston
(Post-doctoral Associate)
1985 to 1992 - Serengeti Wildlife Research Institute
(Visiting Scientist and Research Scientist)

Grants and Academic Honors

1994-95 - Co-author, Editor, Co-PI, Sound Ecosystem Assessment,
EVOS Trustees Fund (about $4,500,000/year)
1984, 1985, 1989 - Graduate School Fellowship, University of Minnesota
1985, 1986 - Dayton Natural History Fellowship,
Bell Museum of Natural History
1984 cum laude graduate, Renesselaer Polytechnic Institute

Related or similar activities

Involved with the Sound Ecosystem Assessment (SEA) research plan for Prince William Sound since September 1993 and contributed to research design and planning. Project PI for one SEA project in 1994 and one in 1995. Project co-PI in FY95 for EVOS Trustee Council restoration research projects on killer whales (95012) and octopus (95009-D).

1996 EXXON VALDEZ TRUSTE)UNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002
Personnel	$0.0	$46.4						
Travel	$0.0	$7.5						
Contractual	$118.1	$55.1						
Commodities	$0.0	$2.7						
Equipment	$0.0	$0.0						
Subtotal	$118.1	$111.7						
Indirect	$6.9	$22.3						
Project Total	$125.0	$134.0	$40.9	No estimate	No estimate	No estimate	No estimate	No estimate
Full-time Equivalents (FTE)	0.7	7.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$20.0							

Comments:
In FY95, approximately $20,000 of in-kind donations have been arranged from Cordova Water Sports and Pentec Environmental. In-kind support includes donations and cost sharing on diver training, equipment cost sharing, and volunteer labor. In addition the FY95 field work has been greatly facilitated by the residents of Tatitlek and Chenega Bay who have shared their knowledge of octopus fishing and of the Sound.

Costs shown for FY95 are for PNW Research, Dept. of Agriculture, USFS. Costs shown for FY96 are for the PWS Science Center, and include costs of consulting with University of Alaska Fairbanks (R. Highsmith). Agency administration costs for FY96-97 are not shown.

1996

Prepared:

Project Number: 96009-D
Project Title: Survey of octopus in intertidal habitats
Name: David Scheel, Prince William Sound Science Center

FORM 4A
Non-Trustee
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FFY 1996
	D. Scheel	Principal Investigator	2.0	6,835		13.7
	TBN	Project biologist	5.0	5,200		26.0
	TBN	Divers	0.8	8,400		6.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	7.8	20,435	0	
					Personnel Total	$46.4

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FFY 1996
	Cordova-PWS	380	8	0	115	3.0
	Cordova-Fairbanks	456	1	4	150	1.1
	Cordova-Anchorage	224	2	8	170	1.8
	RT to National conference	1,000	1	4	150	1.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$7.5

1996

Project Number: 96009-D
Project Title: Survey of octopus in intertidal habitats
Name: David Scheel, Prince William Sound Science Center

FORM 4B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:			Proposed
Description			FFY 1996
SCUBA training & safety			0.3
vessel charter, dive surveys	20 days at	$1,200	24.0
dive gear rental			2.0
driver propulsion vehicle			1.0
computer support			1.0
UAF, Ray Highsmith			12.0
Intertidal den monitoring	24 days at	$328	7.9
vessel charter, early beach survey	4 days at	$700	2.8
financial audit			1.0
telephone, fax, e-mail			0.8
postage, shipping, etc			0.8
copying, etc			0.7
report printing, publication costs			1.0
		Contractual Total	$55.1

Commodities Costs:	Proposed
Description	FFY 1996
foul weather & safety gear	0.4
office & computer supplies	0.5
tagging supplies	1.3
field supplies	0.5
Commodities Total	$2.7

1996

Project Number: 96009-D
Project Title: Survey of octopus in intertidal habitats
Name: David Scheel, Prince William Sound Science Center

FORM 4B
Contractual & Commodities DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	
Diving equipment is being provided under a cost-sharing agreement between Cordova Water Sports and the Science Center. Equipment is leased to the project by Cordova Water Sports.		

1996

Project Number: 96009-D
Project Title: Survey of octopus in intertidal habitats
Name: David Scheel, Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

CI

COMPREHENSIVE KILLER WHALE INVESTIGATION IN PRINCE WILLIAM SOUND, ALASKA (Submitted under BAA 52ABNF500082)

Project Number: 96012A

Restoration Category: Monitoring, Research

Proposer: North Gulf Oceanic Society

Duration: 3 years

Cost FY 96: 167.5

Cost FY 97: 151.0

Cost FY 98: 85.0

Geographic Area: Prince William Sound, Alaska

Injured Resource/Service: Killer Whales, Harbor Seals

ABSTRACT

This project continues the monitoring of the damaged AB pod and other Prince William Sound killer whales that has occurred on a yearly basis since 1984. It develops a GIS database on killer whales that when coupled with genetic and acoustic data will help evaluate recovery, recognize changes in behavior and estimate killer whale impact on harbor seals.

INTRODUCTION

This project is a continuation of the comprehensive killer whale investigation initiated in 1995 in Prince William Sound. Killer whales were monitored under EVOS Trustee Council funding in 1989, 1990, and 1991 (damage assessment) and in 1993 (restoration monitoring) will be monitored in 1995 as part of the comprehensive killer whale study.

A total of 14 whales were lost from resident AB pod in the two years following the Exxon Valdez oil spill and there was no recruitment into the pod during those years. On March 31, 1989 AB pod was observed in oil sheens and six pod members were missing. Since that time the social structure within the AB pod has shown signs of deterioration. Maternal groups have traveled independently, and pod members have not consistently traveled with closest relatives. Although 4 calves were recruited during the period 1992-1994, there were 5 probable mortalities in 1994 (to be

confirmed in 1995 monitoring). The rate of mortality observed in this pod after the oil spill far exceeds that recorded for other resident pods observed in Prince William Sound over the past 11 years or for 19 pods in British Columbia over the past 20 years.

Nine whales from the transient AT1 group have not been observed since 1989. However transient killer whale social structure is not fully understood and we cannot be completely certain that these whales are dead, although we suspect them to be (to be examined statistically in FY 95). In FY95 a comprehensive monitoring and reporting will occur, in following years (FY96-FY98) a reduced cost yearly monitoring is proposed with a comprehensive report in FY98. Recommendations for further monitoring will be considered. A catalogue of individual killer whales will be produced in FY 97.

Additionally, in FY95 as part of the comprehensive killer whale investigation (95012), eleven years of systematic data collected under public and private funding are being placed in a specially designed GIS system at the Prince William Sound Science Center. This data base will allow examination of feeding habits and other behaviors of killer whales before and after the Exxon Valdez Oil Spill and relate them to geographic area. One important product of this project will be to assess the impact of killer whale predation on non-recovering harbor seals in Prince William Sound. FY96 funding will permit the completion of the data input and its continued analysis. Continued analysis of long term behavioral changes and predation patterns will occur in FY97 and FY98. The products of this study will be consolidated with models developed for harbor seals (96064).

Additional observation and collection of killer whale prey remains will occur in FY95, FY96, with a reduced effort in FY97. Results will be incorporated into the GIS database and included in the final report (FY98). Biopsy tissue sampling for genetic analysis and lipid, fatty acid and isotope analyais will be conducted concurrently.

Two forms of killer whale, resident and transient have been described in the eastern North Pacific. Observations indicate that only the transient form consumes marine mammals. It is important that this distinction between residents and transients in Prince William Sound is verified in order to assess the impact of killer whale predation on harbor seals. Genetic analysis that will clarify segregation of killer whale types will be concluded in FY96.

There is very limited sighting information for killer whales during the November thru March period. With the assistance of the village of Chenega, a remote hydrophone in Montague Strait will be monitored on a year round basis. This will provide comparative data on the presence, identity, and duration of stay of killer whales in southwestern Prince William Sound at all times of year.

NEED FOR THE PROJECT

A. Statement of Problem

The AB pod of killer whales was injured by the EVOS. Although it had shown signs of recovery from 1991 to 1993, that recovery is now in doubt. The ATl group of transient killer whales also appears to have declined since 1989. This project will monitor the recovery/non-recovery of AB pod and investigate possible cause recent changes within the pod. In addition, the long term significance of the apparent reduction in the ATl transient group will be assessed.

Predation by killer whales may be a significant factor in the non-recovery of harbor seals, another damaged resource. Harbor seals have continued to decline since 1989 in Prince William Sound (16-20% reduction from 1989-1994). The analysis of historical data, continued observations and sampling of killer whale prey items, biopsy sampling and genetic analysis, and acoustic studies will assess the impact of killer whale predation on harbor seals.

B. Rationale

Yearly killer whale population monitoring will determine whether recovery of AB pod has occurred and will determine the status of the ATl transient group. The actual status of AB pod after 1994 is unclear (whether recovering or non-recovering) and will only be clarified by continued monitoring. A low level annual monitoring program is proposed. All pods/whales are not observed in every year, annual monitoring will prevent extensive data gaps and allow certain determination of recruitment mortalities in a much shorter time frame. Additionally, an annual eleven year killer whale identification database now exists. Continuation of this approach will provide consistency in analysis and interpretation. Because killer whales are a long-lived species with low reproductive and mortality rates, this monitoring must be long term to be meaningful.

Killer whale predation is a possible contributing cause of the non-recovery of the spill damaged population of harbor seals. The proposed analytical approach will directly assess this possibility using historical data as well as continued observations of killer whale behavior and feeding habits. Determining the proportion of the killer whale diet that consists of harbor seals, the number of killer whales that eat harbor seals, and the whales residency in the Sound will be important components of this assessment and address restoration of harbor seals.

C. Summary of Major Hypotheses and Objectives

The study will address the following hypotheses:

Is AB pod continuing to recover from the Exxon Valdez Oil spill? Are restoration objectives reasonable?

Is there sufficient evidence to indicate that the AT1 whales missing since 1989 are likely to be dead?

What is the rate of predation by killer whales on harbor seals and has it changed since the EVOS?

Are transient killer whales (such as the AT1 group) and resident killer whales (such as AB pod) segregated and do they have separate diets. How does this impact harbor seals?

Do killer whales use southwest Prince William Sound in winter and if so which pods and to what extent? How does this impact harbor seals?

Is predation by killer whales sufficient to prevent recovery of the damaged harbor seal population?

D. Completion Date

The photographic monitoring,input of historic data, analysis of killer whale impact on harbor seals, biopsy sampling and analyses and acoustic monitoring will begin in FY95 and continue through FY97. The final report for all aspects of the project will be prepared in FY98. After FY98, continued monitoring of AB pod and the AT1 group may be recommended if restoration is not evident.

COMMUNITY INVOLVEMENT

There is great public concern and interest for killer whales in Prince William Sound. We will involve tourboat and recreational operators and residents by exchanging sighting information on a daily basis and providing a catalogue of individual whales to enhance enjoyment of whale observation. With our supervision, the residents of Chenega and students at the Chenega school will become directly involved in the killer whale project by monitoring and maintaining a remote hydrophone system and participating in the data analysis. Chenega residents will be contracted to maintain the system.

FY 96 BUDGET

Personnel	38.5
Travel	7.7
Contractual	101.1
Commodities	9.3
Equipment	0
Subtotal	156.6
Indirect Costs	10.9
Total	167.5

PROJECT DESIGN

A. Objectives

1. Determine the recovery status of the AB pod of resident killer whales. Examine the demographics of this pod and other resident killer whale pods. Review and possibly redefine measurements used to determine recovery status of killer whales.

2. Assess the possibility that permanent changes in the AT1 transient group of killer whales (ie. emigration or death) have occurred since 1989.

3. Estimate the extent of segregation of killer whale populations (resident and transient) in Prince William Sound based on genetic analysis and behavioral data.

4. Provide blubber samples for lipid/fatty acid and isotope analysis (to National Marine Mammal Laboratory in FY95)

5. Complete the entry of historical data relative to feeding, habitat use, behavior and distribution of killer whales into a computerized GIS format; and enter each additional years data as it becomes available from field work.

6. Examine spatial and temporal aspects of killer whale predation (particularly on harbor seals)in Prince William Sound.

7. Numerically estimate the impact of killer whale predation on harbor seals in light of the non-recovery of harbor seals since the EVOS.

8. Assess the year round residency of killer whales (by pod) using a remote hydrophone system monitored at Chenega Community School.

9. Update and publish a catalogue of individual killer whales used by researchers, tour boat operators, recreational boaters and others to identify whales.

B. Methods

Killer Whale Monitoring

The goal of this aspect of the study is the photoidentification of each individual in each pod/group, that regularly uses the Sound, particularly AB pod and the

AT1 group. Currently killer whales are considered recovered when AB pod is restored to 36 individuals. Because this may be a narrow and unrealistic restoration objective, the FY95 report (currently funded) will present alternative definitions of recovery which would change the methods for determining restoration status of killer whales. Knowledg of the demographics of all regularly sighted pods and groups may be necessary to meet new recovery definitions.

Thus, it is important that researchers maximize the time actually spent with killer whales (particularly AB pod) to insure thorough identification of all individuals. Methods proposed to obtain photographic data necessary to meet monitoring objectives will be similar to those used by the North Gulf Oceanic Society in Prince William Sound for the past eleven consecutive years. Searches for whales will not be made on random transects, but based on current and historical sighting information. In addition whales will be located by listening for killer whale calls with a directional hydrophone (calls can be heard up to 10 miles away), or by responding to VHF radio calls from other vessels reporting sightings of whales. We have developed network of cooperating vessel owners that regularly report whale sightings. In addition requests for recent killer whale sightings will be made routinely on hailing Channel 16 VHF.

A vessel log and chart of the vessel track will kept for each day the research vessels operate. The elapsed time and distance traveled will be recorded and vessel track plotted. Record will be made of the time and location of all whale sightings and the weather and sea state noted at regular intervals (see attached data sheets).

Specifics of each encounter with killer whales will be recorded. Data recorded will include date, time, duration, and location of the encounter. Rolls of film exposed and the estimated number of whales photographed will also be recorded. A chart of the whales' trackline during the encounter will be completed and the distance traveled by the vessel with the whales will be calculated. General behavior of the whales (i.e. feeding, resting, traveling, socializing, milling) will be recorded by time and location.

Photographs for individual identification will be taken of the port side of each whale showing details of the dorsal fin and white saddle patch. Photographs will be taken at no less than 1/1000 sec using Ilford HP5, a high speed black and white film, exposed at 1600 ASA. A Nikon 8008 autofocus camera with internal motor drive and a 300 mm f4.5 autofocus lens was used. When whales are encountered, researchers will systematically move from one subgroup (or individual) to the next keeping track of the whales photographed. If possible, individual whales will be photographed several times during each encounter to insure an adequate identification photograph. Whales will be followed until all whales are photographed or until weather and/or darkness makes photography impractical.

accounting of changes in AB pod and the calculation of recruitment rates and mortality rates for AB pod and the other major resident pods, providing that all pods are completely photographed. Changes within AB pod will be examined with consideration for the age and sex structure of the pod and maternal groups within the pod. Changes in the demographics of the ATl transient group will be assessed. Pertinent statistical assessments will be made every third year. Frame by frame input of identification data from exposed film into VAX computer system will occur annually. Copies of identification data as well as field data sheets will be made available to the EVOS Trustee Council annually.

Killer Whale Predation

A primary task in this study of killer whale predation is the entry of historical data into the GIS system at the Prince William Sound Science Center. This requires the design of a database (to be completed in FY95) and access to data collected by NGOS and NMFS. The available data has not been completely inventoried. However, it is estimated that NGOS records from 1983 to 1994 contain about 560 encounters recorded (360 post spill) encompassing 1700-3500 hours of whale observation during 9000-18,000 hours of field effort (including data collected during NMFS/NGOS damage assessment from 1989-1991). NGOS has agreed to provide access to their data under a 1995 amendment to an existing Memorandum of Understanding between NGOS and the PWSSC. The available data, database design and the initial data entry efforts are described in detail in the response to NOAA's RFP for the FY95 portion of the work.

The results of a literature review completed during FY95 will be used to determine the most useful method of calculating search effort. Prior to the literature review, it is premature to detail the methods of reconstructing search effort. Currently we intend to model this analysis after the grid-based geographic analysis of killer whale ecology of Heimlich-Boran (1988 Can.J. Zool. 66:565), as this study was conducted in a similar manner on the same species. A geographic grid can be laid over the killer whale study area using Arc/Info GENERATE or GRID routines. Once this grid is created, the amount of time and distance traveled by each research vessel in each grid cell can be tabulated. Killer whale encounters or time spent with the whales can be tabulated in a similar manner. For each cell, it will then be possible to calculate a measure of sightings per unit effort. This method currently appears suitable, but we expect to refine these calculations based on the review of the literature. Search effort will be calculated on a least an annual basis for each year. Where appropriate, effort may be tabulated by season or month.

Analyses will be designed to address questions regarding long-term changes in whale behavior, and the relationship between such changes and the 1989 oil spill.

All photographic negatives will be examined under a Wild M5 stereomicroscope at 9.6 power. Identifiable individuals in each frame will be recorded. When identifications are not certain, they will not be included in the analysis. Unusual wounds or other injuries will be noted. Photographic negatives will be analyzed using a photographic database that spans eleven years. Identities of each whale that appears in every frame of usable film will be recorded and stored in VAX computer system. Final analysis and assessment will follow Matkin et al. (1994) in Marine Mammals and the Exxon Valdez (T.L. Loughlin editor).

A substantial photographic database was collected from 1992, 1993 and 1994 by NGOS with private money. These photographs have not been completely analyzed. As part of the FY95 project, these photographic negatives will also be examined frame by frame and the whale identities computerized. This data will be important in the overall assessment of population dynamics within pods and within the population. The monitoring program and comprehenive report in FY95 (detailed in the response to NOAA RFP) will lay the groundwork for the continuation of monitoring proposed for FY96-FY98.

The primary vessel used to secure identification photographs will be a 27' deisel inboard/outboard powered vessel that can sleep two individuals (Whale 2). With sleeping accommodations and large fuel capacity, the Whale 2 will return to camp or to Chenega Village (fuel storage) infrequently which greatly increases available time searching for or photographing whales. Although this vessel will primarily collect photoidentification data, it will collect feeding habit observations and samples and biopsy samples for the predation studies. The operator of this vessel, Eva Saulitis, has eight years experience in the Sound conducting photoidentification of killer whales and humpback whales and collecting food habit data. This vessel will operate a total of 50 days, from early July through late August. From historical data these dates are judged to be to be the most likely time to encounter AB pod as well as many of the other resident pods that use the Sound. Photographic data will also be collected from the 43' R.V. Lucky Star and its associated skiff (32 days in the field) when it does not interfere with the primary goal of this vessel of providing feeding habit observations and samples of prey remains and biopsy samples for predation studies. The R.V.Lucky Star will also deliver fuel to designated locations and provide other logistical support for the operation of the R.V. Whale2.

Annual reports (FY96,FY97) for the monitoring segment will include a summary of field effort, and summary of the pods and individuals encountered and a status report on AB pod and the AT1 group. Comprehensive reports made every third year (FY95,FY98) also will include a detailed

For example, it has been suggested that transient whales have become more difficult to locate following the oil spill. Measures of whale behavior and distribution will be examined by comparing sightings per unit effort and behavior frequencies in pre-and post-spill periods. This will be accomplished first by calculating sightings per unit effort for each year of the data base. Comparison between years in each time period (pre- and post-spill) will be sued to indicate whether any group of whales have become more difficult to locate within the study area and whether the change corresponds to the time of the spill. Similar calculations will indicate whether feeding or other behaviors have changed in frequency or moved in location over the years. For example, the grid-based analysis used for calculating search effort can be repeated on occurrences of each behavior category in each cell. As appropriate and allowed by sample sizes, these can be split by pod type, pod ID, or month and year of sampling. Parametric or non-parametric statistics will be used to evaluate the evidence for the hypothesized changes in behavior.

Previous analyses of this data as well as results from other studies indicate that resident and transient killer whales have minimal dietary overlap. An analysis of observations of transients feeding (E.L. Saulitis, 1993, M.S. thesis, University of Alaska,Fairbanks) found very little indication of fish in the transient diet. A comparable tabulation of observation time and feeding habits of resident whales has not been published from this data. We will tabulate the number, duration, and location of feeding behaviors for all records in the data base and examine the results for evidence of dietary overlap between the two types.

Hypotheses will be formulated and evaluated regarding possible causes for the patterns documented. This may involve use of data on the distribution of prey that is available from other research projects. Possible candidate data sets on prey availability include the SEA program data base, expected to include detailed data on the seasonal distribution of harbor seals from the population surveys or as reflected in the distribution of subsistence harvests; annual salmon or herring harvests by the fishing fleet; or other data as available. Prey distributions will be obtained by the most appropriate means from the candidate data set. The prey and predator distributions can then be overlaid in Arc/Info to examine hypotheses regarding the spatial associations of whales and their prey or of whales and other important features of their habitat (e.g. rubbing beaches, etc.).

A key aspect of this work will involve evaluation of the hypothesis that killer whale predation is impacting the recovery of harbor seals in Prince William Sound following the EVOS. The detail of this analysis may be limited by both the available data on killer whales and the available data on harbor seals. However, the killer whale

observational data will be used to estimate the number of harbor seals taken by killer whales. The results will be used as input to the harbor seal mortality model to ascertain whether killer whales are a limiting factor on the recovery of harbor seals.

Estimates of predation rates will be obtained by calculating the observed predation events per day of killer whale observation. To the extent the data will allow, factors influencing the predation rate (e.g. resident v. transient whales, group size, location, time of year) will be examined. Combined with the information on whale distributions available in the database, estimations will be made of the predation rate on harbor seals.

Behavioral observations, sampling of prey items, and biopsy sampling and processing in FY96 and FY97 will be conducted from The 43' R.V. Lucky Star and associated console skiff. Additionally, the R.V. Whale 2, the primary platform for the completion of the monitoring fieldwork, will make observations of whale behavior and sample prey remains. The R.V. Whale 2 is equipped to allow collection of biopsy samples which will be collected when it does not interfere with the completion of photographic monitoring of killer whales.

The R.V. Lucky Star can house 4 scientists and has work space and equipment sufficient for complete workup of samples taken by biopsy as well prey samples. Freezing facilities for storage of samples are available on both the R.V. Whale 2 and F.V.Lucky Star. Most biopsy sampling will actually occur from a 17' fiberglass skiff that will be launched from the R.V. Lucky Star. The highly maneuverable skiff is equipped with high sides and a raised deck, an operations console (hydraulic steering, remote speed and shift controls) and a 60hp outboard motor. The skiff has unobstructed visibility and is fast and maneuverable allowing for close approaches to whales with minimal disturbance and rapid retrieval of biopsy darts

The biopsy sampling for the genetic analysis (and potential chemical analysis) will be collected without handling or tranquilizing the whales. A small dart will be fired from a specially outfitted pneumatic rifle. The setup is similar to that used to deliver tranquilizing drugs to terrestrial mammals in wildlife research. A lightweight plastic dart (approx. 10 cm long by 1.2cm dia.) is fitted with a bevelled tubular sterile stainless steel tip that will take a small core of skin and blubber (approximately 1.8cm long and 0.5cm diameter). The sterilized dart will be fired from a range of 16-20m. The dart hits the animal in the upper back (in the area of the saddle patch), excises a small tissue sample and bounces off. The dart floats with the sample contained until retrieved. Identification photographs using data-back equipped cameras will be taken of all whales biopsied to insure accurate identification of the individual. The whales will be approached by researchers

in the manner currently authorized under permit No. 840 (held by the North Gulf Oceanic Society) for photoidentification and biopsy sampling of killer whales. The required report detailing sampling in 1994 was submitted to the National Marine Fisheries Service, Office of Protected Resources and the permit reauthorized for 1995.

NGOS has successfully biopsy sampled 25 individually identified killer whales in Prince William Sound under this permit in approximately 12 days of fieldwork (an average of about 2 samples per day). Allocated vessel time in FY96 should be more than adequate to obtain 40 or more samples, if required. Members of the NGOS field team have now biopsied more than 125 killer whales (most in British Columbia). Samples have been used for genetic, lipid/fatty acid/isotope, and contaminant analysis. Only a small piece of skin is required for genetic analysis, the remainder of the sample is potentially available for lipid/fatty acid and isotope analysis.

The field observation and sampling of prey remains as required for predation studies will occur concurrently with biopsy sampling from the R.V. Lucky Star. It will be conducted from the console skiff (described above) and independently from the R.V. Whale 2. It requires a fine mesh, extendable net for scooping prey remains from the water. Detection and recovery of fish scales or small bits marine mammals requires an experienced observer. Members of our research team pioneered the use of this technique and are competent in its use. Signs of killer whale predation are often subtle and transitory. Generally, fragments of blubber, hair, blood, oil, scales of fish and milling of the whales are the only evidence a predation event has occurred. When obtained, samples will be preserved by freezing (tissues) or in envelopes (fish scales, hair) for later identification.

Methods used to locate killer whales for predation and biopsy work will be similar to those outlined for photoidentification monitoring. However, it is anticipated that the R.V. Lucky Star will spend longer time periods with with particular groups of whales maximize biopsy sampling, behavioral observations, and collection of prey remains. In the case of marine mammal predation, extensive time must often be spent with the whales before a kill is observed.

The FY96 genetic study will focus on variable regions of the nuclear DNA, and will complement the mitochondrial DNA (mtDNA) analysis carried out in FY95. Because mtDNA is inherited maternally, the first year of the study will have estimated the extent to which females move between the resident and transient populations. The nuclear DNA analysis will provide more precise information on gene flow between the two populations. For example, it will make it possible to estimate the frequency with which intermatings occur, even in the absence of female emigration. Based on the photoidentification studies that have been carried out in British Columbia and Prince William Sound to date, it

appears that emigration occurs very rarely if at all, but these studies have not ruled out the possibility of intermatings.

The type of nuclear marker that will be used in FY96 will depend on the results of the analysis in FY95. Two approaches are most likely: microsatellite typing and exon-primed intron crossing (EPIC) analysis. Microsatellite markers are useful for assessing levels of relatedness ranging from parent-offspring to sub-populations. The individual who will carry out this part of the study, Lance Barrett-Lennard, is currently using microsatellite typing to investigate the genetic structure of resident killer whale communities and to compare resident and transient populations in British Columbia. EPIC analysis may be used if the mtDNA study and preliminary microsatellite analysis indicates a high degree of separation between the two populations.

To asess year round residency of killer whales, a remote hydrophone will be attached to the sea floor near Sleepy Bay, Latouche Island. An anchored and encased cable will run from the transmitter on shore to the hydrophone at a depth of about 15 meters. The transmitter will be enclosed in a waterproof case and the antenna placed in an adjacent tree. It will be powered by deep cycle batteries stored in waterproof containers. A solar panel will charge batteries in summer months, in winter, residents of Chenega Village will be contracted to recharge and replace batteries.

During summer months the hydrophone will be monitored from the R.V. Whale 2 via broad band receiver to assist in locating whales. During winter months it will be monitored at the Chenega Community School under supervision of principal/teacher Mr. Don Kinsey. The receiver will be connected to cassette recorder so that calls can be recorded. The receiver will be monitored on a regular scheduled basis. Analysis of the calls will be made using specially developed program (developed by Dr. John Ford, Vancouver Public Aquarium) using Macintosh Canary software. Some analysis will take place in the school, and will be directed by Eva Saulitis. Identities of the pods can be determined by calls. The frequency of occurrence of each pod by month will be recorded. Because pod sizes will be determined by photographic monitoring in summer months, estimates of numbers of whales using the area by month will be developed.

All equipment needed to complete the contracted field research will be provided by the North Gulf Oceanic Society, including binoculars, nets, directional hydrophones, photographic equipment, biopsy equipment, and on board laboratory supplies and equipment. New equipment needed for FY96 work will be purchased using matching funds (see budget) Additional supplies and minor equipment will be purchased as necessary. Apple Macintosh and IBM compatible computers owned by NGOS as well as the full array of

computers and the GIS system available at the PWSSC will be used in data analysis.

C. Contracts and Other Agency Assistance

The entire project will be completed under the auspices of the North Gulf Oceanic Society. Analysis of historic data for the killer whale predation segment of this work will be contracted to the Prince William Sound Science Center by the NGOS. The PWSSC has the GIS and computer systems and individuals with the expertise to successfully complete this task. The NGOS will contract residents of Chenega Village to monitor the remote hydrophone system during the October to May period. Contracts for vessel leases will be issued by the North Gulf Oceanic Society. We will provide samples or assist in the collection of samples for lipid/fatty acid analysis proposed by NMFS/NMML to the extent possible.

D. Location

Field work for this project will occur in Prince William Sound and immediately adjacent waters. Benefits will be realized by various user groups in the Sound, including local residents, tour boat operators, and recreational boaters concerned with the future of killer whales in Prince William Sound.

SCHEDULE

A. Measurable Project Tasks for FY96

Start-up to September 1:	Complete input of historical killer whale data and 1995 data into GIS system at PWSSC
Start-up to 3 months:	Complete design of sampling effort analysis
3 months to 6 months:	Design data inventory and analyses of long term behavioral changes
6 months to 9 months:	Begin data inventory and analyses of search effort
9 months to 11 months:	Complete search effort analyses and data inventory
Start-up to April 5:	Arrange logistics, prepare boats, equipment

April 9-20:	First cruise killer whale predation study emphasis
June 5-June 15:	Second cruise killer whale predation study emphasis, installation of remote hydrophone
July 11-August 30:	Killer whale monitoring emphasis field work
September 3-17:	Third cruise killer whale predation study emphasis
October 1- November 30:	Analysis of field data, genetic samples and historical data, assessment of hydrophone project
November 1-30:	Preparation of killer whale annual monitoring report
November 15-December 30:	Preparation of killer whale predation annual report

The R.V. Whale 2 will operate for 50 days in July and August (July 11 to August 30). The primary function of this vessel will be killer whale photoidentification monitoring. This time period is generally a period of high encounter rate with AB pod and other resident pods and will complement the schedule of the R.V. Lucky Star. In addition the R.V. Whale 2 will collect biopsy samples and feeding data opportunistically when it does not interfere with the monitoring segment of this project and monitor the remote hydrophone project.

The field schedule for the predation study is designed to obtain a fairly broad seasonal picture of killer whale predation. The early season fieldwork for the R.V. Lucky Star will be aimed at sampling transient killer whales. Resident whales generally are sighted more frequently later in the season. The remote hydrophone system will operate in FY96 and FY97 with analysis to be completed in FY 98.

B. Project Milestones and Endpoints

FY95: Conduct killer whale monitoring program and produce comprehensive report. Determine current recovery status of AB pod and review measurements used to determine this status. Initiation of field sampling/observation of prey and biopsy sampling of killer whales and completion of initial genetic analysis (mtDNA). Samples for lipid/fatty acid and isotope analysis provided to National Marine Mammal Laboratory. Design database for historical data; enter about half of existing data; inventory data that is computerized. Testing of remote hydrophone system. Annual

report for killer whale predation study.

FY96: Conduct reduced annual monitoring and produce annual report. Collect second season of field sampling/observation of prey data and biopsy samples of killer whales. Complete genetic analysis and summarize resident/transient separation. Complete data entry and inventory of historical data including FY 95 data, complete analysis of sightings per unit effort; design subsequent analyses; make suggestions for improvements in design of data collection. Install and operate (over the winter) the remote hydrophone system. Complete annual report for killer whale predation study.

FY97: Conduct reduced annual monitoring and produce annual report. Publish catalogue of individual killer whales. Final (reduced effort) field season for field sampling/observation of killer whale predation. Enter the FY96 data into GIS; complete analysis of long-term behavioral changes; make behavioral estimate of diet overlap between resident and transient killer whales; determine requirements of prey availability data and locate suitable databases. Operate remote hydrophone system and begin analysis of calls. Complete annual report for killer whale predation and acoustics studies.

FY98: Conduct killer whale monitoring program and submit a comprehensive report. Assess restoration status of AB pod, review definitions of recovery and assess changes in the AT1 transient group. Summarize all killer whale prey sampling/observational field data. Enter FY97 data into GIS system. Analyze prey and whale distribution data; estimate predation rate on harbor seals. In consultation with NMML or others, compare behavioral and chemical estimates of diet overlap between resident and transient whales. Analyze all killer whale calls collected from the remote hydrophone and assess year round killer whale residency. Write final report addressing all aspects of the project.

C. Project Reports

For the killer whale monitoring segment of this project, a draft annual report will be submitted by November 30, 1996, with the final report submitted after review by March 30, 1997. Another annual report will be submitted by November 30, 1997 and final report submitted March 30, 1998. A comprehensive report on the monitoring will be made in 1995 (under current year funding) with the next comprehensive report scheduled for December 31, 1998 (draft) and final version submitted by April 15, 1999. The annual reports will summarize effort and detail changes in pod

composition for that particular year. The comprehensive reports on monitoring will compare effort and sighting rates for each year and detail demographics within the pods and groups. It will assess the significance of changes and long term trends in the population particularly changes in AB pod. Comprehensive reports will specifically address changes in regard restoration goals and the likelihood of meeting those goals.

Annual reports for the killer whale predation studies will be submitted by December 31, 1996 and 1997 (draft), and final annual reports by April 1, 1997 and 1998. The project final report will be submitted November 30, 1998 and the final version completed by March 31, 1999. The FY95 (current year) report will summarize field effort, predation observations, and biopsy collection; report on initial genetic analysis; and discuss database design and provide a preliminary data inventory. The FY96 report will summarize field effort, summarize predation observations; report on the continued genetic analysis; describe the initial results of the remote hydrophone project, provide a completed inventory of historic data and present an analysis of search per unit effort. The FY97 report will summarize the limited field effort, summarize predation observations and final biopsy collection; summarize initial analysis of remote hydrophone data; present the analysis of long-term behavioral changes and analysis of dietary overlap based on behavioral data. The FY98 report will provide the final summary and interpretation data from genetic analysis and the remote hydrophone project; detail and interpret the results of field efforts; and provide analyses of prey availability and estimates of predation rates for killer whales.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The monitoring of killer whales and analysis of historic and current data on killer whale behavior is part of an integrated program to investigate killer whale recovery and the impact of killer whale predation on harbor seals. It will be integrated with the harbor seal trophic studies (project 96064, Kathy Frost, project leader). In addition, this project will offer tissue samples for use in the lipid/fatty acid and isotope analysis of killer whale tissues that is proposed separately by NMML/NMFS. Details of sample sharing remain to be worked out.

In 1996 this project will rely on approximately $10,000 in matching funds from foundations or other private sources. Additional monies may be avaialable following approval of this project. Matching monies will be sought in preparation of a killer whale catalogue (FY 97). The total cost of the catalogue is $20,000 of which $7000 is expected to be obtained elsewhere. The offset of expenses by matching funds in long term monitoring has subtantial future

with private funding sources, NGOS work with Trustee Council cooperation to maximize potential for matching funds in the future.

ENVIRONMENTAL COMPLIANCE

The North Gulf Oceanic Society has a federal permit to conduct both photoidentification studies and biopsy sampling of killer whales in Prince William Sound, Alaska. An environmental assessment was conducted by the National Marine Fisheries Service in issuing this permit. The NGOS also is finalizing a permit from the Chenega Native Corporation for placement of a remote hydrophone transmitter on their lands at the north end of Latouche Island.

PERSONNEL

Craig Matkin (M.S. University of Alaska), is the project leader. Matkin will be responsible for supervising the completion of all fieldwork and insuring successful operation of boats and equipment. He will be the operator of the R.V. Lucky Star and supervise directly all work completed from that platform or the attendant skiff. He will direct data analysis and assemble all material for annual and comprehensive reports and be responsible for completion and submission of these reports. He will represent this project and present the work to the EVOS Trustee Council.

Matkin has studied killer whales in Prince William Sound since 1977. He initiated systematic killer whale photoidentification in Prince William Sound, and is a founding member of NGOS. Recently he completed the "The Biology and Management of Killer Whales in Alaska" for the U.S. Marine Mammal Commission. His most recent pertinent publication is of the EVOS killer damage assessment results ("The Status of Killer Whales in Prince William Sound 1984-1992", Craig O. Matkin, G. M. Ellis, M.E. Dahlheim, and J. Zeh in T.R. Loughlin. ed. Marine Mammals and the Exxon Valdez.)

David Scheel (Phd. University of Minnesota) is an Associate Scientist, at the Prince William Sound Science Center. Scheel will be responsible for the input and analyses of historic data and newly collected predation and distribution data for examination of killer whale predation. He will supervise the input of all data into the GIS system at the Prince William Sound Science Center. Scheel will provide detailed interpretation of his analyses for the final report.

Scheel's research projects have included predator-prey dynamics of Serengeti lions and their prey, habitat selection models of Texas mammals, frequency and density dependence in models of community evolution, social behavior

dependence in models of community evolution, social behavior and resource habitat use of primates in Gombe. He has extensive experience with GIS systems.

Eva L. Saulitis (M.S. University of Alaska) , a director of NGOS, has conducted fieldwork on killer whales in Prince William Sound each season since 1987. She will be the principal field biologist for the monitoring segment of this project (photoidentification) and will operate the research vessel Whale 2 and supervise the remote hydrophone project. She will make ready and maintain all necessary equipment, complete photoidentification work and all logs and data sheets as required and coordinate her activities with that of the other research vessel Lucky Star. Saulitis will also provide research assistance aboard the R.V. Lucky Star when its cruises do not occur at the time of operation of the R.V. Whale 2. She will also help assure accurate entry of historical data into the GIS system.

Saulitis recently completed her MS thesis "The Behavior and Vocalizations of the AT Group of Killer Whales in Prince William Sound, Alaska." She coauthored the "Biology and Management of Killer Whales in Alaska" for the U.S. Marine Mammal Commission. She has done extensive analysis of killer whale calls and has operated research vessels in Prince William Sound since 1988.

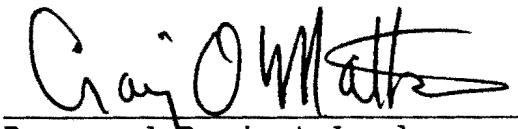
Lance Barrett Lennard (MS, University of British Columbia). Lance (an American citizen) is a Phd. candidate at the University of British Columbia. He will conduct or supervise all genetic lab work at the University of British Columbia for the killer whale predation segment of this project. He will also provide interpretation of those results. He has extensive experience taking biopsy samples from free ranging killer whales and will participate in biopsy work conducted aboard the R.V. Lucky Star and R.V. Whale 2.

Barrett-Lennard has researched killer whales for 8 years, specializing in their acoustics and genetics. He has operated research vessels in Prince William Sound and British Columbia. He is currently completing an extensive investigation and modeling of killer whale predation on Steller sea lions in Alaska and is conducting genetic analysis on over 100 killer whale biopsy samples taken in British Columbia over the past 3 years.

Graeme Ellis has participated in killer whale photoidentification studies in Canada and Alaska for over 20 years. Ellis will do all final identifications of individual killer whales from historical data as well as data collected annually. He will examine all negatives on a repetitive frame by frame basis and supervise the input of the final identification data into the VAX computer system. With Matkin he will update all life history information on individual whales and provide positive identifications from

approximately 2 weeks of field work annually.

Currently Ellis directs whale identification work at the Pacific Biological Station in Nanaimo, British Columbia and has done final identifications on Prince William Sound killer whale photographic negatives since 1983. He has more experience than any other individual identifying Prince William Sound killer whales from photographic negatives and his accuracy has been certified by repeated testing.



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BMORRIS@ABL.AFSC.NOAA.GOV

Date/Enc #_____ NGOS Killer Whale Survey

Platform_____

Observers_____ Time (Beg/End)_____

Location (Beg/End)_____

_____

Pods_____ Naut. miles traveled w/whales_____

Total # whales_____ ad ♂'s _____ ad♂/im♀_____ juv/calf_____

Recognized individuals_____

_____

_____#Whales photographed_____

Film (Date/Enc#/Roll#/Initials)_____

Recordings (Tape#/Side Beg/End)_____

Prey samples (Type/Sample #/Location/Whale I.D.)_____

_____

Tissue samples (Sample #/Whales darted)_____

_____

Oil present Yes/No (Type)_____

Harrassment of whales by researchers Yes/No (#harrassed)_____

Observations:

Time	Behavior	Location	Observations	Time/Rec#

Behavioral categories : Travel (Tr) / Feed/Forage/Fish (Ffish) / Feed/Mammal (Fmam) / Mill / Social (Soc)

Forage/Nearshore/Transient (Nfor) / Forage/Offshore/Transient (Ofor) / Rub / Rest

DAILY RESEARCH LOG

DATE_____ PLATFORM_____

BEGIN LOCATION_____ END LOCATION_____

_____ _____

_____ _____

BEGIN TIME_____ END TIME_____

SEARCH TIME_____ TIME WITH WHALES_____(Hrs)

TOTAL MILES SURVEYED (trackline) _____

PERSONEL_____

_____

WEATHER & SEA STATE /TIME _____

_____

_____

WHALE
SIGHTINGS/TIME_____

_____

ACTIVITIES/COMMENTS _____

_____

_____

_____

_____

_____

_____

_____

1996 EXXON VALDEZ TRU E COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Budget Category:	Authorized FFY 1995	Proposed FFY 1996
Personnel	$80.0	$7.0
Travel	$6.5	$0.0
Contractual	$85.0	$68.0
Commodities	$17.7	$0.0
Equipment	$3.1	$0.0
Subtotal	$192.3	$75.0
General Administration		$5.8
Project Total	$192.3	$80.8
Full-time Equivalents (FTE)	1.9	1.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FFY 1997	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002

Dollar amounts are shown in thousands of dollars.

Comments:
Annual monitoring costs of $26.4K will be reviewed at a later time, possibly to be presented to the Trustee Council at their December 1995 meeting.

1996

Prepared:

Project Number: 96012
Project Title: Comprehensive Killer Whale Investigations
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

8/14/95

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1996
PM	Name	Position Description					
*	B. Wright	Program Manager	GS 12/5	1.0	7	0	0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		1.0	7	0	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1996
PM	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$0.0

1996

Project Number: 96012
Project Title: Comprehensive Killer Whale Investigations
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

Contractual Costs:	Proposed
Description	FFY 1996
When a non-trustee organization is used, the form 4A is required. Contractual Total	$0.0

Commodities Costs:	Proposed
Description	FFY 1996
Commodities Total	$0.0

1996

Project Number: 96012
Project Title: Comprehensive Killer Whale Investigations
Agency: NOAA

FORM 3B
Contractual &
Commodities
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1995 - September 30, 1996

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1996

Project Number: 96012
Project Title: Comprehensive Killer Whale Investigations
Agency: NOAA

FORM 3B
Equipment
DETAIL

8/14/95

IMPACT OF KILLER WHALE PREDATION ON THE RECOVERY OF INJURED RESOURCES IN PRINCE WILLIAM SOUND

Project Number: 96-012 B

Restoration Category: Research

Proposer: Alaska Fisheries Science Center
National Marine Mammal Laboratory
Seattle, Washington 98115

Lead Agency: NOAA

Cooperating Agencies: None

Duration: Three years (FY95 through FY 97)

Cost FY 96: $229.5K

Geographic Area: Prince William Sound, Alaska

Injured Resources: Harbor seals, Pink salmon, Herring.

ABSTRACT

In Prince William Sound, predation by killer whales occurs on at least three resources that were adversely affected by the EVOS (i.e., injured): harbor seals, salmon, and herring. To predict the relative impact that killer whale predation may have on the recovery of these injured resources, the level of predation and the relative proportion of each species consumed by killer whales must be quantified. The objective of the proposed project is to investigate the potential impact of killer whale predation on the recovery of Prince William Sound injured populations. We will collect biopsy samples from 80 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.

INTRODUCTION

Killer whales are classified as top predators with diets that vary regionally and seasonally (Heyning and Dahlheim, 1988). In the North Pacific, killer whales consume a wide variety of prey items including squid, fish, birds, turtles, marine mammals, and occasionally even deer and moose (Dahlheim and Heyning, in press). A complete list of prey species consumed by killer whales is provided in Jefferson et al., 1991. Dietary habits of North Pacific killer whales are based primarily on observational data. Since killer whales rarely

strand, few stomach contents have been examined (Rice, 1968).

For killer whales, two life-history patterns involving two forms of killer whales termed resident and transient, have been suggested (Bigg et al., 1987; 1990). One of the criterion used to differentiate the two forms is the diet. Resident whales are thought to feed primarily on fish, whereas transients are thought to feed primarily on marine mammals. The data used to support these statements are based on a 20+ year research effort conducted in Puget Sound, Washington and British Columbia occurring primarily during the summer months (Bigg et al., 1990). Much of what we know about killer whales is a result of these studies. This information is then extrapolated to other geographical areas, which may be inappropriate. Both forms of killer whales have been described from Prince William Sound (Heise et al., 1991).

NEED FOR THE PROJECT

A. Statement of Problem

In Prince William Sound, predation by killer whales occurs on at least three resources that were adversely affected by the EVOS (i.e., injured): harbor seals, salmon, and herring. To predict the relative impact that killer whale predation may have on the recovery of these injured resources, the level of predation and the relative proportion of each species consumed by killer whales must be quantified.

The objective of the proposed project is to investigate the potential impact of killer whale predation on the recovery of Prince William Sound injured 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 (total samples = 80). 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.

B. Rationale

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 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 (i.e., proportion of whales eating fish) regarding the relative impact of killer whale predation on herring and salmon will also be obtained during the course of these studies.

C. 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 by determining the fraction of the killer whale population that predates on fish versus marine mammals.

D. Completion Date

Project duration is three years (FY95-FY97). Final reports due June 1998.

COMMUNITY INVOLVMENT

We encourage public participation at all levels of this scientific research (workshops, meetings, document reviews, etc.). The Principal Investigator of this Project has attended all scheduled meetings/workshops and has presented all available information pertaining to the whale studies to the general public at these symposia, conferences, and in the published literature. Numerous reports of our research efforts on killer whales are available through the Oil Spill Public Information Office. The Principal Investigator has and will continue to talk with representatives of the public, which have and will include those from tourism, industry, fisheries, and conservation groups.

FY 96 BUDGET

Personnel	$24.0K
Travel	9.0K
Contractual Services	171.0K
Commodities	23.5K
Equipment	N/C
Subtotal	227.5K
General Administration	2.0K
Total	$229.5K

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 by determining the fraction of the killer whale population that predates on fish versus marine mammals.

B. Methods

Background Information

The diet of an organism is one of the key factors in determining life-history patterns. One major factor that is largely unknown about killer whales in the North Pacific Ocean is the trophic level at which they feed. Although killer whales are considered top predators (defined as a species that is not eaten by any other species in the food web; Cohen, 1989), this information alone does not allow for quantitative analysis or comparisons to be made between food webs. It is necessary to determine how many trophic levels 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 (Odum, 1968). 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 (Abend, 1993).

Subjective observations of feeding events of cetaceans may only represent the localized distribution of prey in an area. Stomach contents represents a one time and fairly recent feeding event or series of events and this could mis-represent the relative contribution of the prey item found in the stomach. Other problems associated with stomach content analysis are that the stomach contents may actually represent something that the prey has eaten or a by-catch from an attempt to capture other prey. This problem is exascerbated by the highly mobile nature of killer whales. Longer term estimates of diet are required to more fully address the food web dynamics of killer whales.
Given that killer whales may consume a wide variety of prey, there are few references as to the spatial and temporal aspects to their diet as scales relevant to population structure. Dietary information to date is comprised of a series of observations of whales feeding at given location at a given time. While this approximates the diet of whales, it may not include the diet of animals while they are away from areas being sampled by observers.

Stable isotope analysis has become a powerful tool in the studies of marine food webs (Fry and Sherr, 1984; Petersen and Fry, 1987; Fry, 1988). The ratio of heavy to light isotopes in a sample will vary between organisms. Samples are analyzed for the ratios of $^{13}C/^{14}C$, and an organism is expected to have a similar isotopic ratio as its prey. There are some ambiguities with this technique as carbon isotopes represent the average diet of all prey consumed. The presence of multiple prey items may make it possible only to suggest that a given species is present, not to prove it. However, it may be possible to rule out the presence of a certain species in the diet (Abend, 1993).

Analysis of free-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 free-fatty acids as well as glycerol and monoglyceride (Borgstrom, 1977; Patton, 1981). Fatty acids remain intact during digestion, therefore by comparing the free-fatty acid composition of potential prey with that of the organism that ate the prey will make it possible to determine the prey consumed by that individual (Iversen, 1993). Many fatty acids are, and can be attributed to a single phylogenetic group or species from a specific community. For example, a pair of monosaturates that occur in one species of copepod act as a tracer in Atlantic cod and herring (Ackman, 1980). 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 (Iversen, 1993).

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 are similar in isotopic composition to their diets in carbon but average from 3 to 5 parts per thousand (ppt) heavier than 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 with those of potential prey makes it possible to determine the diet of a species, as well as the trophic level at which they are feeding (Fry and Sherr, 1984; Petersen and Fry, 1987; Fry, 1988).

Both isotopic analysis and free-fatty acid analysis have been completed on marine mammals. Carbon isotope analysis has been conducted on baleen (Schell et al., 1989; Withrow et al., 1992), blubber (Ostrom et al., 1993; Abend, 1993) and skin (Abend, 1993) to yield information on diet of various species of cetaceans. Prey of marine mammals was also identified by analyzing free-fatty acid composition of the blubber of several species (Ackman et al., 1965, 1975; Lockyer et al., 1984; Iversen, 1993). Preliminary free-fatty acid analysis of blubber samples from a limited sample of killer whales from Puget Sound and Argentina were conducted (Hoelzel and Clark, unpublished). These results show that it is possible to determine proportional differences in free-fatty acid composition of blubber samples between killer whales in Puget Sound and Argentina as well as resident and transient whales within Puget Sound. These analyses, using isotopic and free-fatty acid analysis, represent a spatially independent sample of prey consumed by marine mammals. The inherent difficulties are due to the fact that deposition rates of signals are not known.

The question of diet, of course, has several relevant time scales. Based upon differences in assimilation rates, different tissues or layers of tissue will yield different temporal feeding information. It is speculated that short-term feeding history can be determined on the basis of stable isotope analysis of the skin, seasonal feeding is reflected in the middle layer of the blubber, and long-term feeding history is reflected in the outer layer of the blubber (Abend, 1993).

The blubber of baleen whales consists of three distinct layers (Ackman et al., 1965; Lockyer et al., 1984). The middle layer is the most metabolically active and probably corresponds to the seasonal feeding of an individual (Lockyer et al., 1984). Blubber in the region just anterior and posterior to the dorsal fin represents an important fat energy store (Lockyer et al., 1985). It is not clear to what exent odontocetes store energy in the form of blubber. However, this area is the thickest blubber section of the body and has a similar structure as the blubber of baleen whales.

The structure and dynamics of ecosystems influence the life history patterns and demographic parameters of animals. However, the structure and dynamics of an ecosystem can be infiuenced by the effect of prey selection by animals (Carpenter and Kitchell, 1988; Deegan, 1993). Paine (1988) suggested that large, mobile predators are often overlooked in food web studies, resulting in an underestimation in the number of trophic levels. The results of this study will provide information on the energy and material utilization of killer whales in the coastal waters of Alaska. This work, combined with cooperative studies that focus on fish, birds, and pinnipeds will make it possible to obtain quantitative measurements of Alaskan marine ecosystems.

Field Procedures

We propose to collect biopsy samples from 80 killer whales in Prince William Sound over a three-year period (40 each from suspected resident and transient whale populations). Tissue samples for food web investigations will be collected using a biopsy dart. Devises of this type have been used extensively with a number of species including both odontocetes and mysticetes.

Most species have been sampled using a 6mm by 20mm cylindrical dart attached to the tip of an arrow and projected from either a crossbow or a compound bow (Lambertson, 1987). Darts were retrieved using either independent flotation or a tethered line. For the killer whale studies, we have designed a darting system based on one that has been successfully used by the Canadian research team to collect about 40 biopsy samples from British Columbia killer whales. Both designs use an airgun for propulsion. We propose to use an air pistol powered by a CO_2 cartridge, while the Canadian study used an air rifle with blanks of different set charges. We chose the CO_2 system because it allows the force of impact to be more precisely controlled. The Canadian study uses an aluminium airgun dart with a 5mm by 25mm steel cylinder threaded into the leading edge. Ours is essentially the same except that the 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 (dart design is shown in Figure 1). In both systems, the dart is collected free floating after sampling.

The sampling protocol includes the following cautionary steps. First, the vessel approach will be gradual, resulting in a vessel speed that matchs that of the subject whale (experienced boat drivers will be used), and never when the subject whale is engaged in high speed travel (porpoising) or in intensive feeding bouts. Second, the subject whale will only be sampled

when there is no perceivable chance that a non-targeted animal could be struck. This will entail tracking the positions of recognized individuals within sub-groups (experienced field personnel familiar with killer whale behavior will be used), and firing only when non-target whales are at least one whale-length away. Third, only the dorsal surface immediately below the dorsal fin will be targeted. Fourth, dart retrieval will only be attempted after the whales have moved away from the darting area. All darts will be flame sterilized. Detailed data forms will be designed to record all behavioral responses of the whales to the biopsy procedures. The identity of an individual whale will be made prior to sampling. Experienced personnel will be used in all phases of the research.

To determine the diets and trophic relationships of killer whales, each plug of whale blubber collected during field operations will be stored in a glass vial and frozen for later analysis. Once collected, sterile techniques will be used throughout all procedures to ensure that no additional contamination of the sample occurs.

Laboratory Analysis

Analysis of blubber and skin samples will be divided by age-class (i.e., adults and juveniles). This is assuming that there may be differences in prey taken by these age-classes of whales. Five samples will be analyzed for both isotopic and free-fatty acid composition by individuals in a given age class to determine within-class variability.

The isotopic analysis will require a sample of 5-15 mg. Frozen samples will be thawed and dried in a 70 degree centrigrade oven for approximately 24 hours. The dried sample will be ground into a fine powder using a mortar and pestle (Abend, 1993). The samples are then placed in a quartz tube with copper oxide, sealed and then combusted at about 870 degrees centrigrade for an hour and then allowed to cool. Nitrogen and carbon dioxide gases are then separated and pumped into separate tubes. Isotopic ratio measures will be performed on a mass spectrometer, where the ratio of the sample is compared to a known standard following the equation:

$$\delta^{13}C \text{ or } \delta^{15}N = [(R_{sample} - R_{standard})/R_{standard}] \times 1000$$

where: R is $^{13}C/^{12}C$ for $\delta^{13}C$

R is $^{15}N/^{14}N$ for $\delta^{15}N$

The standard for carbon is the Chicago PeeDee Belemnite (PDB) and for nitrogen is atmospheric nitrogen (Fry and Sherr, 1984; Ostrom et al., 1993).

The fatty acid which may be most useful in determining diet are 14:0, 20:1, 22:1, and 22:1n-11m all long chain polyunsaturated fatty acids with n-3 and n-6 double bond positions, and unusual fatty acids (Iversen, 1993). One to three gram samples are needed for this analysis. These samples will be anlayzed using techniques outlined in Lockyer et al. (1984). Lipid

will be extracted from the blubber sample with methanol-chloroform using a homogenizer. Fatty acid methyl esters will then be prepared in a mild alkaline deacylation and then analyzed by capillary gas chromatography.

The isotopic and free-fatty acid analysis will be carried out under Contract to the National Marine Mammal Laboratory.

C. Contracts and Other Agency Assistance

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). The laboratory research of stable isotope/fatty acid analyses will be contracted out. NMML will work closely with other EVOS Principal Investigators involved with the study of injured resources, as appropriate.

Technical support will be provided by the research and 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.

D. Location

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

SCHEDULE

A. Measurable Project Tasks for FY96

Start-up to March 1996:	Arrange logistics (boats, equipment, contracts, etc.)
April to Sept. 1996:	Field season (minimum length of 90 days between April and September).
October 1996 to Feb. 1997:	Analysis of field data
April 1997:	Annual report of FY96 work

COORDINATION OF INTEGRATION OF RESTORATION EFFORT

This project is part of an integrated 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 (ADF&G) and Oceanographic (UAF) studies being submitted under the SEA plan and with the Forage Fish study being developed. The research platform will be shared with the contractor designated to conduct killer whale monitoring during FY 95.

ENVIRONMENTAL COMPLIANCE

The National Marine Mammal Laboratory has the required permits to collect biopsy samples from killer whales.

PERSONNEL

Dr. Marilyn E. Dahlheim will monitor and manage all aspects of this project for the National Marine Mammal Laboratory. In the event of a personnel change, Dr. Howard Braham (Director, National Marine Mammal Laboratory) will ensure the overall completion of this research.

Dr. Marilyn E. Dahlheim is a recognized international expert on killer whales. Dr. Dahlheim has been the Principal Investigator of the EVOS damage assessment and recovery research on killer whales since 1989 and has successfully managed all aspects of these investigations. Her involvement with Prince William Sound killer whales began in 1985 (killer whale/blackcod fisheries interactions), however, she has been conducting killer whale research throughout Alaskan waters since 1978. In addition to her work on killer whales, Dr. Dahlheim has made significant contributions to the biology of gray whales, Alaskan humpback whales, and Alaskan harbor porpoise. Dr. Dahlheim has published extensively on cetacean biology; of which 20 manuscripts have been published on killer whales. Dr. Dahlheim will coordinate necessary experts relating to various topics in the proposed project.

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