19.06.01

FY 99

Project Proposals

Archaeological Index Site Monitoring

Project Number:	99007A
Restoration Category:	Monitoring
Proposer:	ADNR- Office of History and Archaeology
Lead Trustee Agency:	ADNR
Cooperating Agencies:	DOI-FWS, DOI-NPS, USFS
Alaska SeaLife Center:	No
Duration:	5th-year, 10-year project
Cost FY 99:	$151,500
Cost FY 00:	$136,300
Cost FY 01:	$151,500
Cost FY 02:	$136,300
Geographic Area:	Prince Willam Sound, Kenai Peninsula, Kodiak Island
Injured Resource:	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. Scattered instances of vandalism continue and monitoring continues with return to sites initially identified but not recently monitored.

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 damage from vandals at other sites has not been documented, they are still active in the region and their level of depredations 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 and concurred with by the peer reviewer 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.

The archaeological peer reviewer for the Trustee Council recommended during the 1995 science workshop that monitoring continue at oiled sites to check for new movement of buried oil into site deposits. His concern was that subsurface oil would move into archaeological deposits and compromise possible data recovery. That recommendation continues to guide field work proposed during the 1999 field season.

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. Index sites oiled during the early time immediately after the spill in March 1989 were monitored during 1995, 1997, and will be returned to during 1999. Sites in Prince William Sound will include SEW-469 and SEW-431. Outer Kenai Peninsula sites are SEL-178 and SEL-215. In the Kodiak Island area sites AFG-098, AFG-081, and AFG-046 will be visited by the State. The U.S. Fish and Wildlife Service will re-visit KOD-171, and visit AFG-098, AFG-099, and AFG-100.

NEED FOR THE PROJECT

A. Statement of Problem

Sites monitored under project 99007A 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 are 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.

C. Location

The project occurs in Prince William Sound, on the outer coast of the Kenai Peninsula, and in the Kodiak Island archipelago. Most sites are located in very remote areas.

COMMUNITY INVOLVEMENT

The sites being monitored under this project are remote. Because of the remoteness, no direct community involvement is anticipated.

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. Knowledge of continuing and current site status is required to protect the sites from degradation. The objectives of the FY97 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 FY2004 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 the 1994 restoration workshop of designating index sites vulnerable to looting which will be monitored bi-annually 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 that 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 duplicate earlier perspectives as closely as possible. Test localities will be mapped in reference to site reference points.

SEW-469 This site will be re-visited in 1999 to check for signs of vandalism. The location of vandal activity documented during 1990 will be re-examined and photographed with reference to established photo points.

SEW-431 This cave site reportedly has remains eroding out and is highly vulnerable to vandal damage. It was reported during the damage assessment phase of the oil spill and will be documented with mapping and photography.

SEL-188 The National Park Service will return to this site to sample current status of oiled beach sediments. During 1995 oil identified as from the *Exxon Valdez* was present on that beach. The beach will also be examined for any evidence for vandal disturbance of exposed artifacts.

SEL-178 The Port Dick Cabin Site, SEL-178 will be visited to monitor vandal damage to the site. During 1995, damage to a previously undocumented part of the site deposits was noted. Status of that damage will be documented with maps and photography. Areas of artifact exposure in other parts of the site, documented during 1991 will be re-checked and re-documented.

AFG-046 Erosion and vandal collecting at this site continues and this site will be visited during 1999 to map the current position of the erosional scarp and collect any displaced artifacts.

AFG-081 The AFG-081 will be re-visited during 1999 to monitor the location of 1991 vandalism. The damage was restored during 1994 by covering the area with fill and logs. The area was re-damaged during 1995 and replacement of the restorative cover will be a goal of a site visit during 1999. Site status will be documented through photography.

AFG-098 The site was visited during 1995 to document reported damage from the prior winter. Sediment samples from the intertidal zone tested negative for presence of petroleum hydrocarbons. The site will be re-visited during 1999 to monitor site condition through photography and mapping of any damage found.

KOD-098
KOD-099
KOD-100 These three sites have been subjected to vandalism and will be visited to document current site status. Vandal damage will be documented with maps and photographs.

KOD-171 The Chief Cove Site will be re-visited to monitor evidence for continuing disturbance of the midden. Slumpage in the midden deposits was documented during 1995 however the agent of disturbance was not established. Findings will be mapped on the existing map which is based on the field map created by the Dekin, et al., damage assessment study done in 1991.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Cooperating agencies under this project are the DOI-U.S. Fish and Wildlife Service, DOI-National Park Service, and the USDA- Forest Service. Each of the federal agencies has management responsibilities for resources on lands assigned to them, including cultural resources. Each of those agencies has on staff qualified archaeologists who will conduct archaeological activities on agency lands. The Alaska Department of Natural Resources is designated the lead agency only to coordinate all agency activities and oversee compilation of results. Each agency will oversee its own budget and fieldwork.

No major contracts are anticipated by any agency for this project. The only contractual activity will be aircraft or boat charters processed by individual agencies on a per hour or day basis. Normal agency contracting procedures will be followed. The same will be true when contracting for radiocarbon dating or sediment analysis services. Radiocarbon dating will be done in commercial facilities, none of which exist within Alaska.

SCHEDULE

A. Measurable Project Tasks for FY 99 (October 1, 1998 - September 30, 1999)

October 1, 1998 - December 31, 1998:	Complete requirements for NEPA requirements and prepare draft report for FY 98 field activities.
April 15, 1999:	Submit annual report of FY 98 activities for peer and Chief Scientist review.
May 1, 1999 - June 1, 1999:	Finalize arrangements for fieldwork; make changes in FY 98 report for submission to OSPIC.
June 1, 1999 - September 30, 1999:	Complete fieldwork and followup office work. Submit charcoal and sediment samples for analysis.

B. Completion Date

The archaeological index site monitoring has been scheduled for completion in FY 2004. That is the time span which agency experience suggests a pattern of vandal activity will be demonstrated and EVOS related. Findings of negative results at specific sites for a period of at least three years will delete that index site from further monitoring. A final report closing out the project will be written during FY 2004 unless dictated sooner.

PUBLICATIONS AND REPORTS

No formal publications are anticipated for this monitoring project. An annual report will be produced by April 15, 1999 as dictated in the submittal instructions for project proposals. At the end of the continuing project, a final closeout report will be prepared.

PROFESSIONAL CONFERENCES

No professional conferences will be attended nor papers presented in respect to this monitoring project.

NORMAL AGENCY MANAGEMENT

Federal and state laws assign general responsibility for dealing with cultural resource matters

to the various land managing agencies. None of the agencies cooperating in this monitoring project has ever funded a program of site monitoring or data collection at the sites identified in the project proposal. The sites identified have been specifically linked to the *Exxon Valdez* Oil Spill which clearly is outside the normal agency responsibility. The duration of this monitoring project has a estimated length of ten years or a period of sustained negative finding of damages.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Because monitoring of sites are for specific locations for short periods, chances of coordinating travel or facilities with other restoration projects is very limited. Where possible, sharing of boat and airplane charters will be coordinated with other restoration projects within agencies.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No major changes in methodology have been proposed from the detailed project descriptions of prior years other than sites monitored. Part of the originally established procedure of using "index" sites was that monitored sites would vary between years to make coverage more efficient. That variation is reflected in the sites selected for FY 99.

PROPOSED PRINCIPAL INVESTIGATOR

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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	Field and museum assistant, Univ. of Alaska, Fairbanks
1965	Field 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

Terje (Ted) G. Birkedal
Chief, Division of Cultural Resources
Alaska Region, National Park Service
2525 Gambell Street
Anchorage, AK 99503

1968	B.A. - Anthropology, University of Colorado
1970	M.A. - University of Colorado
1976	PhD. - Anthropology, University of Colorado

Field Experience

1965--1992: Survey and excavation experience includes Western Slope of Rockies, Colorado; High Grass Plains, Colorado; Colorado Plateau Area of American Southwest; Delta Area of Louisiana; Southwestern Norway; Bella Bella Region of Canadian Northwest Coast; Guam(Micronesia); and various locations in national parks of Alaska. Includes both prehistoric and historical archaeological experience.

Professional Experience

1971-75	Instructor, Department of Anthropology, University of Guam
1976-82	Archaeologist and later Branch Chief, Branch of Indian Archaeological Assistance, Southwest Region, National Park Service, Santa Fe
1982-85	Chief, Branch of Archaeological Resource Management, Southwest Region, National Park Service, Santa Fe
1986-92	Regional Archaeologist, Alaska Region, National Park Service, Anchorage
1992-Present	Chief, Division of Cultural Resources, Alaska Region, National Park Service, Anchorage

(Majority of Federal career has been spent on the conduct, management, and administration of large archaeological projects.)

Professional Affiliations

Society for American Archaeology
Alaska Anthropological Association
National Trust for Historic Places
Sigma xi: Scientific Honorary Society

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 Service	Archaeological Survey, National Petroleum Reserve, Alaska, National Park
1978 Service	Archaeological Survey, National Petroleum Reserve, Alaska, National Park
1978 National	Excavation, Russian Bishop's House, Sitka National Historic Park, Alaska, 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

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999	PROPOSED FY 1999 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
					$91.8	$28.0	$39.7	
Personnel	$84.0	$86.5						
Travel	$19.1	$20.1						
Contractual	$20.3	$24.6						
Commodities	$3.4	$5.6						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$126.8	$136.8		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
General Administration	$14.0	$14.7						
Project Total	$140.8	$151.5		$136.3	$151.5	$136.3		
Full-time Equivalents (FTE)	1.3	1.2						
			Dollar amounts are shown in thousands of dollars.					
Other Resources	$0.0	$0.0		$0.0	$0.0	$0.0		

Comments: This is a continuation of projects 95007A, 96007A, 97007A, and 98007A.

1999

Prepared: 1 of 21

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Lead Agency: AK Department of Natural Resources

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

4/10/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$55.5	$56.4
Travel	$9.2	$10.0
Contractual	$12.4	$14.0
Commodities	$2.0	$2.0
Equipment		$0.0
Subtotal	$79.1	$82.4
General Administration	$9.2	$9.4
Project Total	$88.3	$91.8
Full-time Equivalents (FTE)	0.8	0.8

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$91.8	$91.8	$91.8		

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments: Project is a continuation of 95007A, 96007A, 97007A, and 98007A

1999

Prepared: 2 of 21

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/10/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
Douglas R. Reger	Archaeologist II	18M	6.0	6.6		39.6
J. David McMahan	Archeologist I	16K	3.0	5.6		16.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		9.0	12.2	0.0	
					Personnel Total	$56.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
	Price	Trips	Days	Per Diem	FY 1999
Travel to Homer to monitor sites	0.2	4	23	0.115	3.4
Travel to Kodiak to monitor sites	0.5	4	40	0.115	6.6
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$10.0

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1999
Air Charter (Kodiak 22 hours, Homer 14 hours @ $285/hour)	10.3
Radio carbon dating, 4 samples @ $300 /sample	1.2
Film processing	1.5
Report duplication	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$14.0

Commodities Costs:	Proposed
Description	FY 1999
Field supplies	1.0
Office supplies	1.0
Commodities Total	$2.0

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$15.0	$9.6
Travel	$4.3	$3.1
Contractual	$2.8	$2.2
Commodities		$0.0
Equipment		$0.0
Subtotal	$22.1	$14.9
General Administration	$2.4	$1.6
Project Total	$24.5	$16.5
Full-time Equivalents (FTE)	0.3	0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Dollar amounts are shown in thousands of dollars.

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$16.5	$16.5	$16.5		

Comments: Project is continuation of 95007A, 96007A, 97007A, 98007A

1999

Prepared: 6 of 21

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: DOI-Fish and Wildlife

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/10/98

1998 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
Charles E. Diters	Archaeologist	GS-12	1.6	6.0		9.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.6	6.0	0.0	
					Personnel Total	$9.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
Travel to Kodiak to monitor sites	0.4	2	10	0.225	3.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3.1

1999

Prepared: 7 of 21

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: DOI-Fish and Wildlife

FORM 3B
Personnel
& Travel
DETAIL

4/10/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1999
Air Charter (Kodiak, 3.5 hours @ $285 /hour)	1.0
Film processing	0.5
Radiocarbon dating (4 samples @ $275)	0.7
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.2

Commodities Costs:	Proposed
Description	FY 1999
Commodities Total	$0.0

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: DOI-Fish and Wildlife

FORM 3B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
			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	Inventory Agency
Description		

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: DOI-Fish and Wildlife Service

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$0.0	$7.0
Travel	$0.0	$1.7
Contractual	$0.0	$3.3
Commodities	$0.0	$1.9
Equipment	$0.0	$0.0
Subtotal	$0.0	$13.9
General Administration	$0.0	$1.3
Project Total	$0.0	$15.2
Full-time Equivalents (FTE)		0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Dollar amounts are shown in thousands of dollars.

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$0.0	$15.2	$0.0		

Comments: Project is continuation of 95007A, 96007A, 97007A, 98007A.

1999

Prepared: 10 of 21

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: DOI-National Park Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/10/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
	Archaeologist	GS-13	0.7	6.3		4.4
	Archaeologist	GS-11	0.5	5.1		2.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.2	11.4	0.0	
					Personnel Total	$7.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
Travel to Seward to monitor site	0.150	2	6	0.225	1.7
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.7

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: DOI-National Park Service

FORM 3B
Personnel
& Travel
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1999
Air Charter, one helicopter trip	1.0
Film processing	1.3
Photo printing	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$3.3

Commodities Costs:	Proposed
Description	FY 1999
Office supplies	1.0
Field supplies	0.9
Commodities Total	$1.9

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
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FORM 3B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
			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	Inventory Agency
Description		

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
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FORM 3B
Equipment
DETAIL

4/10/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$13.5	$13.5
Travel	$5.6	$5.3
Contractual	$5.1	$5.1
Commodities	$1.4	$1.7
Equipment		$0.0
Subtotal	$25.6	$25.6
General Administration	$2.4	$2.4
Project Total	$28.0	$28.0
Full-time Equivalents (FTE)	0.2	0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Dollar amounts are shown in thousands of dollars.

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$28.0	$28.0	$28.0		

Comments: Project is continuation of 95007A, 96007A, 97007A, 98007A

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: USDA Forest Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
L. Yarborough	Archaeologist	GS-11	2.6	5.2		13.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.6	5.2	0.0	
					Personnel Total	$13.5

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
Travel to Prince William Sound to monitor sites	0.3	3	22	0.2	5.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.3

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: USDA-Forest Service

FORM 3B
Personnel
& Travel
DETAIL

4/10/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1999
Air charter (10 hours @ $275/ hour)	2.8
Film processing	0.5
Drafting support	1.8
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$5.1

Commodities Costs:	Proposed
Description	FY 1999
Office supplies	0.7
Field supplies	1.0
Commodities Total	$1.7

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: USDA-Forest Service

FORM 3B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

1999

Project Number: 99007A
Project Title: Archaeological Index Site Monitoring
Agency: USDA-Forest Service

FORM 3B
Equipment
DETAIL

PHOTOGRAPHIC AND ACOUSTIC MONITORING OF KILLER WHALE IN PRINCE WILLIAM SOUND AND KENAI FJORDS, ALASKA (Submitted under BAA #52ABNA700049)

Project Number: 99012

Restoration Category: Monitoring, Research

Proposer: North Gulf Oceanic Society

Lead Trustee Agency: NOAA

Duration: 1 year

Cost : FY 99: $79,800

Geographic Area: Prince William Sound/Kenai Fjords, Alaska

Injured Resource/Service: Killer Whales

ABSTRACT

This project continues the monitoring of the damaged AB pod and other Prince William Sound/Kenai Fjords killer whales that has occurred on a yearly basis since 1984. Methods include the photoidentfication of individual whales and acoustic monitoring with remote and vessel -based hydrophone systems. The project finalizes interpretation and provides for publication of the results of a multi-year examination of killer whale population biology, genetics, acoustics, trophic interactions, spatial and temporal distribution patterns, and contaminant accumulation.

INTRODUCTION

This project is a continuation of the reduced annual killer whale monitoring program. Killer whales were monitored under EVOS Trustee Council funding in 1989, 1990, and 1991 (damage assessment) and in 1993 and 1995 (restoration monitoring) with a reduced annual monitoring program initiated in 1996.In addition this project provides for final data analysis and publication of aspects of the comprehensive killer whale investigation initiated in FY95 and continued in FY96, FY97, and FY98.

On March 31, 1989 AB pod was observed in oil sheens and six of the 36 pod members were missing. 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. Since that time the social structure within AB pod has shown signs of deterioration. Maternal groups have traveled independently or with other pods, and pod members have not consistently traveled with closest relatives. Although 4 calves were recruited during the period 1992-1994, there were 5 additional mortalities in 1994. There has been a net increase of two indivduals since 1995 and the pod currently contains 24 individuals. 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 13 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. Two additional AT1 whales have not been sighted for five years or more. From genetic and photographic data from beached whales, two of these eleven whales are known to be dead. However transient killer whale social structure is not fully understood and we cannot be certain that the other missing AT1 whales are dead. Statistical analysis strongly suggests that they have either died or permanantly emigrated from the area.

This project will continue the monitoring program necessary to map the changes (recovery or non-recovery) of Prince William Sound killer whales on a reduced annual basis. Behavioral observations and spatial and temporal data will be collected opportunistically in the course of photographic and acoustic monitoring, but there will be no new analysis of this data.

Fourteen years of systematic data collected under public and private funding have been placed in a specially designed GIS system at the Prince William Sound Science Center. The database contains 713 records of encounters with killer whales in and near Prince William Sound. Among these are 197 encounters with transient-type whales. Analyses have found large-scale differences in spatial distribuition patterns between resient and transient whales over time. Changes in transient whale distributions have been examined in relation to changes harbor seal populations. Detailed distribution patterns in space and for both residents and transients have been examined potential critical habitats are being described in FY98.

FY98 will be the final year for collection of killer whale biopsy samples and observation and collection of killer whale prey remains. We have obtained solid results from mitochondrial DNA analysis of Prince William Sound killer whales, although FY98 fieldwork will attempt to enlarge sample size from some groups. For this reason we have delayed publication of mtDNA results until FY98 samples are analyzed and seek funding in FY99 for final statistical analysis and publication of results. Current results show fixed differences in mitochondrial DNA between of the resident and transient groups and between three transient and two resident populations. Because mitochondrial DNA is maternally inherited, it accurately reflects patterns of female dispersal. Thus, it is commonly used as a first step in population analyses. It does not, however, shed light on male dispersal. Male dispersal, genetic divergence and variation can be assessed directly by analysis of nuclear DNA, thus we combined both mitochondrial and nuclear analyses. Microsattelite markers in nuclear DNA were developed in FY97 are being used in FY98 to investigate a wide variety of population properties, including mating systems, inbreeding levels, effective population size, and the extent of population subdivision (Queller et al.

1993). The uniqueness of pods or groups (particularly AB pod and the AT1 population) are being tested and the potential vulnerability of populations to extinction from random causes or from increases in mortality associated with human activity examined. In FY99 request funds for completion and publication of this extensive and groundbreaking analysis.

There is worldwide concern that specific PCB and dioxin congeners may have negative effects on reproduction in mammals. The recovery of killer whales in Prince William Sound and the long-term health of the population is dependent on unimpeded reproductive processes. In FY 97 we determined contaminant levels in both resident and transient killer whales, and found much higher levels in the transient population. Contaminants seem to passed from mother to offspring via lactation and levels follow consistent patterns within genealogies. Samples were obtained from individually identified living whales that can be resampled to assess future changes. The ability to sample and potentially resample specific known individuals and their known kin is a unique aspect of this project. FY98 is the final year of field sampling and analysis. Final publication of results will occur in FY99. All analysis of tissue has been provided by the NMFS/NOAA Environmental Contaminant Laboratory, Seattle, Washington.

In FY97 we initiated a remote hydrophone and acoustic analysis element to this project. Initial analysis and separation of pods was competed and monitoring of a remote hydrophone in lower Knight Island Passage is currently in process. An additional hydrophone will be established in Resurrection Bay in FY98 in cooperation with the Alaska Sea Life Center and call analysis and pod separations continued. The current setup has established winter use of the southwestern Sound by acoustically identifiable resident and transient killer whales The recordings also detailed residency of humpback whales in the area and included the recordings of humpback whale song development in Prince William Sound.

Final analysis of pod specific dialects will be completed in FY99 to clearly establish pod identities of whales in the recordings (NGOS is using a 14 year database of killer whale recordings to establish these dialects). Recordings will be analyzed to document which specific killer whale pods and groups were present throughout the year, and specifically, when AB pod was present. With cooperation of the Alaska Sea Life Center another remote hydrophone system will be established in either outer Resurrection Bay or southwestern Prince William Sound, based on results of the systems operating in FY98. The long-term goal of this aspect of project is to determine the year-round habitat use of southwestern Prince William Sound and Kenai Fjords by AB pod and other killer whale pods and provide an additional, innovative, and cost effective tool for monitoring killer whales year round. Also a hydrophone in Resurrection Bay has the added benefit of providing a continous live feed to the Alaska Sea Life Center for education of visitors and residents.

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, mortalities in 1994/95 reduced the number of surviving AB pod whales to 22. Since 1995 there has been a net gain of two individuals but recovery is still uncertain. At least 11 of the AT1 group of transient killer whales have either died or left the Sound since 1989. This project will continue to monitor the status of AB pod and the AT1 group.

The behavior of killer whales in Prince William Sound has changed since the spill. Mortalities following the spill have led to additional mortalities, a deterioration in AB pod social structure, and a splitting of the pod. Despite considerable effort, re-sightings of the

AT1 group have declined and fewer individuals are seen when members of this transient group group are located.

These patterns reflect changes in killer whale social behavior and distribution - the basic patterns that mark normal use of their habitats in Prince William Sound. In recent years resident killer whales have been sighted much more frequently in the Kenai Fjords region. Our analyses found continuing declines in use by both resident pods and the AT1 transient groups in Prince William Sound (FY97 annual report). As yet no increase has been detected in sightings of other transient groups, suggesting that other transients are not increasing their use of the Sound as use by the AT1 group declines. Further, the occurrence of harbor seals in transient whale's diet may be declining (FY96 annual report). It is not clear whether such changes can be related to changes in the Sound ecosystem (e.g. the decline in harbor seals, changes in hatchery production, changes in fish species composition).

Ecological studies on killer whales emphasize the need to identify and protect critical feeding, transit, or social areas and rubbing beaches used by these animals (Matkin & Saulitis 1994, Heimlich-Boran 1988). Work attempting to identify these areas is being completed in FY98.

Nuclear DNA analysis of the microsatellite regions of Prince William Sound's killer whales will help determine whether the surviving members of AB pod are closely related to other resident whales in the Sound. It will detail aspects of the resident pod social structure and mating system. MtDNA analysis has demonstrated the genetic uniqueness of the AT1 group from residents as well as from other transients. Nuclear DNA analysis will clarify those differences. The loss of either AB pod or the AT1 group could represent a serious overall loss of genetic diversity.

Another gap in our understanding of killer whale behavior and ecology is the extent of their use of the Prince William Sound/Kenai Fjords region in the winter months. The remote hydrophone system is a cost-effective means of examining use by resident pods during the winter months. This could also provide an educational tool for the newy opened Alaska Sea Life Center and other institutions.

Some environmental contaminants have been linked to reproductive dysfunction in mammals. In FY98 we are completing our assessment of the levels of environmental contaminants in the killer whales particularly in the transient (marine mammal eating) killer whale populations which demonstrate little or no recruitment.

B. Rationale/Link to Restoration

Annual killer whale population monitoring will determine recovery status of AB pod and the AT1 transient group. The actual status of AB pod appears to be non-recovering at this time. Long term patterns will only be clarified by continued monitoring. A low level annual monitoring program was initiated in FY96 and is proposed to continue in FY99. A detailed summary of pod status was completed in FY97. Since all pods and whales are not observed in every year, annual monitoring will prevent extensive data gaps and allow certain determination of recruitment and mortalities in a much shorter time frame. An annual killer whale behavioral database of spanning 14 years now exists in a GIS format. It is accompanied by a photographic database the includes identiffications of all individuals from each frame of film for every encounter logged in the GIS system. 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 consistent and long-term to be meaningful.

The acoustic monitoring and final dialect analysis proposed here seeks to provide a cost-effective year- round extension of the monitoring program. We plan to work cooperatively with the Alaska Sea Life Center, Kenai Fjords National Park, and Port San Juan and Chenega Village residents. This will directly involve residents and visitors in the process of monitoring and restoration.

C. Location

This project is part of an ongoing killer whale research in Prince William Sound and the Kenai Fjords region, Alaska. The project involves the village of Chenega, Port San Juan Hatchery, the Alaska Sea Life Center, Kenai Fjords National Park, and other residents and visitors to the region. It operates cooperatively with the Kenai Fjords and Prince William Sound tourboat industry.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

There is great public concern and interest for killer whales in Prince William Sound and in Kenai Fjords. The rapidly expanding tourboat industry depends on a healthy killer whale population to attract and satisfy visitors and residents. We have been closely involved with 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. We have begun an educational program to provide guidelines for operations of vessels around whales for both the public and commercial operators, concentrating on the Kenai Fjords region. Our presentation of research results in Cordova, Seward, Kodiak, Homer, Chenega and Anchorage will continue.

With our supervision, the residents of the spill area will be directly involved in the killer whale project by assisting in monitoring and maintaining a remote hydrophone system and participating in the data analysis. Chenega or Port San Juan residents will be contracted to maintain the system in Prince William Sound and Kenai Fjords National Park and the Alaska Scence Center will provide maintanance and monitoring in Resurrection Bay.

We continue to collect observations and stories from native residents and others that will provide background for interpretation of our findings and place the work in a historical and cultural context.

PROJECT DESIGN

A. Objectives

1. Continue photographic monitoring program and determine status of resident killer whale pods, particularly AB pod. Examine the demographics of this pod in relation to other resident killer whale pods.

2. Monitor the AT1 group of transient killer whales to determine if there is further emigration or mortality or if there are signs of recovery to pre-spill distribution and abundance.

3. Monitor year round movements of resident and transient killer whales using remote hydrophones in Resurection Bay and southwestern Prince William Sound.

4. Final analysis of calls and separation of pod dialects necessary for interpretation of remote hydrophone data. Prepare for publication.

5. Compare calls of Prince William Sound resident pods with those of British Columbia resident pods.

6. Examine the relationship between Prince William Sound killer whales and those genetically analyzed in a concurrent study in British Columbia, prepare for publication.

7. Write up and publish a determination of the extent of gene flow between a) the EVOS-impacted AB killer whale pod and other resident killer whales frequenting Prince William Sound, and b) between the declining AT1 assemblage of transient killer whales and other killer whales in Prince William Sound and the Gulf of Alaska

8. Write up and publish a description of the mating system of Prince William Sound killer 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. Knowledge 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 NGOS in Prince William Sound/Kenai Fjords for the past fourteen 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 and tourboat operators that regularly report whale sightings. In addition requests for recent killer whale sightings will be made routinely on hailing Channel 16 VHF and working channel 77.

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. The killer whale encounter data sheet developed in 1995 and specifically tailored to GIS data entry requirements will be used. 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 at the time of GIS input. 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 grey 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 or N70 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.

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 twelve 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).

The primary vessel used to secure identification photographs will be a 27' diesel inboard/outboard powered vessel that can sleep two individuals (R.V. *Whale 2).* With sleeping accommodations and large fuel capacity, the R.V. *Whale 2* resupplies infrequently which greatly increases available time searching for or photographing whales.. This vessel will operate a total of 50 days, from early July through early September. 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. There will be some flexibility of schedule in response to sighting reports. The R.V. *Lucky Star* will also deliver fuel to designated locations and provide other logistical support for the operation of the R.V. *Whale 2.* The *Lucky Star* will operate a total of 3 days.

The report 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. Changes within AB pod will be examined with consideration for the age and sex structure of the pod and maternal groups within the pod. Frame by frame input of identification data from exposed film into VAX and IBM PC computer systems will occur and identifications tabulated by pod and by individual. Copies of killer whale encounter data and vessel logs will be made available to the EVOS Trustee Council and/or lead agency and this data will be archieved in the GIS database for potential future analysis. Frame by frame identification data will also be made available on disc. Copies of the GIS program and data base will also be made available by request to NGOS and the PWSSC.

Acoustic Monitoring

Pod specific dialects for resident killer whales have been determined from tape recordings made by several researchers in the Prince William Sound area and in Southeast Alaska during the spring and summer months of the years 1984 to 1997. Construction of a catalogue of pod specific dialects is ongoing and dependent on recordings that will be made during the FY98 field season. Specific calls from Prince William Sound transient (AT1 group) killer whales also have been catalogued (Saulitis 1993). A total of 8456 calls have been screened and digitized using a Kay Elemetrics Real Time Sound Spectrum Analyzer, Model 5500. Samples from this screening process were digitized using the Canary acoustic spectrum analysis software (The Cornell Bioacoustics Workstation). Calls from different killer whale pods and transient groups are being categorized using the same method used by John Ford in British Columbia, Canada. This process involves arbitrary acoustical identification paired with a visual and statistical comparison of sound spectra.

The final asssessment of repertoires of Prince WilliamSound killer whales will occur in FY99 and a paper readied for publication. Hopefully this will include the repertoires of the less frequently encountered pods from which we will attempt to obtain recordings from in FY98 and FY99. In addition, recordings from the remote hydrophone obtained in winter 1998-99 will be analyzed. The acoustic relationships between resident pods will be clarified and futher compared with genetic results. While similarities of mitochondrial DNA sequences or overall genetic similarity describes relatedness of pods within the past 10,000 to 20,000 years, dialects reflect the more redcent history of community divergence.

Because of movements of killer whales into the Kenai Fjords region in recent years, our second remote hydrophone will be placed in Resurrection Bay for FY98. An anchored and encased cable will run from the transmitter on shore to the hydrophone at a

depth of about 20 meters. The transmitter will be enclosed in a waterproof case and placed atop the bluff. It will be powered by deep cycle batteries stored in waterproof containers. A solar panel will charge batteries in summer months, in winter, National Park Service personnel will recharge and exchange batteries.

During summer months the hydrophones will be monitored from the R.V. *Whale 2* via broad band receiver as an aid in locating whales. During the summer and winter months in Kenai Fjords it will be monitored by the Alaska Sea Life Center and the National Park Service. It will be monitored in the Sound during winter months by Chuck Pratt and Sarah Mariner at Port San Juan Hatchery. The receivers will be connected to cassette recorders so that calls can be recorded. The receiver will be monitored on a regular scheduled basis and a log of operation maintained. The acoustic monitoring is projected to become a joint project with increasing involvement of the Alaska Sea Life Center and National Park Service with additional transmitters placed on the outer coast of Kenai Fjords region.

Genetic Analysis

In FY99 will we complete numerical and statistical analysis of the microsatellite DNA profiles of Prince William Sound killer whales, conduct a statistical comparison of allele frequencies between Prince William Sound populations of killer whales and killer whales biopsied off British Columbia, prepare our findings for publication, and submit them to refereed journals. Specific methods for each of the above objectives are listed below.

Objective 1 will be met by comparing microsatellite allele frequencies in both residents and transient from Prince William Sound to allele frequencies in resident and transients from British Columbia. Significant allele frequency differences between these regions would indicate that they are discrete in terms of both gene flow and emigration. A cline in allele frequencies would be suggestive of limited gene flow along the coast, and the absence of geographic structuring would indicate that substantial gene flow is occurring presently or has occurred recently. This analysis will compliment our mitochondrial DNA analysis (completed in FY97), which showed that females do not move permanently between populations, but which did not rule out inter-matings during temporary associations.

Objective 2 will be met by a statistical comparison of microsatellite allele frequencies in AB pod to other Prince William Sound resident pods, and in the AT1 transient group to the Gulf of Alaska transients, and AT1 transient assemblages. In the case of AB pod, microsatellite-based paternity exclusion tests will be used to determine the probable fathers of as many calves and juveniles as possible.

Objective 3 will be met by testing the following hypotheses:
(1) Resident killer whales do not move permanently between pods.
(2) Matings occur between and not within resident pods.

The first hypothesis predicts that pods consist of maternally-related individuals only, and will be tested by examining the pedigrees of well-sampled pods (AB, AE, AI, AK , AN) at seven independent microsatellite loci. Comparison of the genotypes of individuals at this combination of loci will provide a powerful test of immediate relatedness. The hypothesis will be refuted if pods include in their membership individuals that can be excluded, based on their genotypes, as immediate relatives of other pod members.

The second hypothesis predicts that offspring and their fathers will be found in different pods. The hypothesis will be considered refuted if microsatellite genotype comparisons exclude sampled males from other pods as potential fathers of the calves and juveniles in a given pod, while failing to exclude adult male pod members.

Sufficient DNA samples to meet these three objectives will havebeen collected by FY98 (however, additional opportunistic sampling to extend the mating system comparisons to more resident pods and to transients may be carried out). The laboratory component of the microsatellite analysis will be completed in FY98, and data analysis will be in progress.

Most equipment needed to complete the contracted field research will be provided by the North Gulf Oceanic Society, including binoculars, nets, directional hydrophones, photographic equipment and biopsy equipment. Additional remote hydrophones, transmitters, receivers, and recorders will be purchased with matching monies. Additional supplies and minor equipment will be purchased as necessary. Apple Macintosh and IBM compatible computers owned by NGOS as well and the GIS system available at the PWSSC will be used in data storage.

C. Contracts and Other Agency Assistance

The entire project will be completed under the auspices of the North Gulf Oceanic Society.. NGOS will provide a technician to enter data collected in 1999 into the GIS database using the menu interface provided by the Prince William Sound Science Center. Genetic analysis will be completed by Lance Barrett-Lennard of Pacific Ecological Services at the University of British Columbia. Acoustic analysis will be completed by Harold Jurk at the University of British Columbia. The NGOS will contract residents of Chenega Village or Port San Juan 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 or the Society will use its own vessels for the project.

SCHEDULE

A. Measurable Project Tasks for FY99

Oct 1-30 1998: Summarize monitoring fieldwork for FY98. Input data into GIS system.

Oct. 1 - Dec. 31: Analysis and writeup of final report for Comprehensive Killer Whale Investgations.

Oct. 1 - Dec. 31: Analysis of photographs from 1998 fieldwork. Complete contaminant analysis of 1998 samples.

Oct. 1 - Dec. 31: Complete numerical and statistical analysis of pedigree and allele frequency data (begun in FY 98).

Oct. 1-Dec. 31: Acoustic analysis of killer whale calls from previous year.

Jan. 5, 1999: Draft final report for Comprehensive Killer Whale Investigations due.

Jan. 1 - July 31: Prepare and submit genetic papers.

Jan. 1 - July 31: Prepare and submit paper on acoustic separation of resident pods.

March 1 - April 15: Address review comments on draft FY98 final report and submit final report.

Aug. 1-Sept.30: Respond to reviewers comments on genetics papers and acoustic paper and revise as required.

October 1- March 30: Continue winter recordings from remote hydrophones.

July -September: Killer whale monitoring emphasis field work. Monitor hydrophone from research vessel as possible.

The R.V.*Whale 2* will operate for 50 days in July and August September. 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. A portion of the operational expense will be funded by matching monies. A small percentage of this field time may be used in other months if sighting reports indicate it would be advantageous.

B. Project Milestones and Endpoints

The FY99 killer whale project will continue the reduced annual photoidentification monitoring program and the acoustic monitoring program initiated in FY1997. Future fieldwork will involve population monitoring and acoustic monitoring. Final analysis and publication of genetic data, final definition of acoustic dialects and publication will be completed in FY99 as well as publication of final contaminant analysis results.

C. Completion Date

All phases of the project should be completed in FY99 except for the ongoing limited monitoring and remote hydrophone projects.

PUBLICATIONS AND REPORTS

Final report: Comprehensive Killer Whale Investigations (Draft January 1999, Final April 1, 1999)

Barrett-Lennard, L.G., Matkin, C.O., Saulitis, E.L. Ellis, G.M. 1999. Molecular Ecology. Effective population sizes, patterns of gene flow, and prospects for recovery of *Exxon Valdez* oil spill-impacted AB pod and AT1 assemblage killer whales in Prince William Sound, Alaska.

Barrett-Lennard, L.G., Matkin, C.O., Saulitis, E.L., Ellis, G.M., Heise, K.A., 1999. Evolution. Niche partitioning, and population segregation of killer whales in Prince William Sound, Alaska: development, maintenance and evolutionary implications.

Barrett-Lennard, L.G., Matkin, C.O., Ellis, G.M., Saulitis, E.L. 1999. Animal Behaviour. Mating patterns in Prince William Sound Resident Killer Whales.

We anticipate submitting a fourth article, pertaining to objective 1 (the comparison of killer whales from British Columbia to Prince William Sound), in FY 2000.

Jurk, H., E.L. Saulitis, and C.O. Matkin. Dialects of Prince William Sound resident killer whales. (Draft for Canadian Journal of Zoology)

Ylitalo, G, C.O. Matkin, J. Stein. Patterns in contaminant levels in Prince William Sound killer whales.

PROFESSIONAL CONFERENCES

Funding to be obtained elsewhere.

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 program to investigate killer whale recovery and the interactions of killer whales and harbor seals. It will be integrated with the harbor seal trophic studies (project 96064, Kathy Frost, project leader). In FY99 this project will rely on approximately $8,000 in matching funds from foundations or other private sources. A cooperative program with the University of British Columbia has allowed substantial reduction in laboratory costs for genetic analysis. As a non-profit research institution familiar with private funding sources and cooperative programs, NGOS can work with the Trustee Council cooperation to maximize potential for matching funds in the future.

PROPOSED PRINCIPAL INVESTIGATOR:

Craig O. Matkin
North Gulf Oceanic Society
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Phone/Fax (907) 235-6590
COMATKIN@xyz.net

KEY 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. In 1994 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*.) Mr. Matkin also teaches at the University of Alaska, Lower Kenai Penninsula Campus.

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 is a principal field biologist for the monitoring segment of this project (photoidentification) and will co-operate the research vessel *Whale 2* aid in maintanance of the remote hydrophone. She will make ready and maintain all necessary equipment, complete photoidentification work and all logs and data sheets as required. She will provide entry of field data into the GIS system.

Saulitis completed her MS thesis "The Behavior and Vocalizations of the AT Group of Killer Whales in Prince William Sound, Alaska." in 1993. She coauthored the "Biology

and Management of Killer Whales in Alaska" for the U.S. Marine Mammal Commission and "Killer Whales" for the EVOS Restoration notebook series. She has done extensive analysis of killer whale calls and has operated research vessels in Prince William Sound since 1988.

Graeme Ellis has participated in killer whale photoidentification studies in Canada and Alaska for over 22 years. Ellis will do all final identifications of individual killer whales. 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 photographs of each whale biopsied.

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.

Lance Barrett-Lennard (MS, University of British Columbia). Lance (an American citizen) is a Phd. candidate at the University of British Columbia. He conducted or supervised all genetic lab work at the University of British Columbia for the killer whale genetic studies. He will also provide final interpretation and publication of those results.

Barrett-Lennard has researched killer whales for 11 years, specializing in their acoustics and genetics. He has operated research vessels in Prince William Sound and British Columbia.

Harold Jurk Harald is a Phd. candidated at the University of British Columbia and specalizing in cetacean acoustics. He is conducting analysis and interpretation of killer whale acoustic data collected over the past 13 years in Prince William Sound/Kenai Fjords from vessels and from remote hydrophones.

LITERATURE CITED

Matkin, C.O., G. Ellis, M. Dahlheim, and J. Zeh. 1994. Status of killer whales in Prince William Sound, 1984-1992. in T. Loughlin, ed. Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, CA.

Queller,DC; Strassmann, JE; Hughes,CR 1993. Microsatellites and kinship. Trends Ecol. Evol. 8(8), 285-288.

Saulitis, E. 1993. The behavior and vocalizations of the AT group of transient killer whales in Prince William Sound, Alaska. MSC. Thesis, Instituite of Marine Science, University of Alaska, Fairbanks.

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1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed Fy 1999
Personnel		$31,370.0
Travel		$1,955.0
Contractual		$33,050.0
Commodities		$6,170.0
Equipment		$0.0
Subtotal	$0.0	$72,545.0
Indirect		$7,255.0
Project Total	$0.0	$79,800.0
Full-time Equivalents (FTE)		9.2
Other Resources		$8,000.0

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY2000	Estimated FY2001	Estimated FY2002	Estimated	
	$55,000.0	$50,000.0	$50,000.0		

Dollar amounts are shown in thousands of dollars.

Comments:

1999

Prepared:

Project Number: 99012
Project Title: Killer Whale Monitoring
Name: North Gulf Oceanic Society

FORM 4A
Non-Trustee
SUMMARY

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1998
Craig O. Matkin	P.I. Field Biologist		3.0	4400.0		13,200.0
Graeme Ellis	Photo Analyst		1.0	3500.0		3,500.0
Eva Saulitis	Field Biologist		2.5	2800.0		7,000.0
	Field Assistant		0.7	1500.0		1,050.0
	Data entry technician		0.3	2800.0		840.0
	Acoustic Analyst		1.7	3400.0		5,780.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		9.2	18400.0	0.0	
					Personnel Total	$31,370.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 1998
Homer/Vancouver (RT)		650.0	1	3	75.0	875.0
Fairbankds/:HomerRT		380.0	1			380.0
Homer/AnchorageRT		150	2	4	100.0	700.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1,955.0

1999

Prepared:

Project Number: 99012
Project Title: Killer Whale Monitorng
Name: North Gulf Oceanic Society

FORM 4B
Personnel
& Travel
DETAIL

1998 EXXON VALDEZ TRU[illegible]L COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed FY 1998
Description	
Pacific Ecological Services (genetic analysis and interpretation)	8,800.0
Hydrophone maintenance	2,000.0
27' research vessel (Whale 2) 50 days @ 400/day	20,000.0
Supply/Research Vessel 3 days @ 750/day	2,250.0
Contractual Total	$33,050.0

Commodities Costs:	Proposed FY 1998
Description	
Phone	280.0
Field Food ($14/person/day)	1,400.0
E-mail	120.0
Fuel	1,800.0
Film/Processing/Printing	1,600.0
Field Supplies	320.0
Deep Cycle batteries	180.0
Shipping	470.0
Commodities Total	$6,170.0

1999

Prepared:

Project Number: 99012
Project Title: Killer Whale Monitoring
Name: North Gulf Oceanic Society

FORM 4B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			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	
	1	
	1	

1999

Prepared:

Project Number: 99012
Project Title: Killer Whale Monitoring
Name: North Gulf Oceanic Society

FORM 4B
Equipment
DETAIL

Project Title: Mechanisms of Impact and Potential Recovery of Nearshore Vertebrate Predators (NVP)

Project Number:	99025
Restoration Category:	Research
Proposer:	Leslie E. Holland-Bartels and NVP Scientists[1]
Lead Trustee Agency:	U.S. Geological Survey, DOI
Cooperating Agencies:	ADFG, NOAA, USFS
Alaska SeaLife Center:	
Project Duration:	5th year, 5-year project
Cost FY 99:	$701,300
Geographic Area:	western Prince William Sound
Injured Resource/Service:	sea otter, river otter, harlequin duck, pigeon guillemot, intertidal organisms, subtidal organisms

ABSTRACT

Fiscal year 99 is the closeout year for the Nearshore Vertebrate Predator project. Funds for this year are for data analysis, final report writing, manuscript preparation, poster preparation, and presentation of results at professional meetings.

The Nearshore Vertebrate Predator Project (NVP) makes an integrated assessment of trophic, health, and demographic factors across a suite of apex predators injured by the spill to determine mechanisms constraining recovery and to improve our knowledge of the status of recovery. Primary hypotheses are: 1) Recovery of nearshore resources injured by EVOS is limited by recruitment processes; 2) Initial and/or residual oil in benthic habitats and in or on benthic prey organisms has had a limiting effect on the recovery of benthic foraging predators; and 3) EVOS induced changes in populations of benthic prey species have influenced the recovery of benthic foraging predators.

[1]NVP scientists and affiliations are listed under the PERSONNEL Section

INTRODUCTION

This 5-year project, *Mechanisms of Impact and Potential Recovery of Nearshore Vertebrate Predators* (NVP), was approved by the Trustees in March 1995 and began data collection in late summer, 1995. The project examines the status of recovery of four selected top vertebrate predators (sea otter, river otter, pigeon guillemot, and harlequin duck) in the nearshore environment of Prince William Sound (PWS) and is designed to better assess their recovery and determine mechanisms constraining that recovery.

Work completed in FY 95 and early FY 96 included completion of an extensive data management plan and a data archiving and file serving system to facilitate exchange and integration of project data among the fifteen project scientists. In those years, the sea otter, harlequin duck, and avian copredator components were initiated; however, primary focus was on pilot efforts to refine prey sampling strategies for further study. Full field seasons for sea otters, harlequin ducks, river otters and pigeon guillemots took place in FY96 and FY97. The original FY98 plan was to begin final data analysis and manuscript and final report writing and to conduct minimal field work as was necessary to finish some objectives for some components of the project. In response to January 1997 and 1998 peer reviewer comments, FY98 was a full field year for sea otters, pigeon guillemots, and invertebrates as indicators of sea otter recovery status. FY98 Funds that were to be used in data analysis and beginning report writing were required to address concerns of the peer reviewers. Consequently, FY99 will bear most of the fiscal burden for final data analysis, manuscript and final report writing.

NEED FOR THE PROJECT

A. Statement of Problem

The nearshore marine ecosystem of PWS plays a critical role in the commercial, subsistence, and recreation economy of southcentral Alaska. Because of shorelines and coastal physiography, the nearshore ecosystem served as a repository for much of the oil spilled during the *Exxon Valdez* oil spill (EVOS). As a result, many of the injured resources under study by the EVOS Trustees Council are components of the nearshore system. Thus, the NVP study describes a research approach for assessing the biological and ecological significance of trophic issues and contaminants present in the nearshore environment. We focus on the status of system recovery and a suite of injured apex predators as indicators of environmental stress--the invertebrate feeding sea otter and harlequin duck, and fish feeding pigeon guillemot and river otter. NVP takes a multispecies, integrated approach to assess several potential key mechanisms constraining recovery of the nearshore system.

B. Rationale/Link to Restoration

Field efforts under NVP have addressed the question of recovery for four vertebrate predator species known to have been injured in the EVOS. For each species we asked "Is there evidence of recovery and if not, is it due to oil, food or demographic constraints?"

The final data analyses and final report writing will take place in this closeout year for NVP. The synthesis of analyses of demographic, health and trophic parameters over the life of the project will result in a better understanding of processes in the nearshore environment. This, in turn, will also allow a better understanding of possibilities for restoration of these species.

C. Location

This project was conducted in western PWS (Figure 1). For all four predator species, assessments were made at two areas, one oiled and one unoiled. Northern Knight Island was the oiled area for sea otter, river otter and harlequin duck assessments, and Naked Island was the oiled area for pigeon guillemots. Montague Island was the unoiled area for sea otter and harlequin duck assessments, whereas Jackpot Bay was the unoiled area for pigeon guillemots and river otters.

COMMUNITY INVOLVEMENT

A Traditional Ecological Knowledge workshop was planned in Chenega Village in March, 1998. Poor weather resulted in cancellation of the workshop. There will be another attempt in September 1998. Information gleaned from interactions there, and helpful in our synthesis, will be part of the final report.

PROJECT DESIGN

A. Objectives

Objective 1. Final data analyses and final report writing.

Objective 2. Manuscript preparation and submission.

Objective 3. Poster and presentation preparation.

Objective 4. Presentations at multiple professional meetings.

B. Methods

The data analyses, final report writing, manuscript prep and presentation of results will be a combination of individual and collaborative efforts. Travel to meet as group(s) will be required.

SCHEDULE

A. Measurable Project Tasks for FY 99

Draft final report completed by 30 September 1999.
Final report submitted to EVOS Restoration Office by 20 December 1999

C. Completion Date

20 December 1999

PUBLICATIONS AND REPORTS

A list of 61 proposed manuscripts stemming from work on NVP is in Appendix A. The list indicates manuscripts for which funding is requested in FY99. For those to be published after FY99, tasks funded to support manuscript preparation are listed.

PROFESSIONAL CONFERENCES

Presentations at professional conferences have been proposed for FY99. Requests for funding to attend the meetings has been submitted in the FY99 budget. We will notify the Trustees of presentation titles as they are determined.

NORMAL AGENCY MANAGEMENT

The 1995 proposal was developed as a collaborative effort of a variety of research scientists from State, federal, university, and private centers under the facilitation of the U.S. Geological Survey of the Department of Interior. The USGS has no management function or responsibilities but provides information for the management of DOI trust species as its primary mission. The NVP is a focused 5-year project to identify factors constraining recovery of selected species and provide additional tools to assess status. Upon completion, the developed tools can be transferred to the appropriate management agency for further implementation.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As in previous years, collaboration will continue. Two or three meetings of all PIs may be required for the synthesis of all analyses.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The NVP project continues to follow the original detailed project description of 95025 submitted and approved March 1995.

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PERSONNEL

Dr. Brenda Ballachey, B.S., M.S. Colorado State University, Ph.D. Oregon State University, is a Research Physiologist at the Alaska Science Center, USGS. She has been project manager and senior scientist for the damage assessment and restoration work on sea otters since 1990. She has authored or coauthored over 15 peer reviewed scientific publications and was responsible for or author on 19 NRDA reports recently completed on sea otter issues.

Mr. Jim Bodkin, Research Wildlife Biologist, is the Project Leader for sea otter population research for the Alaska Science Center of USGS. He has over 18 peer-reviewed scientific publications and is involved in an active sea otter research program. He has studied and published on sea otter foraging ecology and community structuring since 1988 and has been principal investigator for sea otter survey methods development.

Dr. R. Terry Bowyer, Professor of Wildlife Ecology, University of Alaska Fairbanks. Dr. Bowyer has an extensive publication record (46). He has conducted extensive research on river otters and impacts of EVOS on this species.

Dr. Thomas A. Dean, is President of the ecological consulting firm Coastal Resources Associates, Inc, (CRA) in Vista, CA. He has over 20 years of experience in the study of nearshore ecosystems, and has authored over 20 publications, including several papers dealing with sea urchin and kelp interactions. He has extensive experience in long-term monitoring studies with marine plants and invertebrates. He has had a major role in both the shallow subtidal and intertidal EVOS investigations since 1989.

Dr. Lawrence Duffy, Professor of Chemistry and Biochemistry at the University of Alaska Fairbanks has been working in the area of toxicology for 15 years and is a member of the International Society of Toxicology. He has studied various bacterial and mammalian toxins. Since the *Exxon Valdez* oil spill, he has published four papers related to developing biomonitors. He is currently funded for two major environmental studies in Alaska. At the University, he teaches "Environmental Biochemistry and Biotechnology" and is a member of the Environmental Chemistry Program and Mammal Group.

Mr. Daniel Esler is a Wildlife Research Biologist for the Alaska Science Center, U.S. Geological Survey- Biological Resources Division with a MS in Wildlife Ecology from Texas A&M University. He has worked primarily with aquatic birds in the fields of reproductive physiology, habitat selction, nesting ecology, and population dynamics, including 7 years of experience in Alaska and Russia. He has 10 publications in national peer reviewed journals.

Dr. Leslie Holland-Bartels, BS University of Massachusetts, MS Louisiana State University, Ph.D. Purdue University is the head of the Marine and Freshwater Ecology Research Program for the Alaska Science Center, USGS and directs research of 17 senior scientists in the areas of seabirds, marine mammals, anadromous fisheries, and associate habitat and population issues. She has 20 years experience in aquatic ecology and over 30 publications in national scientific

journals on subjects ranging from contaminants, ecology of invertebrates, fisheries, water quality and aquatic ecology.

Dr. Stephen C. Jewett has been a Research Associate at the School of Fisheries and Ocean Science, University of Alaska Fairbanks, since 1975. During this time he has been involved in numerous benthic and intertidal investigations throughout Alaska that emphasize assessment and/or monitoring. He has authored more than 30 publications in scientific journals and books. He has been the coordinator of the federal/state EVOS shallow subtidal investigations in Prince William Sound (1989-1994).

Dr. Lyman MacDonald, B.S., M.S. Oklahoma State University, PhD. Colorado State University, is a biometrician with 25 years of comprehensive experience in the application of statistical methods to design, conduct, and analyze environmental and laboratory studies. He has designed and managed both large and small environmental impact assessment and monitoring programs.

Dr. David McGuire is Assistant Professor of Landscape Ecology and Assistant Leader of the Alaska Cooperative Fish and Wildlife Research Unit at the University of Alaska, Fairbanks. He received his Ph.D. in Biology from UAF in 1989. His research interests include operation of ecological processes at large spatial scales, ecological modelling, and global change biology.

Dr. Charles E. O'Clair, B.S. Zoology, 1963 University of Massachusetts, Ph.D. Fisheries, 1977, University of Washington. 1977-present: Fishery Biologist (Research), National Marine Fisheries Service, Auke Bay Laboratory, Juneau, Alaska. Research experience includes seven years of field and laboratory work on the effects of oil pollution and, later, the effects of logging on benthic invertebrates, eleven years of research on the ecology and behavior of Dungeness, king and Tanner crabs in relation to the management of these species, four years of research on the impact of the *Exxon Valdez* Oil Spill on subtidal sediments in Prince William Sound and the Gulf of Alaska and one year on the recovery of subtidal sediments in Prince William Sound.

Dr. Alan Rebar is Dean of the School of Veterinary Medicine and Professor of Veterinary Clinical Pathology at Purdue University. He is internationally recognized as an expert in the field of clinical pathology and toxicology. He has been involved in EVOS studies of sea and river otters since 1991.

Dr. Paul W. Snyder is an Assistant Professor of Pathology and Immunotoxicology and Director of the Clinical Immunology laboratory of the Department of Veterinary Pathobiology, Purdue University. He is also a Diplomate of the American College of Veterinary Pathologists. His research interests are in the area of mechanism based studies on the pathology and immunology of xenobiotics on biological systems. He has an NIH-funded project related to the immunobiology of environmental contaminants.

Dr. Glenn R. VanBlaricom has conducted research on coastal ecosystems since 1970, and has been involved in research on sea otters and their ecosystems for 17 years. Dr. VanBlaricom

studied relationships of sea otters and intertidal mussels in Prince William Sound from 1978 through 1986 and published papers on population size structure and individual growth rate of mussels, and effects of foraging by sea otters. Dr. VanBlaricom worked on sea otter rescue and rehabilitation in the immediate aftermath of EVOS, primarily in the Kenai region, and has published one paper on rehabilitation strategies. Currently Dr. VanBlaricom is Assistant Unit Leader (Wildlife), Washington Cooperative Fish and Wildlife Research Unit, and is Associate Professor of Fisheries in the School of Fisheries, University of Washington. He has 24 peer-reviewed scientific publications.

Cooperators:

Mr. Timothy D. Bowman is a Wildlife Biologist for the U.S. Fish and Wildlife Service, Migratory Bird Management Project. He has a Master of Science in Wildlife Management, Department of Wildlife, University of Maine, Orono. He was principal investigator for the *Exxon Valdez* oil spill damage assessment study on bald eagles, and has been involved with aerial surveys of waterfowl and seabirds in Alaska. He has 6 publications in national peer reviewed journals.

Dr. Dan Roby has conducted research on the physiological ecology and reproductive energetics of high latitude seabirds for the last 19 years. His field research on alcid reproductive biology has been in Alaska, Newfoundland, and Greenland, and he has conducted research on pigeon guillemots as bioindicators of nearshore ecosystem health in Kachemak Bay, Alaska. Dr. Roby's research on seabird reproductive energetics in the Arctic and Antarctic has been supported by the National Science Foundation. Roby is the Assistant Unit Leader of the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University. He has over 35 peer-reviewed scientific publications, 20 of them on topics in seabird ecology.

Dr. John Stegeman is a research scientist at Woods Hole Oceanographic Institution. He is internationally recognized as an expert in the area of cytochrome P450 biomarkers of hydrocarbon exposure.

Appendix A. Expected Manuscripts from NVP Project 1998-2001.
The year listed is the anticipated submission date to the journal. For publications later than 1999 we've listed *planned activities for which we are requesting funding in FY99.*

1. Adkison, M., B. Ballachey, J. Bodkin, and L. Holland-Bartels. 1999. A Bayesian approach to integrating multiple studies testing ecosystem-level hypotheses: sea otters after the *Exxon Valdez* Oil Spill. in Fishery Stock Assessment Models for the 21st Century: Combining Multiple Information Sources. 15th Annual Wakefield Fisheries Symposium. In revision. *Funding requested for revision.*

2. Ballachey, B. and NVP. 1999. Expression of cytochrome P450 in coastal marine vertebrates in Prince William Sound. *Funding requested for sample processing, data analysis, writing.*

3. Ballachey, B. A. Rebar, L. Duffy, P. Snyder, and D. Esler. 1999. Blood chemistry variation in harlequin ducks from Prince William Sound, Alaska. *Funding requested for data analysis, writing.*

4. Ballachey, B., J. Bodkin, D. Monson and P. Snyder. 2000. Bioindicators in sea otters. *Funding requested for coordination, data analysis, writing.*

5. Ben-David, M., R. Bowyer, L. Duffy, D. Roby, and D. Schell. Accepted. Social behavior and ecosystem processes: effects of river otters latrine sites on nutrient dynamics of terrestrial vegetation. Ecol. *Funding requested for publication costs.*

6. Ben-David, M., G. Blundell, R. Bowyer, T. Dean, S. Jewett, and P. Groves. 2000. Effects of prey abundance on diet composition and population levels of coastal river otters. *Funding requested for coordination, data analysis, writing.*

7. Blundell, G., J. Kern, R. Bowyer and L. Duffy. Accepted. Capturing river otters: A comparison of Hancock and leg-hold traps. Wildl. Soc. Bull. *Funding requested for publication costs.*

8. Blundell, G., R. Bowyer, J. Kie, and J. Blake. 2001. Principal-components analysis of blood parameters in river otters: A new approach. *Funding requested for data analysis, statistical methods development.*

9. Blundell, G., M. Ben-David, R. Bowyer, H. Kruuk, T. Dean, S. Jewett. 2001. Energetics requirements of river otters: a test of interactions between quality and quantity of prey. *Funding requested for data analysis, statistical methods development.*

10. Blundell, G., M. Ben-David, R. Bowyer, H. Kruuk, T. Dean, S. Jewett. 2000. Sexual differences in the energetics of river otters: Effects of fish abundance and quality. *Funding requested for coordination, data analysis.*

11. Blundell, G., R. Bowyer, M. Ben-David. 2001. Effects of gender, reproduction, and diet on blood chemistry of river otters. *Funding requested for data analysis.*

12. Blundell, G., M. Ben-David, R. Bowyer, T. Dean, S. Jewett. 2001. Effects of resource dispersion on home range, diet, and social relationships of male and female river otters in a coastal environment. *Funding requested for data analysis.*

13. Blundell, G., P. Groves, M. Ben-David, R. Bowyer. 2000. Genetic relatedness and spatial organization in river otters. *Funding requested for sample processing, data analysis completion.*

14. Bodkin, J., B. Ballachey, D. Monson. 1999. The status of sea otter recovery in Prince William Sound; 10 years later. Cons. Biol. *Funding requested for synthesis, writing.*

15. Bodkin, J., B. Ballachey, M. Udevitz. 2000. Evaluation of a sea otter recovery model with empirical population data. J. Wildl. Man. *Funding requested for model refinement, data analysis, writing.*

16. Bodkin, J., D. Monson, T. Dean, S. Jewett, G. VanBlaricom, A. Fukuyama, C. O'Clair. 1999. Prey availability and sea otter population recovery after the *Exxon Valdez* oil spill. *Funding requested for coordination, data analysis, writing.*

17. Bowyer, R. B. Ballachey, G. Blundell, A. Rebar et al. 1999. Hematology and serum chemistry in sea otters and river otters. *Funding requested for coordination, data analysis, writing.*

18. Bowyer, R. et al. 1999. Recovery of river otters after the Exxon Valdez Oil Spill: An overview of the evidence. *Funding requested for writing.*

19. Dean, T. and J. Bodkin. 1999. Predator/prey relations as indicators of predator population status: making practical uses of paradigms in ecology. Draft ms. Ecol. Appl. *Funding requested for revisions of manuscript.*

20. Dean, T., S. Jewett, and D. Jung. 1999. Spatial distributions and habitat preferences of green sea urchins in Prince William Sound, Alaska. *Funding requested for data analysis, writing.*

21. Dean, T., J. Bodkin, S. Jewett, C. O'Clair, and G. VanBlaricom. 1999. Prey availability and the recovery of sea otters in Prince William Sound, Alaska. *Funding requested for coordination, data analysis, writing.*

22. Duffy, L., R. Bowyer, G. Blundell, D. Sentman. 1999. Fecal porphyrins in river otters and pigeon guillemots. *Funding requested for data analysis completion, writing.*

23. Duffy, L., M. Hecker, G. Blundell, R. Bowyer. 1999. River otters as a sentinel species: Effect and detection of crude oil on fur. *Funding requested for data analysis, writing.*

24. Duffy, L., M. Ben-David, M. Hecker, G. Blundell. 1999. Effect of diet composition on mercury levels in river otters: Evidence from stable isotope analysis. *Funding requested for data analysis, writing.*

25. Duffy, L., R. Bowyer, G. Blundell, D. Sentman. 1999. P450-haptoglobin relationships in river otters inhabiting oiled and non-oiled areas of Prince Willliam Sound, Alaska. *Funding requested for data analysis, writing.*

26. Esler, D. 1998. Estimating body lipid and lean mass of female harlequin ducks during wing molt. *Funding requested for manuscript revision.*

27. Esler, D. 1999. Body composition and mass variation of harlequin ducks during wing molt in Prince William Sound, Alaska. *Funding requested for data analysis, writing.*

28. Esler, D. 1999. Timing and duration of wing molt of harlequin ducks in Prince William Sound, Alaska. *Funding requested for data analysis, writing.*

29. Esler, D. 1999. Survival of adult female harlequin ducks during wing molt. *Funding requested for data analysis, writing.*

30. Esler, D. 1999. Philopatry and dispersal of harlequin ducks during wing molt and winter. *Funding requested for data analysis, writing.*

31. Esler, D., T. Bowman, T. Dean, S. Jewett, and L. McDonald. 1999. Factors influencing wintering harlequin duck density and distribution in Prince William Sound. *Funding requested for coordination, model development, writing.*

32. Fukuyama, A., and G. VanBlaricom. 1999. Bivalve populations in Prince William Sound prior to the return of sea otters: What caused their demise? *Funding requested for data analysis, writing.*

33. Fukuyama, A., and G. VanBlaricom. 1999. Effects of sea otter predation on subtidal bivalve populations in Prince William Sound, Alaska. *Funding requested for complete analysis, writing.*

34. Fukuyama, A., and G. VanBlaricom. 2000. Population ecology of subtidal clams in Prince William Sound, Alaska following the *Exxon Valdez* oil spill. *Funding requested for sample processing, analysis.*

35. Fukuyama, A., and G. VanBlaricom. 2000. Larval availability and recruitment of bivalve species: Residual effects of oil following the *Exxon Valdez* oil spill. NOTE: Gail Irvine may be a co-author on this one. *Funding requested for sample processing, analysis.*

36. Gage, T., and G. VanBlaricom. 1999. Effects of invertebrates as clam predators in Prince William Sound, Alaska, with implications for sea otters. *Funding requested for writing.*

37. Gage, T., and G. VanBlaricom. 1999. Estimated feeding rates of *Pycnopodia helianthoides* on *Protothaca staminea* in Prince William Sound, Alaska. *Funding requested for writing.*

38. Gage, T., and G. VanBlaricom. 2000. Size frequency patterns of *Pycnopodia helianthoides* over time in Herring Bay, Prince William Sound, Alaska. *Funding requested for analysis completion, writing.*

39. Holland-Bartels, L. and NVP. 2000. An integrated approach to understanding nearshore ecosystem recovery from the Exxon Valdez Oil Spill: What to do when all the puzzle pieces don't exist? target journal-- BioScience. *Funding requested for coordination, writing.*

40. Holland-Bartels, L. and NVP. 2000. Status and factors constraining recovery of a nearshore coastal ecosystem from oil spill contamination. target journal--Ecology. *Funding requested for coordination, cross-section analyses.*

41. Jewett, S., M. Hoberg, and A. Blanchard. 1999. Aspects of the biology of the helmet crab *Telmessus cheiragonus* (Tilesius) in Prince William Sound, Alaska. *Funding requested for analysis completion, writing.*

42. Jewett, S., M. Hoberg, A. Blanchard, and H. Feder. 1999. Diet of the sea star *Pycnopodia helianthodes* (Brandt) in eelgrass habitats in Prince William Sound following *Exxon Valdez* Oil Spill. *Funding requested for analysis completion, writing.*

43. Lanctot, R., K. Scribner, D. Esler, B. Goatcher, and D. Zweifelhofer. 1998. Harlequin duck recovery after the *Exxon Valdez* oil spill: a population genetics perspective. Auk. In internal review. *Funding requested for manuscript revision.*

44. Lindeberg, M., C. O'Clair and S. Saupe. 1999. Long-term changes in mussel (*Mytilus trossulus*) abundance and growth at a heavily oiled bay in Prince William Sound, Alaska. Mar. Biol. *Funding requested for data analysis, writing.*

45. Mather, D., and D. Esler. In review. Evaluation of bursal depth as an indicator of age class of harlequin ducks. J. Field Ornithol. *Funding requested for journal revision.*

46. Monson, D., J. Bodkin. 1999. A diet based energetics model for estimating activity-time budgets in sea otters. Mar. Mam. Sci. *Funding requested for final model development, writing.*

47. Monson, D., J. Bodkin and B. Ballachey. 2000. Body condition as an index to population status in sea otters. J. Mamm. *Funding requested for synthesis of all data, model development.*

48. Mulcahy, D. and D. Esler. 1998. Intra-operative and immediate post-release mortality of harlequin ducks implanted with abdominal radio transmitters equipped with percutaneous antennas. In journal review. *Funding requested for journal revisions.*

49. Mulcahy, D., D. Esler, and M. Stoskopf. 1998. Loss from harlequin ducks of abdominally-implanted radio transmitters equipped with percutaneous antennas. J. Field Ornithol. In journal review. *Funding requested for journal revisions.*

50. O'Clair, C. and M. Lindeberg. 1999. Growth and production of *Mytilus trossulus* in two areas with different histories of oiling in Prince William Sound, Alaska. Marine Ecology - Progress Series. *Funding requested for final data analysis, writing.*

51. O'Clair, C., M. Lindeberg, and S. Saupe. 1999. Regional differences in the growth of *Mytilus trossulus* in Cook Inlet, Prince William Sound, and Auke Bay Alaska. Veliger. *Funding requested for final data analysis, writing.*

52. O'Clair, C. Sigler and M. Lindeberg. 1999. A population model for *Mytilus trossulus* in Prince William Sound, Alaska. J. Exp. Mar. Biol. Ecol. *Funding requested for final data analysis, writing.*

53. Sauer, T., M. Ben-David,, and R. Bowyer. 1998. A new application of the adaptive kernel method: estimating linear home ranges of river otters. Wildl. Soc. Bull. In journal review. *Funding requested for final journal revision.*

54. Scribner, K., R. Lanctot, S. Talbot, Pierson, D. Esler, Dickson, B. Goatcher, and D. Zwiefelhofer. 1998. Limited phylogeographic structure in discontinuously distributed populations of Harlequin ducks: A species-wide perspective with conservation implications. Molecul. Ecol. *Funding requested for final journal revision.*

55. Seiser, P., D. McGuire, G. Golet, D. Roby, and D. Irons. 1999. Breeding biology of pigeon guillemots in southwestern Prince William Sound, Alaska. *Funding requested for final data analysis, writing.*

56. Seiser, P., D. McGuire, D. Roby, G. Golet, and D. Irons. 1999. Growth and diet of pigeon guillemots in southwestern Prince William Sound, Alaska. *Funding requested for final data analysis, writing.*

57. Seiser, P., D. McGuire, L. Duffy, G. Golet, Litzow, D. Roby, D. Irons, and J. Piatt. 1999. Comparison of blood chemistry in pigeon guillemot chicks among colonies in Prince William Sound and Kachemak Bay, Alaska. *Funding requested for final data analysis, writing.*

58. Snyder, P. and B. Ballachey. 1998. CYP1A1 gene expression in sea otters (*Enhydra lutris)*: quantitative polymerase chain reaction to measure CYP1A1 mRNA in peripheral blood mononuclear cells. Toxicol. Sci. In internal review, Purdue. *Funding requested for journal revisions.*

59. Trust, K., D. Esler, J. Stegeman, Woodin, and Wolfe. 1999. Comparison of cytochrome P450 induction in sea ducks from oiled and unoiled areas of Prince William Sound. *Funding requested for final analysis, writing.*

60. VanBlaricom, G. 1999. Assessing wildlife population status through evaluation of ecosystem configuration: The confounding effects of uncertainty and nondeterministic processes. *Funding requested for synthesis and writing.*

61. VanBlaricom, G., D. Esler, M. Bishop, C. O'Clair, J. Bodkin and T. Gage. 1999. Competition among top-level carnivores in benthic ecosystems of Prince William Sound, Alaska. *Funding requested for coordination, model development, writing.*

MANUSCRIPTS BY CATEGORY: Numbers correspond with the list of proposed manuscripts.

sea otters: 2, 4, 14, 15, 16, 17, 19, 21, 33, 36, 46, 47, 57.

sea ducks: 2, 3, 26, 27, 28, 29, 30, 31, 43, 45, 48, 49, 54, 59.

river otters: 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 23, 24, 25, 53.

pigeon guillemots: 2, 22, 55, 56, 57.

invertebrates: 16, 19, 20, 21, 32, 33, 34, 35, 36, 37, 38, 41, 42, 44, 50, 51, 52.

fishes: 9, 10, 12.

Ecosystem/integration: 1, 39, 40, 60, 61.

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999	PROPOSED FY 1999 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$69.7			$536.8	$94.8
Personnel	$0.0	$338.9						
Travel	$0.0	$14.7						
Contractual	$0.0	$268.2						
Commodities	$0.0	$4.7						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$626.5		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
General Administration	$0.0	$74.8						
Project Total	$0.0	$701.3		$0.0	$0.0	$0.0		
Full-time Equivalents (FTE)	0.0	5.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0		$0.0	$0.0	$0.0		

Comments:

Prepared by Lisa Thomas final version 4/15/98

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: U.S. Geological Survey-Biological Resources Division

FORM 2A
MULTI-TRUSTEE AGENCY SUMMARY

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999						
Personnel		$206.7						
Travel		$9.3						
Contractual		$268.2						
Commodities		$3.7						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$487.9		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
General Administration		$48.9						
Project Total	$0.0	$536.8						
Full-time Equivalents (FTE)		3.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
SO=sea otters
HD= harlequin ducks
CS=Chief Scientist
RO/PG=river otters/pigeon guillemots
SC=subtidal clams

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: U.S. Geological Survey-Biological Resources Division

FORM 3A
TRUSTEE
AGENCY
SUMMARY

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
SO: J. Bodkin/B. Ballachey	Wildlife Biologists	GS-12	7.0	5.5		38.5
D. Monson	Wildlife Biologist	GS-9	12.0	3.6		43.2
HD: D.Esler	Wildlife Biologist	GS-12	10.0	5.6		56.0
CS: L. Holland-Bartels	Chief Scientist	GS-14	1.0	8.2		8.2
M Whalen	Data Manager	GS-11	12.0	4.8		57.6
M. Ronaldson	Secretary	GS-5	1.0	3.2		3.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		43.0	30.9	0.0	
					Personnel Total	$206.7

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
SO: workshops and meetings	1.5	2			3.0
HD: workshops and meetings	2.1	1			2.1
CS: LaCrosse/ANC/LaCrosse	1.4	3			4.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$9.3

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: U.S. Geological Survey-Biological Resources Division

FORM 3B
Personnel
& Travel
DETAIL

Prepared: 4/15/98

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1999
RO/PG: University of Alaska, Fairbanks Research Work Order	90.4
SC: University of Washington Research Work Order	36.6
HD: Oregon State University	2.0
CS: Statistical consulting	40.0
Contract with Coastal Resources Associates see form 4A&B for details	87.2
Purdue contract	12.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$268.2

Commodities Costs:	Proposed
Description	FY 1999
SO: printing/pub costs for manuscripts* this is more than the allowable costs(1.0K allowed)	1.0
HD: printing/pub costs for manuscripts* this is more than the allowable costs(1.0K allowed)	1.0
CS: workshop presentation materials/film/developing	1.7
Commodities Total	$3.7

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: U.S. Geological Survey-Biological Resources Division

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/15/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: U.S. Geological Survey-Biological Resources Division

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$52.2
Travel		$3.6
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$55.8
General Administration		$13.9
Project Total	$0.0	$69.7
Full-time Equivalents (FTE)		0.5

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:
Indirect cost based on rate negotiated between ADF&G and the EVOS Trustees Council

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
S. Jewett	marine biologist		6.0	8.7		52.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		6.0	8.7	0.0	
					Personnel Total	$52.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
FBX/ANC/FBX	0.2	2	4	0.2	1.2
					0.0
FBX/SD/FBX	0.8	2	4	0.2	2.4
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3.6

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Prepared: 4/15/98

Contractual Costs:	Proposed FY 1999
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/15/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$80.0
Travel		$1.8
Contractual		$0.0
Commodities		$1.0
Equipment		$0.0
Subtotal	$0.0	$82.8
General Administration		$12.0
Project Total	$0.0	$94.8
Full-time Equivalents (FTE)		1.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Comments:

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: National Oceanic and Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
C. O'Clair	Marine Biologist	GS12/10	3.5	6.0		21.0
Lindeberg	Marine Biologist	GS11	12.0	4.5		54.0
	technician- urchin growth					5.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		15.5	10.5	0.0	
					Personnel Total	$80.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
JUN/ANC/JUN, NVP fall meeting					0.9
JUN/ANC/JUN, 1999 Oil Spill Symposium					0.9
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.8

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: National Oceanic and Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FY 1999
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 1999
Description	
printing and pub costs for manuscripts (1.0K allowed)	1.0
Commodities Total	$1.0

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: National Oceanic and Atmospheric Administration

FORM 3B
Contractual & Commodities DETAIL

New Equipment Purchases:			
Description	Number of Units	Unit Price	Proposed FY 1999
			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

1999

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: National Oceanic and Atmospheric Administration

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

	Authorized FY 1998	Proposed FY 1999						
		$55.8						
		$15.0						
		$0.0						
		$7.8						
		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$78.6		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
Indirect		$11.8						
Project Total	$0.0	$90.4						
		11.9						
	Dollar amounts are shown in thousands of dollars.							

Comments:

FY 99

14 of 50

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks

FORM 4A
Non-Trustee
SUMMARY

4/15/98

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
T. Bowyer	Wildlife Biologist		2.2	9.0		19.8
L. Duffy	Physiologist		1.0	10.6		10.6
	GIS Technician		2.3	3.9		0.0
	Student Technician		5.9	1.5		0.0
	Account Technician		0.5	2.7		0.0
MS fellowship(P. Seizer)						11.9
PHD fellowship(G. Blundell)						13.5
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		11.9	27.7	0.0	
					Personnel Total	$55.8

Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
FAI/ANC/FAI	0.3	11	1	6.7	10.0
Bowyer professional meetings (2)					2.5
Duffy professional meetings (2)					2.5
Blundell professional meetings (2)					0.0
Seizer professional meetings (2)					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$15.0

FY 99

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

	Proposed FY 1999
Contractual Total	$0.0

	Proposed FY 1999
duplication/computer fees	2.9
publication costs for 10 pubs(1.0 K allowed per project)	3.0
presentation supplies	1.9
Commodities Total	$7.8

FY 99

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks

FORM 4B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

	Number of Units	Unit Price	Proposed FY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
New Equipment Total			$0.0

	Number of Units	

FY 99

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks

FORM 4B
Equipment
DETAIL

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

	Authorized FY 1998	Proposed FY 1999						
		$29.1						
		$4.5						
		$0.0						
		$3.0						
		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$36.6		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
Project Total	$0.0	$36.6						
		13.9						
	Dollar amounts are shown in thousands of dollars.							

Comments:

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington, Seattle

FY 99

FORM 4A
Non-Trustee
SUMMARY

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
A. Fukuyama	Ph.D. Research Assistant		11.6	1.8		20.9
Fukuyama Benefits						1.7
Fukuyama Tuition						6.5
hourly person-salary			2.3	1.3		0.0
hourly person-benefits						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		13.9	3.1	0.0	
					Personnel Total	$29.1

Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Restoration Workshop X2					2.5
Scientific Conferences					2.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$4.5

FY 99
19 of 50

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington, Seattle

FORM 4B
Personnel & Travel DETAIL
4/15/98

	Proposed FY 1999
statistical/taxonomic consulting	0.0
clamshell dating	0.0
Contractual Total	$0.0

	Proposed FY 1999
telephone/fax/graphics/postage/photocopy	2.0
publication costs	1.0
Commodities Total	$3.0

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington, Seattle

	Number of Units	Unit Price	Proposed FY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
New Equipment Total			$0.0

	Number of Units	

FY 99

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington, Seattle

FORM 4B
Equipment
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Name: University of Washington, Seattle

	Authorized FY 1998	Proposed FY 1999						
		$45.3						
		$2.1						
		$0.0						
		$0.0						
		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$47.4		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
Indirect		$39.8						
Project Total	$0.0	$87.2						
		6.5						
			Dollar amounts are shown in thousands of dollars.					

Comments:
Indirect fee is sum of overhead (26.9K) + general and administrative costs (9.6K) + fee (3.3K)/

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: Coastal Resources Associates, Inc.
USGS-BRD contractor

FORM 4A
Non-Trustee
SUMMARY

FY 99

4/15/98

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
T. Dean	Marine Biologist		5.0	7.6		38.0
L. Deysher			0.5	7.6		3.8
D. Jung			1.0	3.5		3.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		6.5	18.7	0.0	
					Personnel Total	$45.3

Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
SD/ANC/SD	0.5	3	6	0.1	2.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.1

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: Coastal Resources Associates, Inc.
USGS-BRD contractor

FY 99

FORM 4B
Personnel
& Travel
DETAIL

4/15/98

	Proposed FY 1999
Contractual Total	$0.0

	Proposed FY 1999
Commodities Total	$0.0

FY 99

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: Coastal Resources Associates, Inc.
USGS-BRD contractor

FORM 4B
Contractual & Commodities DETAIL

4/15/98

1998 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

	Number of Units	Unit Price	Proposed FY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
New Equipment Total			$0.0

	Number of Units	

FY 99

Project Number: 99025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: Coastal Resources Associates, Inc.
USGS-BRD contractor

FORM 4B
Equipment
DETAIL

4/15/98

Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures

Project Number:	99043B
Restoration Category:	Monitoring
Proposer:	USFS
Lead Trustee Agency:	USFS
Cooperative Agencies:	None
Alaska Sea Life Center:	No
Duration:	4th year, 4-year project
Cost FY 99:	$9.5
Cost FY 00:	$0.0
Cost FY 01:	$0.0
Cost FY 02:	$0.0
Geography Area:	Western Prince William Sound
Injured Resource / Service:	Cutthroat Trout and Dolly Varden

ABSTRACT

This proposal provides for the final report and analysis of data collected from the EVOS Project *Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures* conducted from 1995 to 1998. The sixty three habitat improvement structures were installed in 1995 under EVOS Restoration Project number 95043B. At that time there were concerns raised that habitat structures may inadvertently increase coho salmon populations, thereby increasing competitive stress on Dolly Varden, and cutthroat trout populations. The final report will address the five working null hypotheses presented in previous proposals to determine if the improvements were a benefit to cutthroat trout and Dolly Varden.

INTRODUCTION

In 1989 the oil tanker *Exxon Valdez* ran aground on Bligh Reef spilling millions of gallons of crude oil into Prince William Sound (PWS). The ensuing oil spill damage assessment identified oil spill related injuries to cutthroat trout *(Oncorhynchus clarki*) and Dolly Varden char (*Salvelinus malma*) populations among other species in PWS. Information collected in 1989-1991 by the Natural Resources Damage Assessment (NRDA) study, documented lower growth rates for cutthroat trout and Dolly Varden char in oiled areas than in unoiled areas. The reduced growth rates persisted into 1991 when studies were discontinued. It is unknown if growth rates have since returned to normal. Mortality rates for anadromous Dolly Varden char in oiled areas were significantly higher than rates from sites in the non-oiled areas of eastern PWS (EVOS Trustee Council, 1994).

The cutthroat trout populations found in PWS are at the northern extent of the species' North American range. Generally speaking, species inhabiting the extreme limits of their habitat exhibit higher sensitivities to environmental stresses than the same species well within their normal range. Little is known of the genetic diversity, distribution, or life histories of cutthroat trout in PWS. The cutthroat trout stocks known to exist within PWS are few in number and appear to be discrete populations with limited interbreeding with other cutthroat stocks. It is highly possible that there have been unique genetic adaptations in these populations due to local conditions and their relative isolation from other stocks. Several stocks of cutthroats within PWS appear to be anadromous and have a limited home range within streams (Heggenes et al., 1991). Both adults and subadults of anadromous populations migrate to the ocean for summer feeding (Trotter, 1989; Hepler et al, 1993). Emigration to saltwater occurs in early May through July (Hepler et al, 1993). They return to freshwater in July through November, peaking in September and October (Trotter 1989; Wedemeyer 1993).

During the 1995 field season, USFS, Glacier Ranger District Fisheries crews installed a total of 63 habitat improvement structures at Otter Lake, Gunboat Lakes, Red Creek and Billy's Hole to improve cutthroat trout and Dolly Varden habitats in PWS. The distribution and abundance of cutthroat trout, Dolly Varden and coho salmon *(Oncorhynchus kisutch*) were monitored at these locations using standard mark- recapture techniques to provide baseline information on the various systems prior to enhancement activities. The existing habitat at each project site was surveyed using a modified Hankin and Reeves (1988) methodology before and after structure installation to provide a basis of comparison. The completed stream surveys were also used to determine the proper sampling distribution to trap fish in a stratified random sampling design within the affected stream reaches. Trapping effort was conducted proportional to the availability of the three major habitat types found in each sampling area.

Minnow traps were used to capture the juvenile fish. The trapping effectiveness varies with the stream characteristics at a particular location. It was assumed that a single minnow trap could effectively trap a 10 m^2 area of slow water habitat, and a linear 3 m segment of fast water habitat. The difference in trapping effectiveness resulted in fewer traps being used to trap equal sized

habitat units in slow water than in fast water providing an assumed equal amount of trapping effort for each habitat type.

The exception to this is the work done at Billy's Hole where initial sampling indicated cutthroat trout in numbers too low to be sampled in a statistically valid manner using the proposed mark recapture design. Nearly 100 traps were set at this location throughout the summer that resulted in the capture of only two juvenile cutthroat trout within the proposed project area. Instead, trapping was conducted in a nonrandom manner to maximize capture for cutthroat trout throughout the entire project area prior to any construction.

Bailey's modification of the Lincoln-Petersen Mark and Recapture model (as described in Kohler and Hubert, 1993) was used to estimate the populations of coho, cutthroat trout and Dolly Varden juveniles in the affected stream reaches and a coefficient of variation (CV) was calculated for each population estimate. Sampling in 1996 produced many population estimates with a CV value of greater than 0.20 which is generally inadequate and indicates low precision of the estimates. This is due to the small sample size and the low numbers of recaptures of cutthroat trout. The sampling design for subsequent years was modified to address this problem. The modification involved adding a second day of trapping during the recapture phase using the same techniques as discussed above thereby increasing the sample size during the recapture phase which was expected to increase the precision of the estimates.

Table 1 in Appendix A summarizes the mark- recapture and CPUE (catch per unit effort) datum collected from 1995 to 1997 for each of the project locations. Estimates of cutthroat trout populations did not appear to improve using this modified technique. However estimates of other species did improve. It appears that cutthroat trout are "trap shy" making the likelihood of a recapture more difficult than anticipated. The additional trapping time is providing useful CPUE information on habitat distribution and to assess possible benefits or negative consequences of placing enhancement structures in a stream system.

Sampling by Glacier Fisheries Crews in 1996 again suggested that cutthroat trout densities were greatest in the upper reaches of these inlet tributary streams. This is consistent with studies that have shown that cutthroat trout juveniles are pushed to less desirable habitats by the more dominant coho salmon juveniles (Glova and Mason, 1976). Interspecific competition with juvenile coho salmon is believed to limit cutthroat trout production in quality pool rearing habitat which is one of the key factors for cutthroat trout survival.

Preliminary catch per unit effort (CPUE) information is presented in Appendix A, Figures 2-7, this information is based on pre-project trapping in 1995 of enhancement sites and project area streams, and the data collected from 1996 and 1997 at these same project locations.

NEED FOR THE PROJECT

A. Statement of Problem

Limited information is available on the genetic diversity, distribution, competitive interactions or general life histories of cutthroat trout in PWS. In addition, there is concern that habitat enhancement structures installed under EVOS Project 95043B may inadvertently increase coho salmon populations thereby increasing competitive stress on cutthroat trout populations.

B. Rationale/Links to Restoration

Additional information on cutthroat trout distribution, habitat utilization and competitive interaction with juvenile coho will assist managers in making decisions for future fisheries enhancement work that may affect cutthroat trout in PWS.

Monitoring before and after the installation of improvement structures was conducted to provide necessary information to ascertain the effectiveness of the various projects or of a particular structure. The final year of post-project sampling is scheduled to be completed in FY 98. This proposal is to fund the final data analysis and report writing for this monitoring project.

C. Location

Monitoring occurred at the project sites listed for the Cutthroat Trout / Dolly Varden Habitat Improvement Project, number 95043B.

Otter Creek, Bay of Isle, Knight Island, PWS.
Gunboat Creek, Eshamy Bay, Western PWS.
Red Creek, Esther Passage, NW., PWS.
Billy's Hole, Long Bay, Northern PWS.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

On January 20 , 1994 letters were mailed to 156 individuals, agencies and organizations requesting comments on the proposed habitat enhancement for cutthroat trout in PWS that this proposal is designed to monitor.

In January of 1994, the "Chugach National Forest Schedule of Proposed Actions for Environmental Analysis" was mailed to more than 600 individuals, agencies and organizations. This document has since been mailed on a quarterly basis. The mailings included the PWS projects and a contact person for additional information concerning the project.

PROJECT DESIGN

A. Objectives

The objective of this project, has been to monitor and document the response of cutthroat trout to modifications made to their habitat by enhancement activities.

Specific objectives were:

1. Measure abundance and distribution of cutthroat trout, Dolly Varden and juvenile coho in the proposed project locations for the period specified.

2. Measure and monitor cutthroat trout, Dolly Varden and juvenile coho utilization of newly installed habitat improvements.

3. Measure and monitor the effects that structures have on adjacent aquatic macrohabitats.

4. Provide annual project monitoring results.

5. Provide a project completion report and a summary of our findings on the effectiveness of the habitat structures installed in 1995.

B. Methods

The null hypotheses for this project is that the number of cutthroat trout at the project locations will not increase due to the habitat improvements made in 1995. To test this and meet the project's objectives, five working null hypotheses were developed:

Hypotheses 1. The abundance of cutthroat trout at the project sites will not increase over the monitoring project duration.

Hypotheses 2. The current distribution of cutthroat trout within the project area will not change over the duration of the monitoring project.

Hypotheses 3. Cutthroat trout and Dolly Varden will not be the predominant species to utilize the newly created habitat structures.

Hypotheses 4. Aquatic macrohabitats adjacent to areas of improvement will not be affected by the structures installed in 1995.

Hypotheses 5. The structures installed in 1995 will not have benefitted cutthroat trout over the duration of the monitoring project.

To test hypotheses number one through three, data on the relative abundance, distribution and habitat utilization of cutthroat trout at the project locations were collected during the 1995 through 1998 field season.

Cutthroat abundance will be estimated using a method described in Hankin's (1986) report, *Sampling Designs for Estimating the Total Number of Fish in Small Streams.* This method consists of a two stage stratified random sampling design utilizing auxiliary variables to improve the precision of estimators. It is described in detail as Design B: Ratio Estimation in Hankin's (1986) report. Population estimates for each primary unit will be derived using the mark-recapture method known as the Petersen Index with Bailey's 1951 formula to correct for bias, as described by Ricker (1975). Collection was conducted using baited minnow traps and fish were marked by caudal punches.

Project area streams have been surveyed and habitats classified using a modified Hankin and Reeves (1988) methodology. Stream habitat surveys were conducted during the early part of the 1995 field season in conjunction with the installation of the improvement structures. Data collected from the surveys have been analyzed and the associated habitat units characterized. Primary units (those to be sampled) were then selected by stratified random sampling. The strata consist of various pools, riffles, runs and glides that are then categorized as either slow, turbulent or non-turbulent habitat types (Figure 1, Appendix A).

The percentage of a habitat type found within a given reach can be taken from the total area or length of a particular habitat type in that reach to produce a value that is proportional to the entire reach. It was assumed that a single minnow trap could effectively trap a 10 m^2 area of slow water habitat, and a linear 3 m segment of fast water habitat types. Dividing the proportional value by the appropriate segment length provides the number of traps required to sample the proportional value. The sums of the areas for slow water types and the lengths for the fast habitat types were stratified into primary units based on the trapping segment lengths for each habitat type throughout the entire reach. From these segments a random selection of segments to be sampled was made to correspond to the number of traps required to sample each habitat type. Each season new sampling segments were selected based on the method described above. If the areas where improvements occurred did not fall into the random samples they were trapped separately. The amount of trapping effort was also recorded at each location, since a proportional and equal trapping effort was applied throughout the entire reach, CPUE data will also be used to identify trends in population structures and distribution for a given location.

These estimations were done in mid to late summer to minimize bias due to seasonal migration of fish within the stream. Annual population estimates of the primary units for the project duration should provide enough information to detect a change in the relative abundance and distribution of cutthroat trout at the project sites.

Hankin in his (1986) report discusses errors of estimation of the total number of fish in a stream arising from two sources: (1) extrapolation from the small number of sampled sections to the

entire stream, and (2) errors of estimated fish numbers within sampled sections. Hankin demonstrated that errors arising from the first source will usually be far greater than those from the second source, and that total errors of estimation can be reduced by making sampled sections equivalent to natural habitat units. By stratifying these habitat units and selecting sampling units randomly the precision of estimators can be improved and information on the distribution of cutthroat trout within the stream can be gathered.

Mark-recapture population estimates for primary units utilizing minnow trapping techniques will lead to errors in estimated fish numbers for sampled sections due to size selectivity and inefficiency of minnow traps to capture all individuals within a population. There is however a correlation between the sampled catch and the true population for a given size of individuals within a population. This is discussed in a 1976 paper by Arthur M. Bloom, *Evaluation of Minnow Traps for Estimating Populations of Juvenile Coho Salmon and Dolly Varden.*

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This project will be implemented by the U.S. Forest Service no contracts are expected.

SCHEDULE

A. Measurable Project Task for FY 99 (October 1, 1998 - September 30, 1999)

January 31:	Complete data analysis.
April 15	Provide a final report for peer review summarizing project results. This will satisfy objectives (1, 2, 3, 5)

B. Project Milestones and Endpoints

April 15:	Provide a final report for peer review summarizing project results. This will satisfy objectives (1, 2, 3, 5).

C. Completion Date

Baseline data were collected in 1995 prior to any effects from the habitat improvement work. Data to meet the project objective were collected in 1996, '97, '98, with a final report summarizing the project results being provided for peer review in 1999.

PUBLICATIONS AND REPORTS

No professional publications are planned for at this time. The Forest Service does however

understand that results from this project need to be shared with other resource managers to assist them in making decisions regarding enhancement activities where cutthroat trout are present. Annual Reports will be prepared during each year of the project and provided to the Trustee Council by April 15 of the following year with a final report submitted for peer review by April 15, 1999.

PROFESSIONAL CONFERENCES

At this time there are no plans to present this project at professional conferences. However a poster board display is planned for in 1998 with updates in 1999 for presentation at the District office and at science conferences.

NORMAL AGENCY MANAGEMENT

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. The Forest Service has focused on this species as a result of the injury incurred from the oil spill. The proposal is not part of the normal Forest outyear planning program, therefore no funds have been directed towards this project within the Forest Service budgeting process. Current budgets and Forest Service priorities would not provide an opportunity to conduct this project under normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed project is an integration of project number 95043B, Cutthroat Trout and Dolly Varden Habitat Restoration in PWS. Additionally during the summer of 1994, the Forest Service made significant improvements to an existing fishway at Otter Creek, under EVOS Project 94139-B1 to facilitate pink salmon *(Oncorhynchus gorbuscha)* access to previously inaccessible spawning habitat.

This project is designed to monitor the long term effects of implementing project number 95043B. The effects from project 94139-B at Otter Creek are beyond the scope of the proposal and will not be consider in the analysis. The proposal is a response from a primary land and resource manager (Forest Service) in Prince William Sound to the effects of the *Exxon Valdez* oil spill.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The FY99 proposal differs from the FY98 by dropping the final year of data collection from the

project. In the previous proposals a five year monitoring plan has been presented, however based on the recommendations of the Trustees, 1998 will be the last year of data collection.

PROPOSED PRINCIPAL INVESTIGATOR

Dan Gillikin, Project Leader
U.S. Forest Service
P.O. Box 129
Girdwood, AK 99587
(907) 783-3242
FAX: (907) 783-2094

PRINCIPAL INVESTIGATOR

Dan Gillikin, U.S. Forest Service Glacier Ranger District Chugach National Forest. Currently holds the position of Fisheries Technician and acting Fisheries Biologist on the Glacier District. He has eight years of experience as a fisheries technician with Private and Federal Agencies in Washington and Alaska. He is currently the acting Fisheries Biologist for the Glacier District and manages the Districts Fisheries Program. He would work with the project manager and conduct project implementation, environmental compliance, agency coordination, budget management and reporting.

OTHER KEY PERSONNEL

Cliff Fox, U.S. Forest Service Glacier Ranger District Chugach National Forest. Currently holds the position of Resource Staff Officer on the Glacier District. He has 20 years experience in natural resource management with State and Federal Agencies in California, Idaho and Alaska. He has 25 years experience in project planning, implementation, and monitoring. He has multi-resource experience holding positions in fisheries, wildlife, timber, minerals, recreation, fire, real-estate, cultural resources, Forest Planning and environmental coordination. Cliff presently oversees the District's fisheries, wildlife, timber, ecology, minerals and air quality programs. He was responsible for project oversight during implementation, environmental compliance, agency coordination, budget management and reporting.

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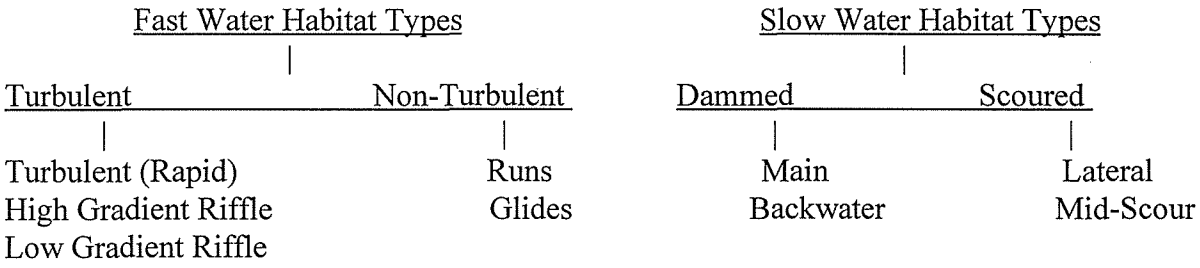
APPENDIX A

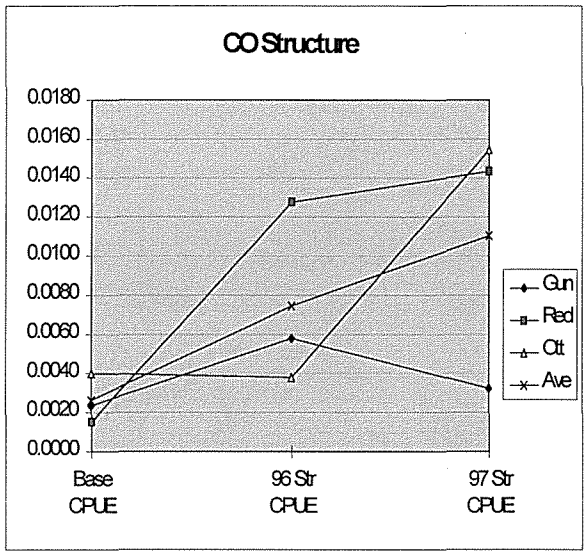
Table 1. Summary of mark recapture and CPUE data for project 95043B. for 1995 and 1996, shaded values indicate a CV less than or near 0.20.

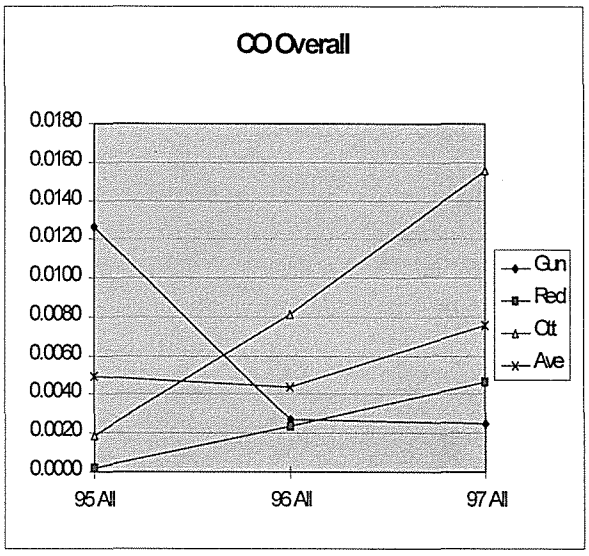
Project Location	Species	Population Estimate, N			Variance of Estimate, V(N)			Coefficient of Variation, CV			Catch Per Unit Effort, CPUE		
		95	96	97	95	96	97	95	96	97	95	96	97
Otter Ck.	CO	45	1220	1482	324	10848	5156	0.4	0.085	0.048	0.0019	0.0081	0.0156
	CT	6	56	300	9	1344	15000	0.5	0.654	0.408	0.0003	0.0002	0.0010
	DV	128	1023	745	1536	7597	1118	0.31	0.085	0.045	0.0039	0.0081	0.0103
Red Ck.	CO	14	760	896	0	60805	2869	0	0.324	0.06	0.0002	0.0024	0.0047
	CT	105	72	852	1125	1344	69005	0.32	0.509	0.308	0.0007	0.0003	0.0012
	DV	427	374	1018	8169	16456	6802	0.21	0.343	0.081	0.0024	0.0012	0.0041
Gunboat Reach 2	CO	504	425	159	6720	9975	1025	3.25	0.23	0.201	0.0127	0.0027	0.0025
	CT	50	36	0	300	1296	0	0.38	1	0	0.0009	0.0004	0.0036
	DV	48	594	28	768	24293	187	0.21	0.262	0.488	0.0004	0.0034	0.0010
Gunboat Reach 3	CO	N/A	30	16	N/A	244	64	N/A	0.51	0.5	N/A	N/A	N/A
	CT	N/A	54	43	N/A	1215	138	N/A	0.64	0.272	N/A	N/A	N/A
	DV	N/A	70	55	N/A	23	1210	N/A	0.068	0.633	N/A	N/A	N/A
Billy's Hole	CO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0244	0.0282	0.0205
	CT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0012	0.0001	N/A
	DV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0589	0.0124	0.0260

Figure 1. Description of habitat classification technique.

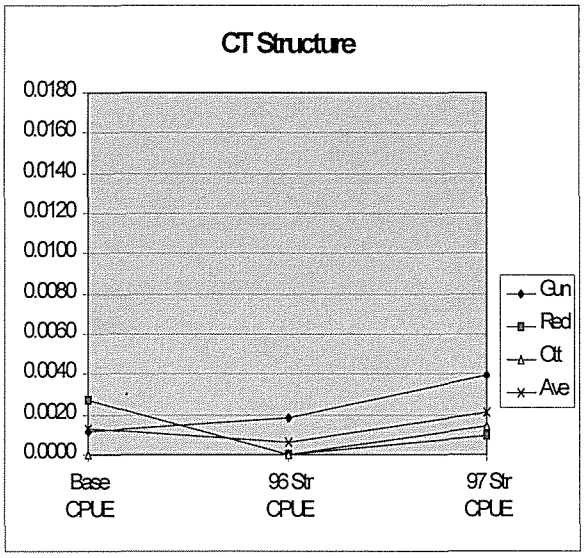


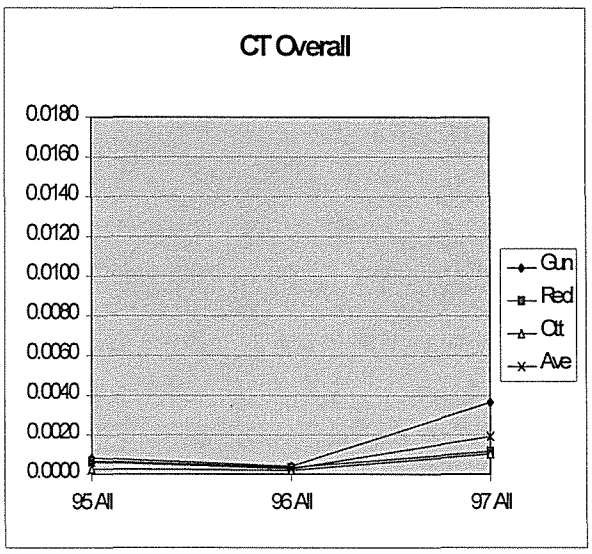
Figures 2,3. Catch Per Unit Effort (CPUE) data for juvenile coho salmon (CO) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.



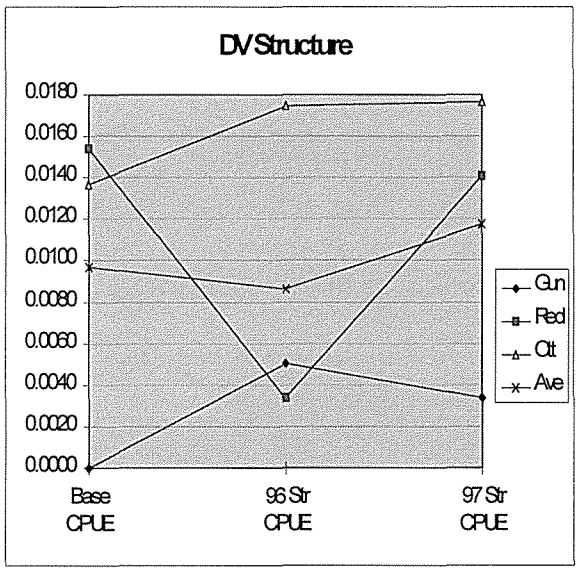


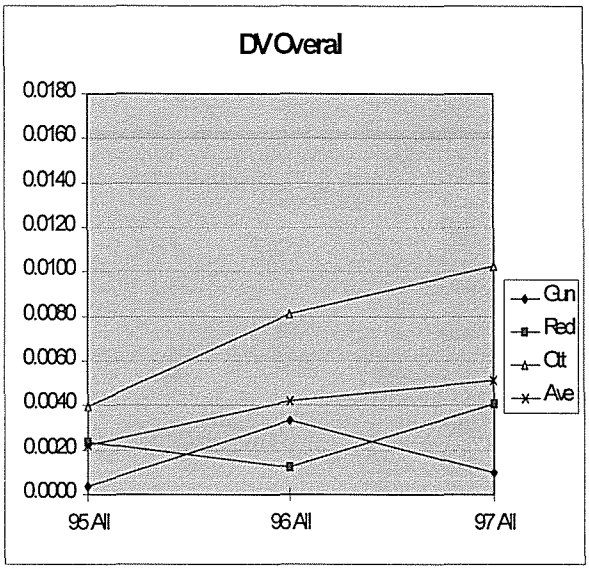
Figures 4,5. Catch Per Unit Effort (CPUE) data for juvenile cutthroat trout (CT) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.





Figures 6,7. Catch Per Unit Effort (CPUE) data for juvenile Dolly Varden (DV) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.





FY 99 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$15.0	$8.3
Travel	$0.0	$0.0
Contractual	$3.0	$0.0
Commodities	$3.5	$0.0
Equipment	$0.0	$0.0
Subtotal	$21.5	$8.3
General Administration	$2.5	$1.2
Project Total	$24.0	$9.5
Full-time Equivalents (FTE)		0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Comments: Provides for Final Report for EVOS Project: *Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures.*

FY 99

Prepared: 4/8/98

Project Number: 99043B
Project Title: Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures.
Agency: USFS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 99 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
D.Gillikin	Fisheries Technician	GS-9	1.5	3.2		4.8
R. Spangler	Fisheries Biologist	GS-9	0.5	4.0		2.0
Unknown	Statisitican	GS-11	0.3	5.0		1.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			2.3	12.2	0.0	
					Personnel Total	$8.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY 99

Prepared: 4/8/98

Project Number: 99043B
Project Title: Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures.
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

FY 99 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FY 1999
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 1999
Description	
Commodities Total	$0.0

FY 99

Prepared: 4/8/98

Project Number: 99043B
Project Title: Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures.
Agency: USFS

FORM 3B
Contractual & Commodities DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
			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:	Number of Units	Inventory Agency
Description		

FY 99

Project Number: 99043B
Project Title: Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures.
Agency: USFS

FORM 3B
Equipment
DETAIL

Prepared: 4/8/98

Community Involvement

Project number:	99052A
Restoration Category:	General Restoration
Proposer:	P. Brown-Schwalenberg/CRRC
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Continued
Duration:	5th year 8 year project
Cost FY 98:	$232.1
Cost FY 99:	$255.7
Cost FY 00:	$255.0
Cost FY 01:	$255.0
Cost FY 02:	$255.0
Geographic Area:	Spill-area wide
Injured Resource/Service:	Subsistence

ABSTRACT

This project will increase community involvement in the restoration process. The Spill-Area Wide Community Involvement Coordinator's (SAWCIC) work will continue through a contract with the Chugach Regional Resources Commission (CRRC). Through direct communication with a network of local Community Facilitators (CF), the SAWCIC will continue to actively involve local residents in the restoration program. The CF's are located in Tatitlek, Chenega Bay, Port Graham, Nanwalek, Valdez, Cordova, Seward, Seldovia, Kodiak Island, and the Alaska Peninsula.

Additionally initiated will be a network of high school interns within the Kodiak Island region. In cooperation with CRRC, the Kodiak Island Borough School District will select one high school

student within the following communities: Port Lions, Larsen Bay, Karluk, Akhiok, Old Harbor, and Kodiak. They will serve as the local facilitator. Additionally, the intern will facilitate discussions within the school and community regarding EVOS scientific data and research, and how this applies to their surrounding ecosystem.

INTRODUCTION

Nine local facilitators were hired in FY 96 through cooperative agreements with the village councils of Tatitlek, Chenega Bay, Port Graham, Nanwalek, Eyak (Cordova), Qutekcak (Seward), Valdez, and the Native associations in Bristol Bay and Kodiak. Under 97052A, the number of CF's was expanded by one to include the community of Seldovia. Kodiak Island internships will be added in FY 99. Hugh Short, the full time SAWCIC, will continue to serve as an employee of CRRC and continue his work out of the Restoration Office. The following tasks will be completed by the SAWCIC:

1. Increase involvement of community members and organizations throughout the spill region in restoration projects. This community process will include a CF.

2. Serve as the contact point for a CF in each of the sixteen participating communities (Tatitlek, Chenega Bay, Valdez, Cordova, Port Graham, Nanwalek, Seldovia, Ouzinkie, Port Lions, Kodiak, Old Harbor, Akhiok, Larsen Bay, Karluk, Chignik Lake, Seward -- the CF's will be subcontractors to CRRC, the interns will be students with the Kodiak Island Borough School District). The tasks of the SAWCIC in relation to the CF's and interns would be to:

   a. At least every month, fax a comprehensive report to the CF's and interns to keep them informed of Trustee Council actions, Restoration Office activities, upcoming events, new research findings, etc. The report will be in the form of a newsletter.

   b. Update the local resources inventories for each community (lodging and meeting space available, human and equipment resources, etc.). This information will be consolidated and distributed to all Principal Investigators. The SAWCIC and CF's will then assist in arranging the use of the local resources.

   c. Coordinate the participation of the CF's and interns in the 10th Anniversary Symposium and other meetings/workshops as appropriate.

   d. Work with the TEK Specialist (99052B) to coordinate an annual review by CF's, interns, and village councils of restoration project proposals involving indigenous knowledge and develop recommendations to the Executive Director.

3. Annually review the community involvement component of all restoration project proposals. Inform the CF's of proposals that would involve their communities. Make recommendations to the Executive Director on the adequacy of, as well as ways to strengthen, the community involvement component. Once funding decisions are made by the Trustee Council, initiate contact with the PI's to offer assistance in implementing their

community involvement components.

4. Assist in organizing Trustee Council/Restoration Office community meetings held in conjunction with the Invitation/Draft Work Plan. This may include arranging presentations in specific communities by PI's.

5. Participate in Restoration Work Force meetings.

6. Provide a "community report" to the PAG at each of its' meetings.

7. Attend (in person or by teleconference) all Trustee Council meetings and report to the CF's on actions taken.

8. Work with the Science Coordinator, Communications Specialist, and TEK Specialist (99052B) to get research results to communities.

9. Coordinate the provision of technical assistance to the villages by the Trustee Council staff and agency personnel to develop project proposals.

10. Provide input to the Restoration Update newsletter.

11. Prepare quarterly project status updates for the Restoration Office and ensure all reports are submitted on a timely basis by the CF's.

The tasks of the local CF's include:

1. Provide a written monthly report to the SAWCIC each month identifying community issues, concerns or questions regarding restoration. These issues could be identified through community meetings or other means and should include relevant issues discussed at village council meetings. Ideas for new projects should also be included.

2. Assist the SAWCIC in increasing community involvement in restoration projects. This will include updating the local resources inventory manual, which includes facilities available for rent (lodging, meeting rooms, storage space) and the names, telephone numbers, areas of expertise, and compensation requirements of specific community members who are interested and able to work on Trustee Council-funded projects. Areas of expertise may include skiff and other equipment availability, general laborers, interviewers, research assistants, guides, and traditional knowledge holders.

3. Work with the SAWCIC in coordinating the Trustee Council community meetings as well as community visits from PI's. Under the TEK protocols adopted by the Trustee Council, the CF will also serve as the initial contact in the village for any project involving TEK. The CF should be knowledgeable about the TEK protocols. All interested CF's will serve on the TEK Advisory Group (99052B).

4. Disseminate monthly newsletter to community members. This could be done by posting the update in a public location, making a presentation to the village council or city, or other ways of communication.

5. All CF's shall attend the 10th Annual Exxon Valdez Oil Spill Symposium and other meetings, including scientific review sessions when appropriate.

Duties of Kodiak Island interns will include:

1. All duties required of the CF's.

2. To work with the Kodiak Island Borough School District coordinator, Science Coordinator, SAWCIC, and Kodiak Island CF to develop strategies to incorporate research data and designs into school curriculum.

3. To make presentations to the community and school to enhance understanding and involvement in the restoration process.

Duties to be undertaken by the ADF&G Subsistence Division include:

1. Work with communities to develop restoration project proposals.

2. Provide technical expertise and general assistance to the Restoration Office, Trustee Council, SAWCIC, and PI's on subsistence restoration.

3. Administer the cooperative agreement with CRRC, which will include renewing the contract and amending the RAP, reviewing and processing invoices, reviewing quarterly reports, and monitoring contractor performance.

4. Contribute to annual project report.

5. Respond to contracts from the general public in regard to EVOS subsistence projects.

NEED FOR THE PROJECT

A. Statement of Problem

The Exxon Valdez oil spill caused severe disruption in the lives of many people living in the spill impacted area. The spill also caused residents of the area to be concerned about the safety of their wild food sources, and the integrity of the surrounding natural environment. While scientific studies aimed at restoring the resources and services damaged by the oil spill have occurred throughout the spill area, most of the researchers work for agencies or institutions based in Anchorage, Fairbanks, or outside Alaska. This project was created in response to concerns voiced by communities over a lack of involvement by spill area communities in the restoration effort and incomplete communication to spill area inhabitants of study proposals and results.

Kodiak Island has proved to be especially difficult in terms of involvement and the quality of communication to the residents. In an effort to facilitate better communication to the residents of the island, an intern would act as a community facilitator to the local residents. The responsibilities of the other CF's would be incorporated into the internship. Curriculum to involve the youth in scientific research would also be developed, much like the Youth Area Watch program. Better communication to spill affected communities and youth education would be the twofold benefit of this aspect of the project.

B. Rationale

This project furthers the Trustee Council's goal of facilitating the involvement of spill area residents and resource users in the restoration process. It also reaffirms the Trustee Council's dedication to the involvement and education of area youth in the restoration process.

C. Location

This project will be spill area wide. All communities will have a CF or an intern within their community, except for the Alaska Peninsula, which is covered by a region-wide CF.

COMMUNITY INVOLVEMENT

The core of this project is community involvement.

FY 99 BUDGET

Budget line items	CRRC	ADF&G	Total
Personnel	$48,500	$5,400	$53,900
SAWCIC	*$48,500*	*$0.00*	*$48,500*
Division Project Coor.	*$0.00*	*$5,400*	*$5,400*
Travel	$33,000	$0.00	$33,000
Contractual	$127,000	$0.00	$127,000
Village councils	$120,000	$0.00	$120,000
Kodiak Island School District	$7,000	$0.00	$7,000
Commodities	$500	$500	$500
Equipment	$2,500	$0.00	$2,500
Subtotal	$211,500	$5,900	$217,400
General Admin.	$21,150	$17,100	$38,250
Project Total	$232,650	$23,000	$255,650

PROJECT DESIGN

A. Objectives

1. To increase the involvement of spill area communities in the restoration efforts of the Trustee Council

2. To improve communication of findings and results of restoration efforts to spill area residents, including village and city councils, other community groups, and the appropriate regional organizations in a format that is meaningful and easy to understand.

3. To enhance the involvement and education of Kodiak Island youth in the restoration efforts through internships.

B. Methods

The project will be implemented by the SAWCIC, Kodiak Island Borough School District and local community facilitators, and with the assistance of the Alaska Department of Fish and Game's Division of Subsistence.

The objectives will be achieved using the following methods:

A contract will be renewed by ADF&G Division of Subsistence to CRRC for overall coordination of the CF's and SAWCIC. CRRC will be expected to arrange for the hiring (where applicable) and coordination of local CF's in the communities of Chenega Bay, Tatitlek, Port Graham, Nanwalek, Seldovia, Valdez, Cordova, Seward and regional coordinators for Kodiak Island and the Alaska Peninsula regions. The remaining communities on Kodiak Island will select local high school interns to serve as community facilitators. All other communities in the oil spill impacted area will be included in the outreach efforts, even though a local facilitator will not be hired in each community.

Working with the CF's and interns, the SAWCIC will increase meaningful public involvement in the restoration process. The goal will be to continue the partnership begun under 95052 between the residents of the oil spill area and scientific researchers. Outreach will include communication of research proposals and study results.

The effectiveness of the project will be evaluated on an annual basis by the Trustee Council staff working in cooperation with the SAWCIC, the oil spill communities, and the Subsistence Division.

C. Contracts and Other Agency Assistance

A contract will be let to CRRC for overall coordination of a facilitator network through a SAWCIC. These tasks are being contracted out for the following reasons:

1. The use of a regional organization as opposed to a state agency will better serve the needs of the local community members.

2. The Trustee Council has encouraged contracting tasks out to the private sector as much as possible, and as appropriate.

3. The state procurement system makes it difficult to contract directly with the communities in the oil spill region. It has proven to be simpler to contract out the coordination of the facilitator network on a sole source basis with CRRC, who has an established working relationship with the communities.

SCHEDULE

A. Measurable Project Tasks for FY 99

October 1, 1998	Contract between CRRC and ADF&G renewed
October 1, 1998	SAWCIC continues CRRC employment
October 1, 1998	Intern begins work
October 1, 1998	Subcontracts with communities renewed
November, 1998	Training workshop/orientation for CF's
December, 1998	Update local resource inventories submitted to SAWCIC and compile for distribution
March, 1999	Participation in 10th Anniversary Symposium
April, 1999	Communities' FY 99 proposals submitted
May, 1999	End of the year projects due for internships
May, 1999	Submit recommendations to Executive Director on community involvement component of FY 99 restoration project proposals; inform CF's of proposals that would include their communities.
Each month	Mail/fax newsletter to CF's
Each month	Report from CF's

B. Project Milestone and Endpoint

The project should be continued as long as there are significant restoration efforts underway. The project should be evaluated on a yearly basis to determine the most efficient way to continue to keep the communities involved in the Trustee Council restoration efforts.

C. Completion Date

Since the objective of this project is to integrate the local communities into the restoration program, this project will continue throughout the life of the restoration effort. The project will be evaluated on a yearly basis to determine how it can best serve the needs of the Trustee Council and the communities.

D. PUBLICATIONS AND REPORTS

Annual reports will be compiled in coordination with ADF&G and submitted to the Chief Scientist on April 15th of each year by CRRC. The annual reports will describe and summarize the progress made toward increasing community involvement during the previous federal fiscal year. In addition, monthly newsletters will be provided to the communities by the SAWCIC and monthly reports will be provided by the CF's to the SAWCIC.

COORDINATION AND INTEGRATION OF RESTORATION EFFORTS

This project is an effort to coordinate the Restoration Program with the local residents and builds on the established relationship between CRRC and the communities in Prince William Sound and Lower Cook Inlet. Under this project, CRRC will work to establish new relationships with Seldovia, Kodiak Island, and the Alaska Peninsula residents.

CRRC is contributing in-kind services to the project through its' other natural resources programs.

PROPOSED PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg
Chugach Regional Resources Commission
4201 Tudor Centre Dr., Ste. 300
Anchorage, AK. 99508
phone: 907.562.6644
fax: 907.562.4939
E-mail: crrcomm@alaska.net

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998
Personnel		$5.4
Travel		$0.0
Contractual		$232.7
Commodities		$0.5
Equipment		$0.0
Subtotal	$0.0	$238.6
General Administration		$17.1
Project Total	$0.0	$255.7
Full-time Equivalents (FTE)		0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$255.0	$255.0	$255.0	$255.0

Dollar amounts are shown in thousands of dollars.

Comments:

1999

Prepared: 4-14-98

Project Number: 99052A
Project Title: Community Involvement
Name: Alaska Dept. of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/14/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
Miraglia		18C	1.0	5.4		5.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	5.4	0.0	
					Personnel Total	$5.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

1999

Prepared: 4-14-98

Project Number: 99052A
Project Title: Community Involvement
Name: Alaska Dept. of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

4/14/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
Contract with Chugach Regional Resources Commission	232.7
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$232.7

Commodities Costs:	Proposed
Description	FY 1998
Telephone, paper, etc.	0.5
Commodities Total	$0.5

1999

Prepared: 4-14-98

Project Number: 99052A
Project Title: Community Involvement
Name: Alaska Dept. of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			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

1999

Project Number: 99052A
Project Title: Community Involvement
Name: Alaska Dept. of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared: 4-14-98

4/14/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998
Personnel		$48.5
Travel		$33.0
Contractual		$127.0
Commodities		$0.5
Equipment		$2.5
Subtotal	$0.0	$211.5
Indirect		$21.2
Project Total	$0.0	$232.7
Full-time Equivalents (FTE)		12.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$230.0	$230.0	$230.0	$230.0

Dollar amounts are shown in thousands of dollars.

Comments:

1999

Prepared: 4-14-98

Project Number: 99052A
Project Title: Community Involvement
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

4/14/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 1998
	Hugh Short	Community Involvement Coordinator	12.0	4.0	0.0	48.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	12.0	4.0	0.0	
					Personnel Total	$48.5

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1998
	Port Graham - Anchorage	0.4	3	8	0.2	2.4
	Tatitlek - Anchorage	0.5	3	8	0.2	3.1
	Chenega Bay - Anchorage	0.6	3	8	0.2	3.40
	Seldovia - Anchorage	0.3	3	8	0.2	2.5
	Nanwalek - Anchorage	0.4	3	8	0.2	2.8
	Seward - Anchorage	0.2	3	8	0.2	2.2
	Cordova - Anchorage	0.3	3	8	0.2	2.5
	Valdez - Anchorage	0.3	3	8	0.2	2.5
	Ouzinkie - Anchorage	0.6	3	8	0.2	3.4
	Chignik Lake - Anchorage	0.6	3	8	0.2	3.4
	Kodiak Island communities - Anchorage	0.6	6	24	0.2	4.8
	1 trip per intern for 10th Anniversary Symposium					0.0
					Travel Total	$33.0

1999

Prepared: 4-14-98

Project Number: 99052A
Project Title: Community Involvement
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

4/14/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed FY 1998
CRRC will subcontract with 10 communities to hire facilitators for this project ($12,000 per community)	120.0
Contract with the Kodiak Island Borough School District to assist in internship coordination	7.0
Contractual Total	$127.0

Commodities Costs:	Proposed FY 1998
Description	
Telephone, paper, coincidentals	0.5
Commodities Total	$0.5

1999

Prepared: 4-14-98

Project Number: 99052A
Project Title: Community Involvement
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities DETAIL

4/14/98

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1998
Laptop computer for Community Involvement Coordinator	1	2.5	2.5
			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**	$2.5

Existing Equipment Usage:	Number	
Description	of Units	

1999

Prepared: 4-14-73

Project Number: 99052A
Project Title: Community Involvement
Name: Chugach Regional Resources Commission

FORM 4B
Equipment
DETAIL

4/14/98

Traditional Ecological Knowledge

Project Number:	99052B
Restoration Category:	General Restoration
Proposer:	Chugach Regional Resources Commission
Lead Trustee Agency:	ADF&G, Division of Subsistence
Cooperating Agencies:	None
Alaska SeaLife Center:	
Duration:	2 years; may be continued
Cost FY 99:	$70,910.00
Cost FY 00:	
Cost FY 01:	
Geographic Area:	Spill-area wide
Injured Resource/Service	All Resources/Services

ABSTRACT

The project, which is one component of the Community Involvement Project (99052A), would fund a TEK (Traditional Ecological Knowledge) Specialist to (1) provide technical assistance to restoration project principal investigators (PIs) who plan to use, or for whom it would be appropriate to use, TEK, (2) serve as a contact point for spill area communities, the community facilitators and spill area wide coordinator hired under Project /052A, and principal investigators on issues related to TEK, and (3) organize and coordinate informational workshops between PIs and community experts. The TEK specialist would work in cooperation with an Advisory Group. Also, community training workshops will be held to enhance understanding of the benefits and implications of working with TEK. These workshops may involve experts who have experience in applying TEK from an Alaska Native perspective. The Alaska Department of Fish and Game will provide staff support for the project.

INTRODUCTION

This project would continue work begun under the Community Involvement and Use of Traditional Knowledge Project (/052). Much progress has been made in making Principal Investigators (PIs) aware of the availability and value of traditional knowledge. This project would continue the EVOS Trustee Council's initiative to enhance community involvement in the restoration program through the application of traditional ecological knowledge (TEK) in Trustee Council-funded projects. In FY 99, there are three primary tasks, including:. (1) Provide technical assistance in data collection, analysis, and interpretation (continue working with PIs to develop appropriate ways to apply TEK in ongoing and potential projects); (2) Informational workshops (organizing focused discussions between PIs and community experts to develop substantive interactions about restoration research findings and TEK); and (3) Community assistance (building understanding of the benefits and implications of TEK research in local communities).

To meet these goals, this project would provide funds to contract with a TEK Specialist. The TEK Specialist would work in cooperation with an advisory group, composed of a diverse group of individuals familiar with both TEK and the restoration program. In FY 99 the TEK specialist would (1) serve as a contact point for spill area communities, the community facilitators and spill area wide coordinator hired under Project /052A, and principal investigators on issues related to TEK, (2) provide technical assistance to restoration project PIs who plan to use, or for whom it would be appropriate to use, TEK, such as assisting PIs in design and implementation of data gathering instruments and assisting in interpreting TEK; (3) review FY 99 work plan to identify restoration project that may benefit from a TEK component, (4) consult with the Advisory Group, and (5) organize and coordinate six informational workshops between PIs and community members.

Also, community training workshops will be held to enhance understanding of the benefits and implications of working with TEK. These workshops may involve experts who have experience in applying TEK from an Alaska Native perspective. Workshops will occur in the communities in which informational workshops are planned, if desired by the communities. The Alaska Department of Fish and Game will provide staff support for the project, to provide assistance to the Advisory Group and TEK Specialist, and community facilitators and to assist with follow-up to community training workshops.

NEED FOR THE PROJECT

A. Statement of Problem

Through the efforts of the Community Involvement project (/052), principal investigators have been made aware of the value of traditional ecological knowledge for their projects. Traditional ecological knowledge was a major theme of the annual Restoration Science Workshop in January 1996. Principal investigators have requested technical assistance in the collection of traditional knowledge. This project would continue to provide that assistance.

B. Rationale/Link to Restoration

People living in the spill area have detailed knowledge about the condition of resources, which can add to data collected as part of scientific studies and may enhance the success of the restoration effort. This includes knowledge of the historic population sizes and ranges of many of the species injured by the spill, as well as observations concerning the diet, behavior and interrelationships of injured species. This information can help researchers evaluate the injury and recovery status of these species.

C. Location

Spill area wide, including Prince William Sound, the lower Kenai Peninsula, Kodiak and the Alaska Peninsula

COMMUNITY INVOLVEMENT

Community involvement is a major emphasis of this project. The project would foster communication between the principal investigators and residents of the communities impacted by the oil spill. The TEK Specialists would work closely with the Spill Area Wide Community Involvement Coordinator and the local facilitators hired under the Community Involvement project (/052A) and with the Youth Area Watch (Project /210) students.

PROJECT DESIGN

A. Objectives

1. Renew contract with the TEK Specialist.

2. Use the community facilitators and spill area wide coordinator hired under Project /052A when possible as contact points for spill area communities and principal investigators on issues related to TEK.

PROJECT DESIGN

A. Objectives (continued)

3. Provide technical assistance to restoration project PIs in the collection, interpretation, presentation (including presentation of study findings and results to participating communities), and archiving of TEK.

4. As a result of the community faclitators retreat in FY98, workshops will be held where most needs are identified. In cooperation with the Community Involvement Coordinator (-052A), develop community understanding of the benefits and implications of working with TEK. Where such needs are identified, arrange appropriate workshops to be conducted by experts in the particular topic(s) of interest to the community.

5. Organize and coordinate at least six informational workshops, bringing together PIs and community members to discuss topics of mutual interest and significance. These workshops will help in the application of TEK to restoration by engaging local experts in the analysis of research findings, and will help communicate the results of research project(s) by substantive dialogue between scientists and community members.

B. Methods

A TEK Specialist will be contracted to carry out objectives of this project in cooperation with an Advisory Group, the composition of which is described below. Experts in particular topics may be contracted with to conduct community-based workshops, as described below in "Community Assistance". ADF&G/Subsistence Division will also be involved in the project to provide staff expertise.

Interaction between the TEK Specialist and the Principal Investigators may occur in one of two ways. Either the PI will approach the TEK Specialist with a request for information, or the TEK Specialist will approach a PI to suggest the use of traditional knowledge. In either case, if both agree a TEK component would be of benefit to restoration, the TEK Specialist and the Principal Investigator will work together to formulate a research tool in order to elicit the desired information. The TEK Specialists will work closely with the Spill Area Wide Community Involvement Coordinator (Project /052A) to ensure appropriate community involvement in the TEK effort.

The TEK effort may be summarized as three primary tasks:

1) Data Collection, Analysis and Interpretation

If the information needed by a Principal Investigator on an existing project is not available through existing sources such as published literature and current databases, and if this information is likely to be held as TEK, the TEK Specialist will work with the Principal Investigator to develop an appropriate research tool to seek the desired information. In doing so, the TEK Specialist will consult with the relevant local facilitator(s) and village council(s). When such a project is underway, the TEK Specialist may also provide technical assistance to the PIs in the research and subsequent analysis and interpretation.

2*) Hold Informational Workshops*

The TEK Specialist will identify PIs who are interested in utilizing TEK expertise through focused discussions, or informational workshops, with community experts. The TEK Specialist will work with the PIs and the communities to schedule, prepare for, facilitate, and report on the workshops. The workshops will last 2-3 days, and will be limited to the PIs, local experts identified by the community, and a facilitator (probably the TEK Specialist). The workshops will likely be held during late fall, winter, or early spring. Preparations for the workshop will include distributing relevant information, discussing the objectives of the workshop with the participants, and creating a list of topics to be covered. The workshops will be held in a setting chosen to encourage interactions between participants, both during formal discussions and informally at other times. Following the workshops, the participants will hold a community meeting to share the results of their discussions with community members. The TEK Specialist will oversee production of workshop reports that describe the background, participants, content and results of each workshop. Following all the workshops, the TEK Specialist will also prepare, with the assistance of the participants and the Advisory Group, a brief report for the Executive Director evaluating the utility of the workshops and making recommendations for future workshops.

The goal of the workshops is to promote substantive interactions between PIs and community members on topics related to spill area resources, restoration and stewardship. This will be achieved by focusing discussions on the PIs' research and findings, and local observations related to the subject of research. There are five nested objectives for the workshops:

a. to help the PIs and community members understand each other's perspectives;
b. to see whether and how the information each has can help the other understand better what is happening to the resources and the ecosystem;

c. to analyze together the various observations and findings, to see if a common understanding can be reached regarding the state of the resource and the need for further information;
d. to determine whether further collaboration between the PIs and the communities will help better understand or manage the resource; and
e. to plan future collaboration, if desired.

Not all objectives may be relevant to every workshop, and the overall success of each workshop will be evaluated less on the number of objectives achieved and more on the quality of interaction for each achieved objective.

In FY99, it is expected that six informational workshops will take place. The first will involve seal and herring research projects in Tatitlek and Chenega Bay. Workshops will also be conducted in Port Graham, Nanwalek, and Valdez. A total of six workshops is expected, and a time commitment for the TEK Specialist of 2.5 months to the planning, preparation , conduct and follow-up of these workshops.

3) Community Assistance

The Alaska Department of Fish and Game, Division of Subsistence, the TEK Specialist (to a limited degree depending upon work on other objectives), and Community Involvement Coordinator will work with community facilitators to identify specific training needs in the different communities. Based on the needs identified, the Community Involvement Coordinator, assisted by ADF&G, will schedule community-based workshops, to be conducted by experts in the topic(s) of interest to the community. These workshops will help build understanding of the benefits and implications of TEK research and use, and the capacity to develop, plan, and undertake TEK projects for the benefit of the community and others. ADF&G and the Community Involvement Coordinator will responsible for follow-up to these workshops, including identifying ways to implement ideas identified at the workshops in components of ongoing project, potential new projects, or informational workshops. It is most likely that community training workshops will be held in Port Graham, Tatitlek, and Chenega Bay, prior to the informational workshops in those communities. The community facilitator retreat scheduled to be held in late April, 1998 will assist in identifying communities and topics for these information workshops.

TEK Specialist: Duties and Responsibilities

Regarding Objectives 1, 2, and 3 (1.5 months)

1. Serve as a contact point for spill area communities, the community facilitators and spill area wide coordinator hired under Project /052A, and principal investigators on issues related to TEK.

***TEK Specialist: Duties and Responsibilities* (continued)**

2. Review the FY00 workplan to identify restoration projects that may benefit from a TEK component, initiate contact with the PI(s) to determine whether adding a TEK component is desired and feasible, and develop plans for such a component.
3. Provide technical assistance to PIs in the design and implementation of questionnaires and other research tools to be used in the collection of TEK, the development of data collection methods, and the development of research agreements between the PI and village council as proposed in the draft TEK protocols.
4. Work with the Community Facilitators in identifying residents having specialized knowledge on a particular topic of interest to the principal investigators, and provide technical assistance in data collection as appropriate.
5. Assist the PIs in interpreting the TEK data collected as well as any data brought in from existing records, and in communicating study findings and results back to participating communities.
6. Consult regularly with the Advisory Group to obtain feedback, advice, and direction on the TEK Program as it develops.

Regarding Objective 5 the informational workshops (2.5 months),

7. Organize and coordinate informational workshops as described above.

Advisory Group: Composition and Duties

The Advisory Group is made up of a diverse group of individuals who are familiar with both TEK and the EVOS restoration program. Members were jointly selected by the Executive Director of CRRC and the Executive Director of the Trustee Council in FY97, and include:

1. Spill Area Wide Community Coordinator (Project /052A)
2. Three research scientists involved in the EVOS restoration process - Stan Senner, Bruce Wright, and Kate Wynne
3. All interested Community Facilitators (Project /052A)
4. Federal Trustee Council agency representative - Don Callaway
5. State Trustee Council representative - James Fall
6. Regional native organization representative - Patricia Cochran
7. A person with expertise in TEK - Maria Fernandez Giminez

The advisory group will meet regularly and where possible in conjunction with community facilitator meetings, to provide feedback to the TEK Specialist on the progress and development of the project and its various components. All relevant materials (draft reports, trip reports, proposals, etc.) will be circulated to the Advisory Group for comment. In addition to the meetings, the TEK Specialist may consult with

any or all members of the Advisory Group at his/her discretion. The advisory group members will work on a volunteer basis. Travel costs, where required, will be provided out of this project.

Other TEK Experts

Regarding Objective 4, community training workshops, one or more individuals who have experience in applying TEK from an Alaska Native perspective may be contracted to conduct community training workshops. Follow-up to these workshops will be the responsibility of ADF&G and the Spill Area Wide Community Coordinator.

ADF&G/Subsistence Division: Duties and Responsibilities

Regarding Objectives 1, 2, and 3 (One month).

1. Provide assistance to the Advisory Group, the TEK Specialist, and community facilitators, including writing summaries of Advisory Group meetings, adding references to the reading list/bibliography, and helping to orient the Spill Area Wide Community Involvement Coordinator to issues involving TEK; provide general expertise on subsistence uses and oil spill impacts on these uses to assist in the design of research and data gathering instruments, and in the interpretation of study results.
2. Assist the TEK Specialist in providing technical assistance to PIs and potential PIs in application of TEK, including development of DPDs, and by reviewing data gathering instruments, field plans and project designs related to TEK components in EVOS projects.
3. Contribute to the annual project report.

Regarding Objective 4 (One month)

4. Provide input into the planning of community-based workshop/training sessions, and with the Spill Area Wide Community Coordinator develop follow-up to community training workshops, including identifying ways to implement ideas identified at the workshops in components of on-going projects, potential new projects or informational workshops.

C. Cooperating Agencies & Organizations

National Park Service, other Trustee Council agencies

SCHEDULE

A. Measurable Project Tasks for FY99 (October 1, 1998-September 30, 1999)

October 1, 1998	Contract between ADF&G and CRRC renewed
October 1998	TEK Specialist contract renewed Identify needs for community-based training workshops (will likely continue at least into December), and interest in informational workshops
October 1998 to March 1999	Hold approximately six community training workshops
November 1998	TEK Specialist initiates contacts with PIs with TEK components in their FY 99 projects; and schedule informational workshops; Initiate contact with appropriate PIs regarding their participating in the informational workshops
November 1998 to April 1999	Hold six informational workshops
January 1999	TEK Specialist attends 10th Anniversary Symposium and makes contacts with PIs re: including TEK component in FY 99 proposals
May 1999	TEK Specialist review all proposals submitted for FY99 and develop recommendations for Executive Director re: TEK
June 1999	Prepare draft workshop reports Prepare draft reports on training workshops
July 1999	Review all projects recommended for funding in FY99 to determine which would benefit from a TEK component
September 1999	Prepare final workshop reports and distribute Prepare final reports on training workshops

B. Project Milestones and Endpoints

October 1998	TEK Specialist contract renewed
October 1998	Community workshop planning begins
November 1998	Informational workshops scheduled and initiated
March 1999	Approximately three community training workshops completed
April 1999	Informational workshops completed
September 2000	Informational workshop reports completed Community workshop reports completed
Ongoing	Provide technical assistance to PIs regarding the collection, interpretation and presentation of TEK.

C. Completion Date

April 15, 2002

PUBLICATIONS AND REPORTS

An annual report on the development, progress, and accomplishments of this TEK project will be provided to the Trustee Council on April 15, 2000. Reports on the informational workshops will be prepared and completed by September, 1998. These reports will summarize discussions held during the workshops, and identify what was gained by the participants.

Following the informational workshops and the community training workshops, the TEK Specialist, workshop experts, community participants, ADF&G, and PIs involved will review whether publication of results in a peer-reviewed journal is desirable and feasible. If so, manuscript(s) will be prepared for appropriate journals. Consideration will also be given to publishing a review of the TEK effort as a whole.

PROFESSIONAL CONFERENCES

Participation in professional conferences is not anticipated during this year of the project.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is focused more than most on the coordination and integration of the restoration effort. The TEK Specialist will work with the Principal Investigators of other projects, providing a service that is expected to benefit those projects and the restoration effort as a whole. This project will also be closely coordinated with the Community Involvement Project (99052A), and the Youth Area Watch Project (99210).

BUDGET

	CRRC	ADF&G	TOTAL
TOTAL	**52,650**	**18,260**	**$70,910**
Project Personnel	**36,750**	**10,800**	**47,550**
TEK Specialist (Huntington, 4 mos.)	24,750		
ADF&G (Miraglia, 2 mos.)		10,800	
Training Workshop Experts	6,000		
Informational Workshop Participants (250 X 5 workshops X 4 participants)	6,000		
Travel	**10,400**	**2,000**	**12,400**
Community Assistance (Community Training Workshop Experts: 3 trips, 3 days each)	1,800		
Project Assistance (TEK Specialist, 2 trips, 3 days each)	1,700		
Informational Workshops (TEK Specialist, prep. Trips, workshop trips: 8 trips, 2.5 days each)	5,900		
PI travel to workshop (Some PIs would cover their own travel, this would help those without a budget for it: 3 PI trips, 3 days each)	1,000		
ADF&G (To attend community training workshops, and follow-up)		2,000	
Commodities	**500**	**0**	**500**
Maps, paper, notebooks, pens	500		
Contractual		**200**	**200**
Telephone		200	
Overhead	**5,000**	**5,260**	**10,260**
CRRC indirect at 10%	5,000		
ADF&G (15% on line 100, 7% on line 300)		5,260	
TOTAL			$70,910

FY 99 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999						
Personnel		$10.8						
Travel		$2.0						
Contractual		$52.7						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$65.5		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
General Administration		$5.3						
Project Total	$0.0	$70.8						
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 99 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
Rita A. Miraglia	Subsistence Resource Specialist III	18D	2.0	5.4		10.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	5.4	0.0	
					Personnel Total	$10.8

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
Anchorage to Port Graham/Nanwalek	0.2	2	4	0.1	0.8
Anchorage to Chenega Bay/Tatitlek	0.4	2	4	0.1	1.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.0

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

FY 99 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Contractual Costs:		Proposed FY 1999
Description		
4A Linkage	Cooperative Agreement with Chugach Regional Resources Commission	52.5
Telephone		0.2
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$52.7

Commodities Costs:		Proposed FY 1999
Description		
	Commodities Total	$0.0

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Agency: ADFG

FORM 3B
Contractual & Commodities

FY 99 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Agency: ADFG

FORM 3B
Equipment
DETAIL

FY 99 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$0.0
Travel		$10.4
Contractual		$36.8
Commodities		$0.5
Equipment		$0.0
Subtotal	$0.0	$47.7
Indirect		$4.8
Project Total	$0.0	$52.5
Full-time Equivalents (FTE)		0.0

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

FY 99 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1999
						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		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1999
	Training Workshops					0.0
	(Bryan MacLean: 3 trips, 3 days each)					1.8
	Project Assistance					0.0
	(Henry Huntington; 2 trips, 3 days each)					1.7
	Informational Workshops					0.0
	(Henry Huntington, prep. & workshop trips; 8 trips, 2.5 days each)					5.9
	PI Travel to Synthesis Workshops					0.0
	(Some PIs would cover their own travel, this would help					0.0
	those without a budget for it; 3 trips, 3 days each)					1.0
						0.0
						0.0
						0.0
					Travel Total	$10.4

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

FY 99 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FY 1999
TEK Specialist (Henry Huntington)	24.8
Training Workshop Experts (Bryan MacLean and others)	6.0
Local TEK Experts	6.0
Contractual Total	$36.8

Commodities Costs:	Proposed
Description	FY 1999
Supplies (pens, paper, notebooks, etc.)	0.5
Commodities Total	$0.5

FY 99

Prepared: 4-15-98

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities

FY 99 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
			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		

FY 99

Project Number: 99052B
Project Title: Traditional Ecological Knowledge
Name: ADFG

FORM 4B
Equipment
DETAIL

Prepared: 4-15-98

Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in PWS

Project Number:	99064
Restoration Category:	Research, Monitoring
Proposer:	Kathryn J. Frost, ADF&G
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	none
Alaska Sea Life Center:	
Duration:	2nd year, 3-year project
Cost FY 99:	$264,800
Cost FY 00:	$175,000
Geographic Area:	Prince William Sound
Injured Resource:	Harbor Seals

ABSTRACT

This project will monitor the status of harbor seals in Prince William Sound and investigate the hypothesis that food limitation to pups and juveniles is causing the ongoing decline. Aerial surveys will be conducted during molting to determine whether the population continues to decline, stabilizes, or increases. Seal pups will be satellite-tagged to describe and compare their movements, hauling out, and diving behavior to older seals and seals in other areas. Deuterium oxide will be used to examine annual variations in the nutritional status of pups and yearlings, as indicated by total body fat content. Fatty acids analysis will be conducted on recent and archived blubber samples and mathematical models developed to estimate seal diets and whether they have changed since the 1970s. Special emphasis will be on pups and juveniles, the age groups most likely to be affected by food limitation.

INTRODUCTION

The *Exxon Valdez* oil spill (EVOS) occurred in Prince William Sound (PWS) in March 1989. Because harbor seals (*Phoca vitulina richardsi*) and their haulouts became oiled by the spill, harbor seal studies began almost immediately as part of the Natural Resources Damage Assessment (NRDA) program. These NRDA studies were conducted by the Alaska Department of Fish and Game (ADF&G), and included aerial surveys to quantify mortality and necropsies to document levels of hydrocarbons and tissue damage in oiled seals. Based on these investigations, it was estimated that more than 300 harbor seals (36% of the seals in oiled areas) died in PWS following the EVOS. As NRDA studies progressed, it also became clear that the harbor seal population throughout PWS was declining and had been doing so since at least 1984. Therefore, beginning in 1991 as NRDA studies neared completion, the Trustee Council funded a harbor seal restoration study in which ADF&G continued to monitor the trend of harbor seals in PWS and began to investigate the causes of the ongoing decline. These early restoration studies addressed a broad array of possible causes for the decline including disease, predation, human-caused mortality, reproduction, and food limitation.

Marine mammals and seabirds are apex predators in ecosystems in which fishes and cephalopods are important prey. As such, a strong relationship would be expected between predator populations and the abundance of fish stocks. This relationship is likely to be influenced by factors such as commercial fisheries and ecosystem changes (e.g., Beddington, et al. 1985; Springer 1993). In many parts of the world pinniped populations have increased as predicted after protection from over-exploitation (e.g., Olesiuk, et al. 1990; Shelton et al. 1995). However, large declines in populations of harbor seals and Steller sea lions (*Eumetopias jubatus*) have been documented in the Bering Sea and the GOA, including PWS (Pitcher 1990; Loughlin, et al. 1992). These declines occurred despite implementation of the 1972 Marine Mammal Protection Act (MMPA) which ended commercial hunting for pups and bounty payments for adults. Likewise, since the 1970's numerous species of seabirds have also declined in PWS. These unanticipated declines have prompted monitoring and assessment of marine mammal, seabird, and fish population trends, and perhaps most importantly, have furthered the idea of using predators as samplers of forage fish abundance (Duffy 1996; Roseneau and Byrd 1996). The latter aspect may provide the most useful information towards addressing the question of "Is it food?", since the mean abundance of prey at large spatial scales, as determined from fisheries surveys, may not be relevant to the scale at which seals and seabirds forage (e.g., Duffy 1996; NRC 1996).

In PWS, harbor seals are one of the most abundant and widely distributed marine mammals, hauling out and/or breeding at more than 50 sites. Since 1984 harbor seal numbers in PWS have declined by about 60%, with only part of this decline attributable to the 1989 *Exxon Valdez* oil spill (EVOS) (Frost and Lowry 1994a, Frost et al. 1994). The decline in harbor seals has not been limited to PWS, but has also occurred in adjacent parts of the GOA (Pitcher 1990). A change in the trophic structure of the ecosystem, and hence the availability of prey, is among the hypothesized causes for this observed decline, as well as that of other apex predators. Thus, understanding the diet of harbor seals and how they may depend on seasonal or area-specific concentrations of prey is not only needed in the management of harbor seals as a resource, but because harbor seals may also act as important indicators of other marine resources.

Recently, the use of fatty acid signature analysis (Iverson 1993) has been proposed to study marine food webs and pinniped diets (Iverson 1995). Fatty acids are the largest constituent of lipids and those of carbon chain length 14 or greater are often deposited in animal tissue with minimal modification from diet. Lipids in the marine food web are exceptionally complex and diverse. Owing to various restrictions and specificities in the biosynthesis and modification of fatty acids among different taxonomic groups (e.g., Paradis & Ackman 1976; Ackman 1980; Cook 1985; Fraser et al. 1989), many components appear which can be traced to a general or even specific ecological origin. Certain "indicator" fatty acids (Iverson 1993) exist which are particularly useful in food web studies since they can arise only or mostly from the diet. Although methods of fatty acid signature analysis are still being developed, the technique has been used both to identify general trophic level of diets and to detect major and minor shifts in diet within populations (Iverson, Arnould & Boyd 1997; Smith, Iverson & Bowen 1997).

This harbor seal restoration study conducted in PWS during 1994-1997 is one of the two most comprehensive ecosystem studies ever conducted using fatty acids signature analysis (Iverson, Frost & Lowry, 1997; Iverson, Bowen & Ackman, unpublished data), and has come the farthest in advancing the development of this method. In the first four years of study in PWS, fatty acid signatures have indicated that fine-scale structure of foraging distribution of harbor seals can be discerned, and that this is due not only to localized feeding patterns in seals, but also to specific differences in prey species with size and location or habitat within PWS (Iverson, Frost & Lowry, 1997). From this initial work, it was also possible to make inferences about predominant prey species in the diet of individual seals. Since harbor seals are likely to adjust their foraging patterns to changes in abundance of local prey (Olesiuk 1993; Tollit & Thompson 1996), this suggests that determining diets or changes in diets of harbor seals over time using fatty acid signatures may provide clues not only to changes in foraging patterns, but also to differences in local prey availability, predominant species size classes, and species abundance at the spatial and temporal scales that are essential to the nutrition of individual animals. It has been proposed that one cause for the decline in some Alaskan pinniped populations may have been a change in community structure over time that resulted in an ecosystem dominated by large predatory pollock, thus making small forage fish less available to pinnipeds, especially juveniles (NRC 1996). Thus, the ability to detect relationships between and within predators and prey on a small spatial scale indicates that fatty acid signature analysis could begin to address such hypotheses.

Since the inception of this restoration study, the focus has continued to narrow and tighten. As other possible causes for the decline (for example disease and poor pup production) appear less likely, the focus has shifted increasingly to the question "Is it food?" Initially we addressed this question relative to adult and subadult segments of the population. More recently, we have begun to focus on pups.

Since 1994, we have collected samples from 165 PWS harbor seals for stable isotope, blubber energy, blood chemistry, and fatty acids analyses. Morphometric measurements, ultrasound, and measurements of bioimpedence were also obtained from these seals. This included 36 seals in 1994, 42 in 1995, 39 in 1996 and 50 in 1997. In addition, more than 60 blubber samples have been obtained from subsistence hunters as part of an EVOS-funded biosampling program. These samples have been analyzed by a variety of investigators in a multi-disciplinary approach to the question of whether food is limiting the recovery of harbor seals. Stable isotope results are

reported by Schell and Hirons as part of EVOS Restoration Project 170 and blood chemistry and blubber energy results by Castellini et al. as part of EVOS Restoration Project 001. As part of our study, we have addressed the food limitation hypothesis through satellite-tagging and fatty acids analysis. New methods for both of these approaches were developed by this restoration project.

Satellite-tags have provided information about locations, movements, and diving of seals, which is helping us to identify feeding areas and understand feeding behavior (Frost et al. 1996). To date, 63 harbor seals have been successfully instrumented with satellite-linked depth recorders (SDRs), including 26 adults (11 males, 15 females), 23 subadults (12 males, 11 females), and 14 pups (10 females, 4 males) (Table 1). Twenty-two of these were tagged in April- May, 29 in September, and 12 of the 14 pups immediately following weaning in late June-early July.

Satellite-tagging data clearly indicate substantial individual variation in the way seals make their livings (Frost and Lowry 1994b; Frost et al. 1995 and 1996). Some tagged seals used only a few haulouts and made only short trips away from them to feed. Others made longer trips of several days to almost two weeks. Some of these feeding trips were apparently entirely within PWS and others were in the GOA. Movements between terrestrial haulouts in central PWS and glaciers in northern PWS were not uncommon. Preliminary analysis of data from newly weaned pups tagged in 1997 suggests that their movements are generally similar to those of adults. Contrary to expectations, pups did not appear to move farther or show less site fidelity than adults. Analysis of diving behavior of adults and subadults indicated that some seals made consistently shallow dives, while others fed in deeper waters and dove to greater depths. The deepest dive by a tagged seal was 404 m, but most dives were to less than 200 m. In general, seals dove more and hauled out less in the winter. They spent a greater proportion of days hauled out in summer, and used more haulout sites during this period. This is the period when pupping, breeding, and molting occur.

Over the five years of this study, there appears to have been a change in the feeding behavior of seals during winter. None of 6 seals tagged in September 1993 and only 2 of 8 tagged in September 1994 left PWS. All three adult females tagged in fall 1994 spent the entire winter in PWS. In contrast, 12 of 15 seals tagged in September 1995-1996 made winter-spring feeding trips outside PWS. Of the 5 adult females, 4 moved to the Copper River Delta in March, suggesting that food resources found there in spring may be important to pregnant females. These feeding trips outside PWS occurred primarily during winter and spring, and most were to the Copper River Delta. Only 3 of 22 seals tagged in April/May left PWS. Two of these were adults that went to the GOA in May and returned to PWS by June. One small subadult spent parts of May-July in the Copper River Delta. Fatty acids data also show a change in the diets of PWS harbor seals between 1994-1995 and 1996-1997.

The SDR data set for 63 harbor seals from PWS is one of the largest of its kind. It is especially valuable because ADF&G has similar SDR data from an additional 70 harbor seals instrumented in SEAK and near Kodiak as part of the NOAA-funded harbor seal study (Swain et al. 1996). When the information from these two data sets are synthesized, it will represent the most complete body of information about harbor seal movements and diving/feeding behavior anywhere in the world.

The sample size of satellite-tagged adult and subadult males and females in PWS is now sufficient to generally characterize the movements and diving behavior of these age groups of seals. However, we have tagged only fourteen seal pups. This is because satellite tags were initially too large to use on pups. Small 0.25-watt SDRs developed and tested in 1996-1997 now allow us to safely instrument small seals. Consequently, our emphasis in 1997 shifted to the tagging of newly-weaned pups. This will continue to be our emphasis during the next two years of this project.

Fatty acids analysis in PWS harbor seals and their prey was initially funded by the EVOS Trustee Council starting in 1994 as a pilot project. Early results were published in Marine Ecology Progress Series (Iverson, Frost & Lowry, 1997). In that initial study, fatty acid signatures were used to investigate the diet and spatial scales of foraging in harbor seals and selected prey in PWS and the GOA (Iverson, Frost & Lowry, 1997). Since then, many additional blubber samples and prey have been analyzed. To date, blubber samples from 296 harbor seals from PWS, Kodiak Island, and SEAK have been analyzed for fatty acid composition. A total of 792 potential prey samples representing 18 taxa have also been analyzed for total fat content and fatty acid composition. Classification and regression tree analysis was used to classify seals and prey according to their fatty acid signatures. We continue to find large differences in the fatty acid composition of blubber from seals sampled at Kodiak, SEAK and PWS. Additionally, fatty acid signatures distinguished seals from different regions within PWS, as well as from haulout sites only a few kilometers apart. These findings suggested that seals forage very site-specifically.

Prey fatty acid patterns also differed on similarly small spatial scales within PWS. Not only could prey species such as herring and pollock be differentiated from one another using fatty acid signatures, but they could also be distinguished by size-class and location within PWS, reflecting differences in diet with age and as well as with fine-scale habitat. Results from this study were consistent with both satellite data from tagged harbor seals and stomach content analyses of forage fish species in PWS.

Preliminary efforts to mathematically model the diets of seals suggest that medium and large herring and squid dominate the diets of seals in southcentral PWS. This is consistent with information about prey distribution and abundance in PWS and historical information about harbor seal diets. The modeling exercise is still in its preliminary phase and will continue to be refined and improved in the future. However, it is already clear that fatty acid signature analysis will be an important contribution to understanding marine food webs in PWS and other marine environments. Perhaps its greatest potential is that it integrates diet over time and allows us to identify, not every individual prey that was eaten, but instead the key prey species that have contributed most to fat reservoirs, and therefore nutritional status of these seals.

During FY 98, the objectives of the harbor seal restoration study addressed six hypotheses regarding the status and trends of harbor seals in PWS, possible causes for the ongoing population decline, and the nutritional status of PWS harbor seals. The status of studies relative to these hypotheses is very briefly summarized below.

Hypothesis 1: The PWS harbor seal population has stabilized and/or increased since the EVOS. Annual counts of seals at 25 standardized "trend count" haulout sites in PWS have been made since the oil spill in 1989. From 1990-1997, surveys showed a decline of about 4.5% per year. Counts that had been adjusted for the effects of tide, date, and time of survey were 28% lower in 1997 than in 1990, and 63% lower than in 1984. The results of these analyses were prepared and submitted for publication to Marine Mammal Science. The manuscript has been reviewed, revised, and was resubmitted in April 1998 (Frost et al. in review).

Hypothesis 2: Prey changes in PWS have resulted in food limitation, poorer body condition, and therefore reduced survival of juvenile seals. During 1997, total body composition (fat, protein, lean body mass) of pups, yearlings, and subadults was measured using isotope dilution with deuterium oxide (D_20). Average fat content was 43% for pups, 23% for yearlings, and 18%-20% for other subadults. PWS pups averaged 7 kg heavier than harbor seal pups form Sable Island, and PWS yearlings had twice the fat content of Sable Island yearlings. This suggests that PWS pups and yearlings were adequately nourished - much better than expected - in 1997. We currently have no means of assessing survival of juveniles.

Hypothesis 3: The diets of PWS and other declining populations of harbor seals differ from diets of harbor seals in areas where populations are stable. Fatty acid signature analysis has been conducted on blubber of almost 300 harbor seals from PWS, southeast Alaska, Yakutat, and the Kodiak area. In general, southeast Alaska seals were clearly distinguished from Kodiak and Yakutat seals and most similar to seals from northern PWS. Southern PWS seals were quite similar to those from Kodiak. This was not surprising since satellite tagging data indicated that some southern PWS seals made regular feeding trips to the northern Gulf of Alaska. Diets in southeast and northern PWS were generally more diverse than those in other areas. Although we have been able to identify geographic differences in prey base, we have not yet been able to determine whether and how these differences might affect nutritional status.

Fatty acid signature analysis indicates clear annual differences in diet for all regions. Diets in PWS were quite different in 1994 and 1995 than they were in 1996 and 1997. Samples were available only for 1995 and 1996 for SEA and Kodiak. In both regions, fatty acids analysis indicated a substantial change in diet from one year to the next.

Hypothesis 4: The diets of harbor seals have changed over the past few decades, reflecting a change in the distribution and abundance of important forage fishes. Several samples of harbor seal blubber collected in the 1970s were analyzed to determine whether such archived samples are still suitable for fatty acid signature analysis. The samples were relatively clean and free of oxidation, and the results indicated that further sample analysis should be productive and provide us the opportunity to assess changes over a longer term period. The fatty acid signatures of these first few samples were substantially different than those form more recent samples. We have subsampled 24 additional archived samples from 1976-1978, and will analyze them in the near future. Fatty acid signatures of blubber from seals in the 1970s, matched by geographic area, will be compared to more recent samples. Stomach contents data from seals collected in the 1970s will be incorporated into these comparisons.

Hypothesis 5: The diet composition of harbor seals in areas of population decline reflect differences or changes in the relative distribution and abundance of prey important to various demographic groups. As part of a Master of Science graduate thesis project, Ms. Tracey Gothardt is collecting information on recent and historical distribution and abundance of forage fishes in PWS and the northern Gulf of Alaska. She is synthesizing forage fish data layers by compiling a literature/data search of the most recent forage fish studies in PWS. Forage fish distribution data acquired from ADF&G, APEX and SEA have been entered into a GIS database to provide maps for use in spatial analysis of species distribution in PWS. This synthesis of forage fish information will be used to coarsely depict year round distributions of fish and particularly to identify "hot spots" and describe species distribution on a seasonal basis.

Ms. Gothardt is also analyzing seal diving and movement data for 14 seals satellite-tagged near Montague Island. Location data have been entered into a GIS database and seals tracked through time to determine the range of foraging trips, and any patterns in spatial and temporal distribution. She is currently examining spatial and temporal co-occurrences of seals and fish in an attempt to describe harbor seal distribution and movements in relation to their prey base.

Ms. Gothardt has completed the data acquisition phase of her project and is in the process of writing her thesis. She anticipates that her thesis will be completed and defended during FY 99.

Hypothesis 6: Harbor seal pups and juveniles spend more of their time foraging to obtain adequate nutrition than do adults; pups in PWS spend more time foraging than pups in other areas where the population is not declining. Twelve post-weaning harbor seal pups from PWS were instrumented with SDRs in 1997. As of March 1998, four were still transmitting, and all were within PWS. Preliminary analysis of dive data indicates that pups and non-pups spent similar amounts of time diving during September-December, and that seasonal patterns in amount of time spent diving were generally similar for all ages. Pups did not make obviously more or longer feeding trips, nor did they show less site fidelity than adults. ADF&G, as part of the NOAA-funded harbor seal study, also tagged 10 newly-weaned harbor seal pups on Tugidak Island in the northern GOA in summer 1997, and over half of these SDRs were still transmitting in March. In the future, comparisons will be made among PWS pups tagged in different years, and between PWS pups and pups tagged on Tugidak.

Proposed work in 1998. During the 1998 field season, satellite tagging, sampling, and monitoring will continue. Research will focus on the hypothesis that the availability of food, particularly to pups and subadults, is limiting the harbor seal population. Aerial surveys will be flown to monitor trends during the molting period in 1998. We plan to attach satellite transmitters to 6 harbor seal pups in 1998 to assist with the interpretation of dietary information provided by fatty acid analysis, and to identify areas used by newly weaned pups for feeding. Satellite-tagging will also provide information about dispersal of pups after weaning, and whether or not they leave PWS. Body fat content of 20-30 pups and yearlings will be determined using D_2O. Blood, blubber, skin, and measurements will be taken from all seals that are caught during tagging operations regardless of age. Similar samples are being collected by ADF&G in SEAK, where harbor seals are not declining, and in the Kodiak region where they have declined more than 90% since the mid-1970s as part of the NOAA-funded harbor seal project. Data will be compared to better understand why seals are doing well in some areas and declining in others.

Work proposed in 1999 and beyond. The research being proposed for 1999-2000 will build upon previous research findings and incorporate new components to address high-priority issues regarding harbor seal recovery.

We will conduct aerial surveys to monitor the trend of harbor seals in PWS during 1999. These surveys are relatively inexpensive to conduct, and since PWS harbor seals continued to decline through 1997, we think it is important to continue to monitor their trend. During 1999, we will finalize our reanalysis of survey data using hierarchical Bayes models that relate observed seal count to a number of covariates (including location). Recommendations regarding future trend monitoring will be made after this hierarchical Bayes analysis has been completed.

We plan to attach satellite transmitters to 6-8 additional harbor seal pups in 1999. Data collected from the 51 adult and subadult seals satellite tagged during 1992-1996, as well as the pups instrumented in 1997 -1998, will be thoroughly analyzed. Following pup tagging in 1997-1998, we will assess the information obtained from this program and make recommendations regarding tagging in 1999 and beyond.

Fatty acid studies will be continued and extended. Additional samples of a few select prey species will be analyzed to fill in missing locations or age classes and to enable an examination of annual variability in fatty acid signatures. We will obtain and analyze blubber samples from seals that we catch, as well as from subsistence caught seals. We will place particular emphasis on pup and young subadult seals, since this is the age class thought to be most sensitive to food limitation. Information on diet will be integrated with data from forage fish studies to understand how harbor seals utilize prey and how they may depend on seasonal or area-specific concentrations of prey.

NEED FOR THE PROJECT

A. Statement of Problem

From 1984-1988, harbor seal counts at 25 trend sites in PWS declined by 43% due to unknown causes. The decline continued in 1989, aggravated in oiled areas by the EVOS. Counts of seals at oiled trend count sites declined by 45%, compared to 11% at unoiled sites. More than 300 harbor seals (36% of those in oiled areas) were estimated to have died in PWS due to the spill.

Since 1990, numbers have continued to decline at about 4.5% per year. There were 28% fewer seals in 1997 than in 1990, and over 60% fewer than in 1984. The reasons for the continuing decline remain unknown, but may relate to food limitation.

B. Rationale/Link to Restoration

Harbor seals are important to residents of PWS for subsistence. In 1985-1989, harbor seals made up 13%-27% of the subsistence foods harvested in Tatitlek and Chenega Bay. During 1992-1995, these two villages harvested less than half the number harvested annually before the spill. Native residents have noted the scarcity of seals and the impact this has had on subsistence

hunting. Harbor seals are also watched and photographed by tourists and recreational users of PWS, and they interact with and are incidentally killed by commercial fisheries.

Like all marine mammals, harbor seals have special federal protection under the Marine Mammal Protection Act. Because of the ongoing decline, it is essential that current population data be available so that inappropriate restrictions on human activities are not implemented. It is important to understand what factors are limiting the population. We cannot assume, given the ongoing decline, that the number of seals in oiled areas will return naturally to pre-spill levels. It is necessary to continue monitoring trends, identify and appropriately manage areas of particular biological significance, and communicate information on population status to subsistence hunters and fishermen in order to minimize mortality and augment recovery in any way possible. Commercial fisheries in PWS may face greater restrictions designed to reduce incidental take of harbor seals unless something can be done to understand and reverse the population decline.

The ongoing decline of harbor seals began over two decades ago in the Kodiak area, and was detected at least a decade ago in PWS. Although periodic surveys have documented the downward trends and are useful for determining whether the recovery objective of "stable or increasing population trends" has been met, they are not adequate for determining what is causing the seal population to decline, or for designing conservation and management measures to facilitate recovery and ensure the future health of the population. Unless research is specifically designed and conducted to investigate the factors limiting harbor seals, it is likely that little progress will be made in understanding and mitigating the decline. This is a difficult but important topic to investigate. It will require a multidisciplinary approach that incorporates an understanding of harbor seal behavior, habitat use, and energetics, with data about the distribution, abundance, and biology of prey species and predators.

C. Location

This project will be conducted in PWS. Aerial surveys will be flown over the 25 established trend count sites listed in Table 1. Seal tagging and sampling will take place at a variety of locations throughout PWS. Pup tagging locations will be chosen based on our ability to catch seals, to represent different habitats, and the existence of previous tagging data for adult and subadult seals, to facilitate comparisons. Comparative data will be obtained by other ADF&G harbor seal studies near Kodiak and in SEAK.

Communities that harvest harbor seals or engage in commercial fishing activities, and may be affected by or utilize results of this study, include Cordova, Chenega Bay, Tatitlek, and Valdez.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

"Harbor Seal Updates" were produced and distributed to PWS subsistence hunters and other interested persons in PWS communities in September 1997. The Principal Investigator has been invited to participate in the Elder Youth Conference in Cordova during August 1998.

Information from this study will be presented at oil spill symposia, planning workshops, conferences, and in the published literature. Information will be provided to the University of Alaska Sea Grant program and ADF&G Division of Subsistence for use in meetings and discussions with PWS subsistence hunters regarding the biosampling program. ADF&G marine mammals staff regularly attend meetings with various public groups (tourism industry, fisheries, conservation groups, subsistence communities) to inform them about status, important conservation issues, and key research needs for harbor seals.

Project investigators will cooperate with personnel from the ADF&G Division of Subsistence in their efforts to inform residents of Chenega Bay, Tatitlek, Valdez, and Cordova about the findings of this study and to incorporate the suggestions of PWS residents in study design. Such an exchange of information will allow biologists to benefit from residents' observations about abundance and behavior of harbor seals in PWS, and will help residents to make informed decisions about their annual harvest of harbor seals.

When invited, investigators will continue to attend meetings of the ANHSC to discuss study results and proposed research. Investigators will assist as requested in developing community-based sampling programs. Biosampling is a cooperative effort of the ANHSC, NMFS, the University of Alaska Sea Grant program, and the ADF&G Division of Subsistence. Personnel from this harbor seal project will facilitate sample analysis and communication of results to community residents. The principal investigator will continue to prepare newsletter-type reports of project findings (Harbor Seal Updates) for distribution to community residents and to the Public Advisory Group.

PROJECT DESIGN

A. Objectives

1. Monitor the abundance and trends of harbor seals at trend count sites in oiled and unoiled areas of PWS to determine whether the PWS harbor seal population has declined, stabilized, or increased since the EVOS.

2. Recommend a schedule for continued aerial survey monitoring based on observed trend and statistical characteristics of survey data.

3. Identify important prey species in the diets of harbor seals in PWS, with a particular emphasis on pups and yearlings, and determine whether there are dietary differences among different components of the population.

4. In conjunction with research efforts being done on the Scotian Shelf, develop mathematical models and associated software programs to quantitatively estimate species composition of individual harbor seal diets.

5. Determine whether there are differences in diets and important prey species among populations of harbor seals in areas of the Gulf of Alaska where they are continuing to

decline (e.g., PWS and northern GOA) and areas where the population is stable or increasing (SEAK).

6. Determine whether changes in harbor seal diets and important prey species have occurred over the past two decades.

7. Compare estimates of abundance and importance of harbor seal prey to trawl survey data and data obtained from seabird diet studies being conducted concurrently under the APEX program.

8. Determine foraging range and diving behavior of harbor seal pups and juveniles and compare to similar information for other age groups.

9. Provide information to subsistence hunters so they can make informed decisions about the appropriate level of harvest for harbor seals.

B. Methods

The following hypotheses were developed for FY 98 - FY 00 for this harbor seal study to meet the above objectives.

Hypothesis 1: The PWS harbor seal population has stabilized and/or increased since the EVOS.

1. Conduct aerial surveys at PWS trend sites during molting in 1999;
2. Re-analyze survey data using hierarchical Bayes models and develop estimates of the annual number of observed seals.
3. Develop hierarchical Bayes models that relate observed seal count to a number of covariates, including location, calendar day, time, height of low tide, time of low tide, qualitative assessments of wind and sky conditions, and trends for each site.
4. Develop a hierarchical Bayes approach to trend monitoring by combining trends among sites, taking into account the covariates.
5. Reevaluate survey data collected since 1989 using hierarchical Bayes methods to evaluate whether seal numbers are continuing to decline, have stabilized, or are recovering to pre-spill levels.

Hypothesis 2: Juvenile harbor seals are particularly sensitive to characteristics of prey abundance such as depth, prey size, and prey type. Prey changes in PWS have resulted in food limitation, poorer body condition, and therefore reduced survival of juvenile seals.

1. Obtain blood and blubber samples from pups, subadult and adult harbor seals in PWS during two time periods: a) in late June/early July, representing the diets of pups about 2 weeks post-weaning (and therefore of their mothers) and the first over-winter diets for yearling harbor seals, and b) in August/September, a time when pups have lost blubber stores obtained from milk fat consumed during suckling and have begun to forage on their own, and also a time representing the summer diets of other age groups.
2. Analyze blubber samples for fatty acid signatures of individuals and age groups.
3. Measure total body composition (fat, protein, and lean body mass) of pups and juveniles using D_20 equilibration as an indicator of individual nutritional status.

4. Use fatty acids signature analysis to determine whether individual, age-related, and interannual differences in diets occur in harbor seals; use this information to examine whether seals from different areas appear to have different diets because of differing prey intake with location or because of different age-group composition.
5. Continue to assess variation in the fat content and fatty acid composition of prey species in PWS, but with a particular emphasis on characterizing size-class and regional differences in the four prey species that are likely of most importance to harbor seals and especially juveniles: herring (*Clupea pallasi*), pollock (*Theragra chalcogramma*), capelin (*Mallotus villosus*), and sandlance (*Ammodytes hexapterus*).
6. Assemble the entire database being gathered in PWS on the fatty acid signatures of predators and prey and, together with a cooperating Scotian Shelf research program, develop mathematical models and associated software programs to quantitatively estimate species and size-class composition of individual harbor seal diets.
7. Estimate the most important prey items (and size classes) in diets of different demographic groups of harbor seals and determine whether diets of pups and small subadults differ significantly from diets of large subadults and adults and relate this to data obtained previously on characteristics and limits of dive depths in pups, subadults, and adults.

Hypothesis 3: The diets of PWS and other declining populations of harbor seals differ from diets of harbor seals in areas where populations are stable, reflecting differences in the distribution and abundance of important forage fishes at relevant scales.

1. Obtain blood and blubber samples at similar time periods as in Hypothesis 2.1 from similar demographic groups of harbor seal populations, in another area of decline (Kodiak) and an area of stability (SEAK).
2. Analyze blubber samples for fatty acid signatures of individuals and age groups.
3. Determine whether diets of pups, subadults and adult harbor seals differ between PWS, Kodiak, and SEAK using fatty acid signatures.
5. Assess variation in the fat content and fatty acid composition of prey species that are likely to be of importance to harbor seals in Kodiak and SEAK, in cooperation with other ADF&G harbor seal studies.
6. Using mathematical models developed (Hypothesis 2.7), estimate the diet of the differing demographic groups among the differing regions and determine whether juveniles appear to be less constrained by prey availability in SEAK versus Kodiak and PWS.

Hypothesis 4: The diets of harbor seals have changed over the past few decades, reflecting a change in the distribution and abundance of important forage fishes.

1. Archived blubber samples collected in the 1970s from Kodiak and in the late 1980s from PWS are available for analysis and have been successfully tested for their ability to be cleanly analyzed for fatty acid signatures. These samples will be analyzed for fatty acid signatures of individuals and age groups.
2. Using data on prey species fatty acid signatures (and accounting for any annual variability in these signatures), the species composition of diets of archived samples will be estimated using the developed mathematical models.
3. Compare estimated diets of seals collected in the 1970s with diets in the 1990s.

Hypothesis 5: The diet composition of harbor seals in areas of population decline reflect differences or changes in the relative distribution and abundance of prey important to various demographic groups.

1. Target PWS prey collection to areas both where seals are sampled and to where other work is being done on prey and/or seabirds under the APEX program.
2. Compare size-class and regional differences within prey species, especially herring and pollock, to data from stomach content analysis of these prey (APEX).
3. Compare and combine estimates of abundance and importance of harbor seal prey to trawl survey data (APEX).
4. Assess whether fish species important to juvenile seals, such as capelin and sandlance, are limited in areas where harbor seals are declining, as determined through data obtained from seabird diet studies being conducted concurrently under the APEX program.

Hypothesis 6. Harbor seal pups and juveniles spend more of their time foraging to obtain adequate nutrition than do adults; pups in PWS spend more time foraging than pups in other areas where the population is not declining.

1. Compare dive data from seal pups satellite tagged in PWS with data from subadult and adult seals tagged in the PWS.
2. Compare dive data from seal pups satellite tagged in PWS with data from pups tagged in other areas of Alaska (northern GOA and/or SEAK).
3. Assess the annual variability in the foraging behavior of satellite-tagged seal pups.

We are proposing one additional year of field study (1999) with final data analysis and reporting to take place in 2000. Findings from this study will be evaluated after each field season. Any modifications to the study approach will be recommended based on findings during the previous field season from this and other PWS studies. In addition to the components outlined in this project description, questions about harbor seal health and condition, stable isotope analyses, and prey availability will be addressed by other ongoing studies.

Aerial Surveys and Analysis

Harbor seal abundance will be monitored by flying aerial surveys during the molting period in mid to late August. A fixed-wing aircraft will be used to survey 25 trend count sites at an altitude of 700-1000 ft. These haulout sites have been used by ADF&G for PWS harbor seal trend counts since 1983, including NRDA and Restoration studies in 1989-1996 (Calkins and Pitcher 1984; Pitcher 1986, 1989; Frost and Lowry 1994a; Frost et al. 1994a; Frost et. al 1995; Frost et. al 1996). The trend count route includes 7 sites that were impacted by the EVOS (Agnes, Storey, Little Smith, Big Smith, Seal, and Green islands, and Applegate Rocks) and 18 unoiled sites (Table 2). The survey methodology and observers will be the same as those used in PWS harbor seal studies conducted in 1989-1996 (Frost et. al. 1996), and as summarized below.

Maximum numbers of harbor seals are known to haul out during pupping and molting (Pitcher and Calkins 1979; Calambokidis et al. 1987). Within these periods, more animals are usually hauled out at lower stages of the tide, since availability of many haulout sites is limited by tidal stage. Our surveys will be conducted during mid to late August (molting), and will begin within two hours before daylight low tides and finish within two hours after low tide. Multiple counts

will be made at each site to allow statistical analysis of trend. As part of NOAA-funded harbor seal studies, aerial photographs will be taken of harbor seals hauled out on ice near the Columbia Glacier during mid-August in conjunction with our regular surveys. This will be a test program to determine suitability of several photogrametric techniques for counting seals on glacial ice.

Power analysis of data from 1989-1994 indicated that in order to detect a 5% increase per year over a five year period ($p=0.05$) with a greater than 80% probability of being right (using initial population = 767, the number of seals at trend count sites in 1994), it is necessary to fly annual surveys during the molting period, with at least 7 replicates per year, and to adjust them for the effects of time of day, date, and tide. This analysis was based on data collected by ADF&G during 1984-1994, and took advantage of one of the most extensive data sets of its kind. The recommendation of 7 or more replicates is similar to the number of replicates recommended by Pitcher based on analysis of other harbor seal surveys in Alaska (Pitcher 1986, 1989). The number of replicates also may be influenced by weather, which can limit the number of days suitable for flying within a survey period.

Aerial surveys do not estimate the total number of seals present since they do not account for seals that are in the water or seals hauled out at locations not on the trend count route. Surveys provide indices of abundance based on the number of hauled out seals. Interpretation of trend count surveys relies on the assumption that counts of harbor seals on select haulout sites are valid linear indices of local abundance. We assume that within a given biological window, such as the molting period, hauling out behavior remains the same from one year to the next, and counts can thus be compared (e.g., Harvey 1987, Pitcher 1989). Standardization of procedures minimizes, but cannot eliminate, the effects of variables such as tide and weather that could influence the number of seals hauled out on a given day. Consequently, there may be considerable variation in daily counts, despite our attempts to standardize conditions. As part of this project during 1994-1996, we developed multivariate analyses to correct counts for weather, tide, and date (Ver Hoef et al. submitted). However, even this approach may not adequately estimate the variance associated with corrected counts.

The current models for trend-monitoring use Poisson regression and linear regression in a two-stage analysis. For the Poisson regression, a separate effect is fit for each site and year. With 10 years of data, and 25 sites, that makes 216 parameter estimates (9x24=216). We have also considered separate covariate effects for time of day (6 levels) and plan to include site-specific effects (but not separately for each year), so that adds more parameters (=5+24=29). In addition, site-specific effects for time relative to low tide (8 levels) (7+24=31), date (1+24=25), and other parameters related to weather are used. If we average 6 replicate flights per year, we have 6x25x10=1500 observations. That makes approximately 300 estimated parameters, and the fraction of parameters estimated to number of data is 1/5. A problem with such an approach is that we are estimating hundreds of parameters, and we may be getting large variances and poor estimation properties under these conditions. For the second stage analysis, the mean effect for year and location are calculated from the Poisson regression parameter estimates for standardized states of the covariates, and then the sites are summed for each year. This sum is then used in linear regression to determine trend across years. This second stage does not formally include estimation variance from the Poisson regression, which is an additional concern.

We have considered variations to our model to get rid of the 2nd stage regression analysis, but they also cause difficulties. For example, we could put the overall trend parameter in Poisson regression. However, this would cause all sites to have a common yearly mean. Another approach would be to allow each site to have a separate intercept with a common trend in the Poisson regression. However, it is clear that not all sites have a common trend. A final approach is to allow each site to have a separate trend slope and intercept in the Poisson regression model, but then it is unclear how to combine all 25 slope estimates into a single estimate of overall trend. Ideally, we would like to weight each slope estimate by the abundance at each site, but computing the variance of such a method may not be possible.

The Poisson regression model has served its purpose as a simple model that, 1) incorporated covariates that allowed us to examine different effects on seal counts, 2) allowed us to adjust our counts to get better trend estimates, and 3) allowed us to do power analysis. However, as we acquire more data, we feel that it is important to model effects separately for each site, and this makes the model much more complicated. For example, how do we summarize an effect for time of day, with 6 categories, for 25 sites? A natural approach is to combine parameters by giving them a distribution; this is called a hierarchical modeling approach.

Given the problems listed above, one solution is to put more structure on the model. This can be done using a hierarchical model, where all the "parameters" above can be considered "variables" in their own right, coming from one or a few "prior" distributions. For example, rather than having 25 separate trend slope parameters (one for each site), we might consider all 25 slopes as coming from a common prior distribution. These prior distributions have only a few parameters that control their behavior. Thus, we have reduced a large set of hundreds of parameters to a set that contains relatively few. Also, because the 25 slope parameters will have a "distribution," it is conceptually easy to take a weighted sum and obtain the proper variance for an overall trend.

With a hierarchical modeling approach, we will develop a hierarchical Bayes model that relates observed seal counts to a number of covariates. Covariates recorded at each observation include year, spatial coordinates, calendar day, time, height of low tide, time of low tide, and qualitative assessments of wind and sky conditions. Using modern Monte Carlo Markov Chain methods, we will assess the usefulness of any or all of these covariates in explaining and/or predicting the number of seals observed. An integral part of this modeling will be the inclusion of separate trend parameters for each site in the hierarchical Bayes model and then combining trend parameters in an overall approach to trend monitoring. Ultimately, a separate trend may be occurring at each of the 25 haul-out sites in the Prince William Sound. One can consider a trend parameter, such as the slope of a regression through time, for each site. Hierarchical Bayes methods are ideally suited for combining these 25 trend parameters to get an overall trend indicator for all sites.

Catching and Sampling Seals

Seals will be caught by entanglement in nets placed near the haulouts. Nets will be approximately 100 m long and either 3.7 or 7.4 m deep with standard floats or float line and light lead lines. Mesh openings will be about 30 cm stretched measure. Nets will be deployed from a 6 m boat assisted by one or two other small boats to assist in maneuvering the net and tending it to ensure

that all captured seals are quickly detected and removed (see Frost and Lowry 1994b). Some seal pups may be caught using long-handled dipnets.

When seals become entangled, they will be brought into the boats or to shore, cut free from the tangle net, and placed into hoop nets (large stockings made of 1 cm mesh soft nylon webbing). As necessary, seals will be sedated with a mixture of ketamine and diazepam administered intramuscularly at standard doses (Geraci et al. 1981). Each seal will be weighed, measured, and tagged in both hindflippers with individually numbered plastic tags. Field personnel will collect approximately 50 cc of blood from the extradural intervertebral vein. Standard blood chemistry panels and virology screens (phocine distemper virus, herpes, and others as indicated) will be run on these samples. The following samples will also be taken: a 0.5 cm x 2.5 cm blubber biopsy for fatty acid analysis and analysis of energy content, whiskers for stable isotope analysis, and a small piece of skin for genetics studies. Virology screens will be coordinated and paid for by the ADF&G's NOAA-funded harbor seal study, as will all genetics analyses. Seal pups and small juveniles will be selected for instrumentation with satellite tags, as described below.

Total body composition (fat content, protein content, lean body mass) will be measured on a subset of the pups and juveniles that we sample using isotope dilution with deuterium oxide (D_20). D_20 is a stable isotope of water, which is widely used as a non-invasive method to measure body water pool size and the rate of water turnover in mammals and other vertebrates (Nagy & Costa 1980; Oftedal & Iverson 1987; Oftedal, Iverson & Boness 1987; Iverson et al. 1993). After administration of a known amount of D_2O, the isotope completely equilibrates with all body water of the animal. Measurement of the final dilution of D_2O in the body water (dilution space) can then be used to accurately measure total body water content (Oftedal, Bowen & Boness 1993). Body water content is then used to calculate total body fat, protein, and energy stores of the seal, based on the fact that the water and protein contents of lean body mass (fat-free mass) are approximately constant among mammals, particularly among individuals of a given species and age (Pace & Rathbun 1945; Reilly & Fedak 1990; Iverson et al. 1993).

Prior to the onset of the D_20 procedure, seals will be weighed to the nearest 0.5 kg, and a blood sample. Any stomach contents of the animal will be evacuated by gastric intubation using a 3/8 inch veterinary stomach tube. A pre-weighed amount (approximately 1g/kg body mass) of deuterium oxide (99.9% purity), contained in a syringe with a three-way stopcock, will be delivered by gastric intubation using a small 12 French stomach tube (to reduce total surface area during delivery). The syringe and stomach tube will then be rinsed with 2 x 5 ml quantities of water, and air blown through the tube as it is withdrawn to ensure complete delivery. The animal will then be held for approximately two hours to permit isotope equilibration. After that, two sequential blood samples, separated by about 20 minutes, will be taken to ensure that equilibration has occurred. Bloods will be centrifuged and sera collected and frozen in airtight cryovials until the time of analysis. Laboratory analyses will be done at Dalhousie University. Total free water will be collected from blood sera by heat distillation, and D_2O concentration will be determined by quantitative infrared spectrophotometry according to Oftedal & Iverson (1987) and Oftedal, Iverson & Boness (1987) on a Perkin Elmer Fourier Transfor Infrared Spectrophotometer with integrated data station (Paragon 1000).

Seals will be caught in two regions of PWS to coincide with sampling areas used is previous years. These will be: southern PWS near Montague, Green, and Little Green islands; and central PWS near Agnes, Smith, and Seal islands. We will try to catch and sample approximately 40-50 seals total per year in PWS.

Seals will be caught from other areas (Kodiak and SEAK) during similar time periods, to the extent possible, as part of the NOAA-funded harbor seal study. We hope to obtain about 20 blubber biopsy samples per year from each area. Additionally, wherever possible, blubber samples from harvested seals will be obtained from subsistence hunters in SEAK and Kodiak. Archived samples are available from both of these areas (10-20 per year since 1995).

Fatty Acids Analysis

Recently, a method has been developed for understanding marine food webs through the use of fatty acid signatures (Iverson 1993). Fatty acids are essentially the building blocks of lipid. Organisms are able to biosynthesize and modify fatty acids, but there are biochemical limitations and differences in these processes depending on the organism. Specific fatty acids cannot be synthesized by animals and therefore can only originate from diet. Because of this, some fatty acids in the food chain can be attributed to specific origins (Cook 1985). Lipids from marine organisms are characterized by a very complex array of fatty acids. There are substantial differences in fatty acid composition among species and prey types, as well as within species by geographic region (e.g., Ackman et al. 1975, Iverson 1993). In marine mammals, dietary fatty acids are often deposited in body tissue without modification (Iverson and Oftedal 1992, Iverson et al. submitted). Consequently, it is possible to trace fatty acids obtained from the diet and to compare arrays in the tissues of the predator to those in the prey consumed.

The use of specific lipids as biological markers has been demonstrated in a number of studies on fish and copepods (Lee, Nevenzel & Paffenhofer 1971; Sargent et al. 1988; Fraser et al. 1989; Klungsoyr et al. 1989; Graeve, Kattner & Hagen 1994; St. John & Lund 1996). Relative proportions of dietary fatty acids have also been shown to be reflected in the fatty acid composition of storage lipids in both captive and free-ranging carnivores (e.g., Reidinger et al. 1985; Rouvinen & Kiiskinen 1989; Colby, Mattacks & Pond 1993; Pond et al. 1995). In seals, ingested fatty acids can be deposited directly into adipose tissue, such that blubber may be a mirror of current diet when a seal is rapidly fattening on a high fat diet (Iverson et al. 1995), or may reflect a longer-term integration of dietary fatty acids and possibly biosynthesized fatty acids at times of reduced intake (Kirsch, Iverson & Bowen 1995).

This concept of fatty acids as trophodynamic indicators can be applied to harbor seals. In general, lipid transfer from prey to deposition in tissue is extremely efficient (Iverson 1988, Iverson et al. 1995). Because certain fatty acids cannot be biosynthesized by seals, these can be identified as being of dietary origin. Since most seals undergo seasonal periods of fasting and depletion of fat stores (e.g., during the breeding season or the molt) followed by intensive blubber deposition (prior to the subsequent breeding season), blubber fatty acids usually reflect the integration of diet over a period of several months. Thus, fatty acids in blubber provide information on dietary history of the animal. Since many seals tend to feed on only a single or few selected prey species at a given time or season (e.g., Bowen 1990), this facilitates the use of fatty acid signatures.

In the initial study funded by the EVOS Trustee Council, we used fatty acid signatures to investigate the diet and spatial scales of foraging in harbor seals and selected prey in PWS and the Gulf of Alaska (Iverson, Frost and Lowry, in press). We found large differences in the fatty acid composition of blubber from seals sampled in geographic regions several hundred kilometers apart. Within PWS, fatty acid signatures distinguished seals from haulouts only a few kilometers apart, suggesting that seals forage very site-specifically. Prey fatty acid patterns also differed on similarly small spatial scales within PWS.

The next step is to advance fatty acid signature analysis so that we can use it to quantitatively estimate the composition of the diet. This means not only determining the species composition, but also the size classes of species eaten and possible area from which the prey were fed upon. Then, it will be critical to apply this technique to evaluating possible problems in recruitment of the population by better understanding the foraging ecology of juvenile harbor seals and perhaps pregnant females. It will be important to document diet differences among age-groups in the declining PWS harbor seal population, as well as differences which occur in the same age-groups but in areas where the population is stable. It will also be important to compare this information with data available from time periods of lesser declines (1970's and 1980's). Juveniles in particular are thought to be significantly affected by reduced prey availability at scales relevant to the nutrition of individuals (NRC 1996). Thus, there could be several indications about stresses on juveniles through understanding diets. Small forage fish species such as capelin and sandlance have long been an important part of pinniped diets and a decline in these prey species may have affected the seal populations which depend upon them. If reductions in these prey are apparent in the diets of adult seals in areas of decline, this would suggest a lower abundance of these prey in general. If indeed juveniles are found to be dependent on and limited to smaller size prey, this would coincide with the above finding. If juveniles are feeding on smaller but different prey than the small prey in adult diets, this might indicate competition with large animals for available food and further indication of low abundance of important forage fish species.

Blubber samples will be taken from seals of the various demographic groups using routine biopsies (sterile 6 mm biopsy punches). Samples will initially be collected in late June-early July to coincide with initial summer foraging period. Samples will be placed in chloroform and methanol with BHT as an antioxidant, and kept frozen until analyzed. Samples will be collected from all seals that are caught during tagging operations. Blood will be collected from the same animals and centrifuged in the field. In addition, some samples may be available through the biosampling program being conducted by the Alaska Native Harbor Seal Commission.

Blubber samples archived by ADF&G from harbor seals collected in the 1970s will be subsampled, placed in BHT and sent to Dalhousie University for anlaysis. Several of these archived samples were analyzed on a test basis during 1997 to determine whether the blubber was still in suitable condition. The analyses were successful, indicating that some or all of the remaining archived specimens will be useful for this study. There are 365 total archived specimens from 1976-1978, of which approximately 200 are from areas where recent samples have also been collected (southeast Alaska, n = 16; Kodiak, n = 193; Middleton Island, n = 5; and miscellaneous others from the northern GOA). Samples will be prioritized based on age and specific location, to facilitate comparisons with samples from the 1990s. Some of these same

samples have been analyzed for lipid and water content, as well as total caloric density, by Castellini et al. (EVOS project 001). This will enable a comparison of the energy content of the blubber and diet in recent and 20-yr-old samples from areas that have and have not declined.

By 1999, few additional prey items will be collected. We will focus on several key prey species which are readily available from several locations without large-scale fish sampling programs. We plan to continue to assess annual variation in the fat content and fatty acid composition of prey species. Particular emphasis will be on characterizing size-class and regional differences in the four prey species that are likely of most importance to harbor seals and especially juveniles: herring, pollock, capelin, and sandlance. Prey species from the other areas of harbor seal sampling (Kodiak and SEAK) will be obtained as possible through other studies and sources of funding, including in cooperation with the National Marine Mammal Laboratory as part of sea lion studies.

Laboratory analysis and evaluation of data will be conducted by Dr. Sara Iverson at Dalhousie University, Nova Scotia. Fatty acids will be extracted from seal blubber and prey according to methods described in Iverson (1988). Fatty acid methyl esters will be prepared directly from aliquots of the chloroform extract, then extracted and purified in hexane. Analysis of fatty acid methyl esters will be performed according to Iverson et al. (1992) using temperature programmed capillary gas liquid chromatography and linked to a computerized integration system (Turbochrom, PE Nelson). Identifications of rare isomers will be performed using techniques described in Iverson, Frost and Lowry (in press). Approximately 70 fatty acids and isomers can be separated and quantified in most marine lipids. The proper isolation of all components in any sample is critical in assessing diets and prey items; these methods are currently set up and routinely used in the Dalhousie University laboratory of Dr. Iverson.

Data will initially be analyzed using a multivariate model called classification and regression tree (CART) analysis (Clark and Pregibon 1992). This model has recently been applied and modified for fatty acid signature analysis (Iverson et al. 1997; Smith et al. 1997). CART is a non-parametric technique which considers all 70 component fatty acids in each sample and uses the fatty acid arrays of species to determine classification rules for types of signatures. CART proceeds by recursively partitioning data into two or more groups based upon a series of dichotomous splits, hence building complex trees through which observations (predators or prey) may subsequently be sent for classification. This method will allow us to differentiate individual seals and groups of seals by such factors as age-group, pregnancy status, or haulout location. These differences in turn are a function of differing fatty acid signatures resulting from differences in diets. We will also use CART to determine characteristics and differences among prey by species and within species by size class, time period, and geographical location. We will also account for differences in fatty acid classes in the use of CART. In other words, in the analysis and interpretation of data, fatty acids will be grouped as: 1) components which could readily be biosynthesized by the seal; 2) components that could be biosynthesized but at the measured levels are likely mostly of dietary origin; and 3) components that could only come from the diet. Categories 2 and 3 represent the important "indicator" fatty acids (Iverson 1993). The latter two categories will be most heavily relied upon in interpreting CART results.

Modeling of Seal Diet Composition using Fatty acid Signatures

The use of fatty acids to elucidate diet and trophic relationships has proceeded considerably in its developmental stages and now requires a mathematical modeling component in order to use it quantitatively. Using fatty acids to determine the diet of seals is facilitated by the fact that seals go through biannual periods of extensive blubber fat depletion followed by intensive fattening and that 2-4 prey species often account for most of the diet. Nevertheless, in free-ranging seals, fatty acid composition of lipid stores will rarely, if ever, match that of their prey because dietary fatty acids will be integrated into the seal's fatty acid signature. The time course of these changes will depend on the rate of food intake and the extent to which lipids are stored seasonally. Finally, biosynthesis of some fatty acids will take place, thus altering their representation in the signature. Thus, the next stage in using fatty acids to estimate diet composition, must be the development of a statistical model which takes possible prey species signatures and computes the most-likely mixture of signatures (species and levels) to create the closest signature (a maximum-likelihood estimate) to that of the predator. Such a statistical program must incorporate information on a wide range of potential prey signatures, and the variability in these signatures with size-class and geographical location, as well as season if applicable. The mathematical model must also incorporate a relative weighting of prey signatures that reflects the proximate fat content of each prey and size class, and finally, weighting on individual fatty acids as a function of their ability to be biosynthesized by the predator. We expect to start out from a basis of an optimization problem with a simple least square error assumption (R. Myers, pers. comm.). Given the constraints listed above, standard optimization methods cannot be used. The inequality (of fatty acids) is more difficult to deal with analytically and hence also the estimation of standard errors. However, software can be written and developed to handle these. This work will be done in the laboratory of Dr. S. Iverson as a cooperative effort between Alaska and Scotian Shelf research and with partial support from NSERC.

Fatty acid signature analysis has not to date been a stand-alone method, but neither has any other currently available method for examining marine mammal diets. Stomach contents analysis is limited by our ability to obtain large enough samples, the digestive state of contents, and by the fact that food in a stomach represents a single meal. In PWS, large tidal fluctuations every 6 hours make it virtually impossible to collect scats from areas where seals haul out. Stable isotopes indicate the trophic level at which seals feed and temporal variations in prey type, but provide little information on specific prey. Studies of prey availability (e.g. from trawl surveys) are necessary to establish the "menu" from which seals may choose, but they do not reflect the availability of prey to seals on relevant scales or the energetic costs of capturing different prey. Progress towards answering the question of "Is food limiting harbor seals?" will most likely come through the combination and integration of a variety of approaches, but it is clear from our previous work that fatty acids may be a particularly valuable tool in achieving a better understanding of trophic dynamics, dietary differences and demography of harbor seal populations in PWS and the Gulf of Alaska.

Satellite-tagging

Satellite-linked telemetry can be used to gather information about habitat use, including site fidelity, movements between haulouts and in and out of PWS, seasonal changes in hauling out

patterns, feeding habitats, and feeding and diving behavior. Satellite-linked time-depth recorders (SDRs) have provided researchers with the ability to monitor location and diving behavior of marine mammals (Mate 1986, 1989, Hill et al. 1987, Stewart et al. 1989, Lowry et al. 1994, Frost and Lowry 1994b). The SDRs transmit to a satellite-based Doppler positioning system that calculates locations and tracks movements of animals with considerable accuracy. When combined with appropriate environmental sensors and microprocessor hardware and software, other information about an animal's environment and behavior can be transmitted to the satellite.

This study has demonstrated that SDRs are an effective means of monitoring the movements and haulout locations of harbor seals in PWS. During 1992-1997, significant data were received from SDRs attached to 63 harbor seals in PWS, including 27 males and 36 females (Table 1). Twenty-six were adults, 23 were subadults, and 14 were pups. SDRs were attached to 24 seals from areas in central PWS that were oiled by the EVOS (Seal Island, Herring Bay, Bay of Isles, Applegate Rocks); four from eastern PWS (Olsen Bay, Gravina Island); one from northwestern PWS (the Dutch Group); and 34 from unoiled sites in southcentral PWS (Port Chalmers, Stockdale Harbor, Little Green Island, and Channel Island). SDRs were operational for up to 10 months, and provided locations for about 80% of those days.

During 1999, SDRs will be attached to 6-8 harbor seal pups at locations chosen to complement data from 18 pups tagged in 1997-1998 and from adults and subadults tagged during 1992-1996. These will include southern PWS near Montague, Green, and Little Green islands (herring and fish data from here, and a large number of seals); and central PWS near Applegate Rocks and Seal Island (APEX fish data available, and significant seal haulouts with pups). Actual tagging locations will depend on where seals are present and can be caught.

One-quarter-watt transmitters (10 cm x 5 cm x 3 cm and weighing 170 g) will be attached to the mid-dorsal surface of seal pups by gluing with epoxy resin (Fedak et al. 1984; Stewart et al. 1989). SDRs attached after weaning should remain attached until the next molt, but will not operate that long. A prototype 0.25-watt SDR attached to a harbor seal pup in September 1996 operated until the end of December and sent approximately 12,000 transmissions. Through duty cycling and by limiting the number of daily transmissions, four of twelve SDRs deployed on pups in PWS and seven of the ten deployed at Tugidak during 1997 were still transmitting in March. It is likely that new, more powerful batteries will be available by 1999, and perhaps as early as the 1998 field season.

Data will be acquired from the ARGOS satellite receiving system and formatted using software provided by the manufacturer of the transmitters. Each SDR will transmit signals to polar-orbiting satellites whenever the seal is hauled out or when it surfaces sufficiently long for a transmission to occur. An uplink occurs when a satellite is positioned to receive the signal. Information transmitted by the SDR is used by Service ARGOS to calculate the geographic location of the seal. Units will be equipped with built-in programmable microprocessors to collect and summarize data for periods when animals are diving and store it for later transmission, as has been done for crabeater seals, Steller sea lions, and spotted seals (Hill et al. 1987; R. Merrick, personal communication; Lowry et al. 1994a). These data will be stored in six hour blocks and transmitted to the satellite once the six hour data collection period is complete. Sensor information from a pressure transducer and a conductivity switch will be used to indicate when

the animal is hauled out. Data from four periods will be stored in memory, providing at least a 24 hour window for transmission before the data are lost. Dive data will be summarized as histograms in depth bins of 4-20 m, 21-50 m, 51-100 m, 101-150 m, 151-200 m, 201-250 m, 251-300 m, 301-350 m, and over 350 m, and duration bins of 0-120 seconds, 121-240 seconds, 241-360 seconds, 361-480 seconds, 481-600 seconds, 601-720 seconds, 721-840 seconds, 841-960 seconds, 961-1080 seconds, and over 1080 seconds. In addition, SDRs will store and transmit the amount of time spent in each depth bin and the total time spent at the surface.

Each SDR broadcasts a unique identification code so that data can be assigned to a particular seal. Position accuracy for all geographical location information is rated by Service ARGOS to reflect the predicted accuracy of the calculated locations (Fancy et al. 1988, Stewart et al. 1989). Locations calculated by ARGOS will be screened for accuracy and plotted on charts of PWS.

Data on the haulout patterns of tagged seal pups will be examined for indications of daily or seasonal variations, for example to determine whether there is a change in the frequency of haulout by season, or whether the amount of time spent hauled out changes. Plots of locations where continuous signals are received will be used to determine the degree and regularity of use of particular haulout sites. We expect to receive fewer locations of seals while at sea, because the transmitter antenna will frequently be submerged. At-sea locations will be plotted as an indication of areas used for feeding. Information on depth and pattern of diving will be compiled, and will provide additional information on the general areas used for feeding.

Dive data will be presented as graphs and histograms which indicate the range in individual behavior as well as summary data for all seals combined. Dive data histograms will present the number of dives at different depth increments and by duration of dive. Means and standard deviations for dive depth and duration will be calculated and compared for seals in different locations or habitats and at different times of day and year. Compilation of data on time and location of feeding dives will be used to identify feeding areas near different haulouts, if possible. If sensors indicating whether the seal is on land or at sea become more reliable and the necessary SDR software is developed to provide a continuous record of this information, then diving and hauling out cycles will be examined relative to time of day, tide, and season. These data will be compared for different age groups. Summaries of the number and quality of uplink data and at-sea position data will be presented in tabular form.

Tabular summaries will also be prepared for use of different haulouts by individual seal pups, and frequency of haulout and amount of time spent feeding by season. These data will be used to evaluate site fidelity of seal pups, to quantify the amount of interchange among haulouts within and outside of the area impacted by the EVOS and within and outside of PWS, to determine seasonal importance of particular haulouts, to identify areas used for feeding, and to examine differences in movements and feeding behavior of pups, subadult and adult seals.

C. Cooperating Agencies, Contracts and Other Agency Assistance

Survey aircraft will be chartered from the private sector. Charter aircraft for surveys will not require contracts. ADF&G maintains a list of qualified air charter operators. Aircraft for surveys will be chosen from this list according to state procedures. Vessels will also be chartered from the

private sector. Vessel support for tagging work will use small vessels contracts that will be completed by the Principal Investigator according the state SOP manual.

Costs of acquiring SDR data from Service ARGOS are paid for through a contract with NOAA. This contract covers all ADF&G Division of Wildlife Conservation satellite tagging projects, not just this harbor seal restoration project, and is processed by the Division of Wildlife Conservation. Funds for data acquisition must be encumbered and guaranteed to NOAA in early February. Actual contract processing occurs later in the spring.

Satellite SDRs will be purchased under contract award from Wildlife Computers, a private company in Seattle, Washington. The contract award is valid through the proposal period. Wildlife Computers is the only company in the United States which manufacturers SDRs with the capabilities necessary to acquire the data we require about diving behavior of seals.

Fatty acid analyses and interpretation will be done by Dr. Sara Iverson at Dalhousie University through a Cooperative Agreement between ADF&G and Dalhousie. Dr. Iverson is the only person in North America with specific experience in analysis of fatty acids in seal blubber, and particularly with the sophisticated statistical analyses necessary to infer diet from the relative abundance of these fatty acids.

Hierarchical Bayes analysis will be conducted as a cooperative effort between Jay Ver Hoef, ADF&G, and Dr. Ron Barry, Professor of Statistics at University of Alaska Fairbanks. This work will be undertaken through a Reimbursable Services Agreement between ADF&G and UAF. Drs. Ver Hoef and Barry have co-taught Bayesian statistics at UAF, and their experience with hierarchical Bayes model will speed the process of obtaining results.

SCHEDULE

A. Measurable Project Tasks for FY 99 (October 1, 1998 - September 30, 1999)

Field work for this project will take place during 1999, with final data analysis and submission of a final report in 2000. A schedule of field activities, data analysis, and report preparation is shown in Table 3 and below.

FY 99: October 1, 1998- September 30, 1999 (99064)

October:	Analyze 98 aerial survey data (preliminary)
October-December:	Analyze SDR tag data
October-December:	Update "user friendly" population model
October-March:	Retrieve 1998 Argos SDR data
October-March:	Analyze seal/prey fatty acids samples, continue model development
December:	Prepare and distribute Harbor Seal Update
December 31, 1998:	Submit final report (masters thesis) on fish distribution/seal diving
January:	Order SDRs for 1999 field season; reserve Argos channels
January-March:	Arrange logistics (vessel, plane, contracts, equipment)
January (3-4 days):	Attend Annual Restoration Workshop

February (2-3 days):	Coordination meeting for ADF&G and NOAA harbor seal studies
April 15:	Submit annual report (FY 98 findings)
April 15:	Submit renewal proposal
June-August:	Hierarchical Bayes reanalysis of survey data continued
June 20-July 7 (8 days):	Sample seals in PWS
August 1 -15:	Satellite tag and sample seals in PWS
August-March:	Retrieve Argos SDR data
August 15-30:	Aerial surveys in PWS during molting

FY 00: October 1, 1999- September 30, 2000 (00064)

October:	Analyze 99 aerial survey data (preliminary)
October-March:	Retrieve 1999 Argos SDR data
October-September:	Analyze SDR tag data
October-March:	Analyze 1999 seal/prey fatty acids samples
October-March:	Fatty acids model development continued
December:	Prepare and distribute Harbor Seal Update
January (3-4 days):	Attend Annual Restoration Workshop
February (2-3 days):	Coordination meeting for ADF&G and NOAA harbor seal studies
January-June:	Final SDR tag data analysis
January-June:	Final trend analysis 1989-1999
January-June:	Final fatty acid analysis and interpretation
April-September:	Final report and manuscript preparation
30 September:	Submit final report

B. Project Milestones and Endpoints

Objective 1

August 15-30, 1999:	Conduct aerial surveys at 25 sites in PWS
December 1999:	Submit manuscript describing hierarchical Bayes trend analysis
December 1998, 1999:	Prepare Harbor Seal Updates for hunters to describe trend
June 2000:	Submit manuscript describing 1989-99 PWS harbor seal trend

Objective 2

June 2000:	Submit ms describing 1989-99 PWS trend analysis and methods
September 30, 2000:	Submit final report with recommended monitoring scheme

Objectives 3 -7

October-September,1998-99:	Analyze 50-80 harbor seal samples for fatty acids
October-September,1998-99:	Analyze 100-200 archived harbor seal samples for fatty acids
October-September,1998-99:	Analyze 100-300 prey samples for fatty acids
December 1998:	Submit manuscript describing D_20 studies of seal pups
June-August, 1999:	Sample 30-50 harbor seals for blubber fatty acids
June-August, 1999:	Sample 30 seal pups and juveniles using D_20 for body composition
July 1999:	Submit manuscript describing fatty acids work
November 1999:	Paper on fatty acids work at 13th Biennial Marine Mammal Conf.
September 2000:	Submit manuscript describing fatty acids work

Objective 8

February 1999:	Submit manuscript on PWS seal movements
June-July 1999:	Attach SDRs to 6-8 seal pups in PWS
November 1999:	Paper at 13th Biennial Marine Mammal Conf. on PWS seal diving
May 2000:	Submit manuscript on diving and movements of seal pups in PWS

Objective 9

November? 1998-1999:	Attend ANHSC meetings to discuss status and studies with hunters
December 1998-1999:	Prepare and distribute Harbor Seal Update describing study results

C. Completion Date

This project will continue for two more fiscal years, FY 99-FY 00. Field work and laboratory analyses will be conducted during FY 99. Final data analyses will be conducted and a final report prepared in FY 00.

PUBLICATIONS AND REPORTS

1. Oral/poster presentations at EVOS Restoration Annual Workshop (January 1999)
2. Submit manuscript on PWS seal movements (February-June 1999)
3. Annual report for FY 1998 studies; will include results of molting surveys including progress of hierarchical Bayes covariate and trend analyses; analysis of data for SDRs deployed on pups in June-July 1997; status report on 1998 fatty acid analyses (April 1999)
4. Manuscript describing fatty acids work (July 1999)
7. Report of field activities for August surveys and pup/juvenile tagging and sampling (September 1999)
8. Manuscript describing hierarchical Bayes approach to trend analysis (December 1999)

Manuscript titles and journals to which they will be submitted have not been determined. Topics include: 1) results of hierarchical Bayes modeling of the harbor seal trend count data (Ver Hoef and Barry); 2) age, sex, and location related differences in harbor seal diets in Prince William Sound and the Gulf of Alaska using fatty acid signature analysis (Iverson, Frost, et al); and 3) seasonal movements and distribution of satellite-tagged seals in PWS (Lowry and Frost). It is possible that a fourth manuscript will be prepared describing the use of population modeling to evaluate the role of carrying capacity in the ongoing harbor seal decline (Small, Frost, et al.).

PROFESSIONAL CONFERENCES

Project investigators plan to attend the 13th Biennial Conference on the Biology of Marine Mammals in Hawaii in November 1999. This conference is sponsored by the Society for Marine Mammalogy and is the largest marine mammals conference in the world. Abstracts will be submitted and it is anticipated that oral or poster presentations will describe the results of fatty acids (Iverson) and satellite-tagging studies (Frost or Lowry). Results of other studies using

samples from PWS provided by this restoration study are also likely to be reported but travel will not be funded by this grant.

NORMAL AGENCY MANAGEMENT

This project is funded entirely by the Trustee Council as a restoration project. ADF&G conducts no other studies of harbor seals in PWS that are not a part of the restoration program. ADF&G has no management responsibility for harbor seals. ADF&G biologists are conducting this research as principal investigators because of their many years of experience investigating the biology of seals and other marine mammals in Alaska. The Subsistence Division of ADF&G has been funded by the Trustee Council to monitor the harvest of harbor seals in PWS (Project 244) and to conduct food safety testing (Project 279). Subsistence Division also collects and reports harbor seal harvest data for other parts of the State with funding from NOAA.

ADF&G is conducting studies of harbor seals in SEAK and near Kodiak with funding from NOAA/NMFS. Those studies contain similar components to the PWS study and are closely coordinated to ensure that data are collected and analyzed in a similar manner. This will facilitate comparisons of data from declining populations (PWS and Kodiak) and a stable population (SEA) of harbor seals. Equipment is shared by the two projects. Consequently, it has not been necessary for the PWS project to purchase many equipment items and supplies solely for the use of this study. Because of these other ongoing projects, the PWS harbor seal project has had access to a GIS system with which to analyze tagging data.

Without this project, information on the status and trend of harbor seals in PWS will not be regularly available. There will be no systematic documentation of trend, and whether or not the decline continues will be unknown for a much longer time than if regular monitoring continues. Power analysis of data collected through this study has indicated that a minimum of five consecutive surveys is required to reliably detect a trend. If surveys do not occur on a regular basis, it will be a very long time before a trend can be correctly identified.

Because of Trustee Council-funded projects, progress is being made on communicating information about the decline to the public, in particular to fishermen who may incidentally take harbor seals while fishing and to subsistence hunters from PWS villages. This transfer of information is making local residents more aware of the factors that may affect the decline, and has resulted in the initiation of a village-based biosampling program that may provide important samples to researchers. One of the significant long-term benefits of this and other harbor seal studies will be the involvement of local hunters in the research and management of harbor seals and the formation of the Alaska Native Harbor Seal Commission.

The statistical methods developed to analyze survey data from PWS will be applicable to harbor seal surveys in other regions of Alaska and elsewhere. Other investigators should be able to design more reliable and cost-effective surveys using methodology developed through this Trustee Council-funded project. Similarly, the application of fatty acids analysis to investigations of diet and changes in diet is likely to have significant and far-reaching effects on our ability to investigate the trophic dependencies and interactions of many other species, not only marine mammals.

Already, techniques developed as part of this project appear to have application for studies of fish movements and stock identity.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Other EVOS-funded marine mammal studies have included: Recovery of Harbor Seals from EVOS: Condition and Health Status (Project 001); Harbor Seals and EVOS: Blubber and Lipids as Indices of Food Limitation (Project 117-BAA, UAF); and Isotope Tracers - Food Web Dependencies in PWS (Project 170, UAF). Investigators from the three projects regularly communicate and discuss these projects, and will continue to do so in the future.

Project 064 is a multidisciplinary, inter-agency undertaking. Surveys and satellite tagging will be conducted by ADF&G; lipid analyses and interpretation by Dalhousie University; blood chemistry analyses at UAF; and hierarchical Bayes modeling by ADF&G and UAF. Inclusion of interdisciplinary components within the same project will ensure that data are shared and interpreted in an interdisciplinary manner.

Project 064 (this project) will provide logistics, the MMPA permit to conduct sampling, and access to seals and samples for this study and for a study proposed by Dr. Jennifer Burns (Moss Landing Marine Laboratory, California) regarding pup physiology. Archived harbor seal data and blubber samples have been provided to Castellini/UAF for use in analyses of body condition and blubber. Subsamples of these same archived ADF&G harbor seal blubber samples have been sent to Dalhousie University for fatty acids analysis. It will be very useful to have historical fatty acids and blubber quality results from the same individuals. Harbor seal investigators at ADF&G and UAF have been working successfully together for the last five years on harbor seals in PWS and elsewhere, and future collaborations should be equally productive. Regular meetings and seminars are held by marine mammal investigators at UAF and ADF&G Fairbanks to exchange information and ideas.

This study will continue to directly interface with the study entitled "Isotope Ratio Studies of Marine Mammals" (Project 170, UAF) as long as it continues to be funded. Samples of seal whiskers and seal prey have been and will continue to be provided to that study. Investigators of the two projects (Frost and Schell/Hirons) discuss stable isotope results at regular intervals and are pursuing preparation and publication of a joint manuscript describing preliminary findings of this study.

Prey samples for fatty acid analysis have been obtained through PWS System Investigation studies, the APEX study, and from ongoing ADF&G work. In the future, as large scale fisheries surveys receive less funding, we expect most of our samples to come from routine ADF&G operations. Information on distribution and movements of harbor seals, and diving behavior, will be shared with PWS Sound Investigation modeling studies to look at energy flow within PWS, and with forage fish investigators who may examine the effects of predation on fish population dynamics.

Statistical modeling to assign quantitative values to seal diets based on fatty acids signatures will be done as a cooperative effort between this restoration study and Scotian Shelf research project, with partial support from NSERC.

This harbor seal study has obtained samples of prey and incorporated results from Herring (ADF&G) and SEA studies being submitted under the PWS System Investigation, and from the study Apex Predator Ecosystem Experiment. In the next two years, prey samples from the GOA and SEAK will be obtained on an opportunistic basis, in cooperation with other ADF&G harbor seal studies and with National Marine Mammal Laboratory (NMML) sea lion projects. These samples will be analyzed with non-EVOS funding, but analyses will be included in the results of the project. Fatty acids analysis in the future will emphasize pollock, herring, capelin, and sand lance. These species are important to seabirds and to harbor seals. The NMFS Auke Bay laboratory has been funded to investigate fatty acid profiles and lipid class analysis of herring and other forage fishes. That study plans to conduct detailed sampling and fatty acids analysis of herring (and perhaps others) in northeastern (Port Fidalgo) and southwestern PWS. Investigators of that project and this harbor seal study will coordinate to eliminate overlap in sample analysis. Project 064 will also share some harbor samples with Auke Bay personnel for duplicate analysis. This will provide a basis through which to ensure that results of analyses conducted by different laboratories are the same and can therefore be compared and combined. This is especially important as fatty acids studies become more prevalent and are conducted by a variety of laboratories.

ADF&G harbor seal investigators are currently and will continue to participate in interactive discussions with subsistence hunters in PWS and the GOA the Alaska Native Harbor Seal Commission. These discussions include the ongoing harbor seal decline, communication of results of Restoration-funded studies, and suggestions for future research.

ADF&G receives funding from NOAA to conduct complementary studies of harbor seals in the northern GOA and SEAK. This funding provides an "economy of scale" for many aspects of both studies. For example, disease and genetics analyses of PWS seals have been done at minimal or no cost to this study, but are instead provided through the NOAA-funded harbor seal study. Equipment is shared and analytical techniques and software developed by one project can be used by the other.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There are no major changes between what we proposed in the 3-year proposal submitted in April 1997 and this renewal proposal. The major focus in FY 99 will be on addressing hypotheses related to food limitation and population trend. This focus will continue in the form of fatty acid analysis, analysis of historical fatty acid samples from Kodiak and SEAK, and satellite tagging of pups, with a considerable increase in effort devoted to data analysis. Annual molt-period surveys will continue. Survey analysis will include a hierarchical Bayes approach that should eliminate some problems with variance associated with so many count locations and the variety of covariates.

The timelines for completion of some project objectives have been modified and extended due to delayed approval of funding for this project in FY 98. Several other minor modifications have been made to FY 98 and FY 99 planned activities. For example, at the recommendation of reviewers only 6 SDRs (instead of 10) will be attached to pups in FY 98, and an additional 6-8 in FY 99. This is to ensure that SDR technology has adequately developed to maximize data return for the dollar. There will be a single field trip and sampling effort in FY 98, rather than two as initially planned. However, more D_2O samples will be collected than initially proposed. In addition, if a companion study proposed by Dr. Jennifer Burns is funded, there will be extensive additional physiology work conducted on the pups we capture in 1998-1999. Hierarchical Bayes modeling work will commence in May 1998 and will be conducted by ADF&G in conjunction with Ron Barry at UAF, rather than Rutgers University as originally proposed.

PROPOSED PRINCIPAL INVESTIGATOR

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PERSONNEL QUALIFICATIONS

Kathryn Frost (the principal investigator) has conducted research on marine mammals in Alaska since 1975. She has undertaken extensive research on natural history and ecology of seals, including aerial surveys; studies of food habits and trophic interactions; and studies of habitat use using satellite tags. She has conducted extensive aerial surveys of harbor seals in PWS and boat-based observations and sampling of harbor seals as part of NRDA studies following the EVOS. She has conducted satellite tagging studies of harbor seals in PWS from 1991 through 1997.

Lloyd Lowry is the Marine Mammals Coordinator for the State of Alaska. He has conducted research on marine mammals in Alaska since 1975, including studies of the natural history, ecology, distribution, abundance, and food habits of seals. He has participated in all NRDA and Restoration studies on harbor seals, including the development of methodology to catch and attach satellite tags to harbor seals. He has been responsible for project coordination and management of state and federally funded research projects, and is familiar with the federal marine mammal permit system.

Rob DeLong is an Analyst Programmer for ADF&G. He has developed custom software for analysis of data from satellite-tagged seals. Mr. DeLong is also accomplished in seal catching and tagging techniques.

Dr. Jay Ver Hoef is a Biometrician for ADF&G. He has been responsible for statistical analysis of all harbor seal data during NRDA and Restoration studies. He has participated in field work in PWS and is familiar with seal catching and tagging techniques.

Grey Pendleton is a Biometrician for ADF&G with extensive background in analyzing satellite tagging and aerial survey data. He will be responsible for statistical analysis of satellite tagging data for this and other ADF&G harbor seal projects.

Dr. Sara Iverson is an Assistant Professor at the University of Dalhousie. She is currently conducting research at Sable Island, Nova Scotia, on the lipid metabolism of seals and the use of fatty acids to determine marine food webs. She received her Ph.D. in nutritional sciences, conducting studies of the energetics of reproduction and fatty acid metabolism in seals. She developed procedures for analysis of lipids in milk, blubber and tissues of pinnipeds. Dr. Iverson has published extensively on these subjects.

KEY PERSONNEL

Kathryn Frost:	Project management and coordination, planning, data analysis, reporting, seal tagging, aerial surveys
Lloyd Lowry:	Permitting, tagging, GIS analysis, coordination with other ADF&G studies
Robert DeLong:	Tagging, programming, GIS analysis of SDR data
Jay Ver Hoef:	Statistical analysis of survey data, tagging
Grey Pendleton	Statistical analysis of tagging data
Sara Iverson:	Fatty acid analysis and interpretation

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Table 1. Harbor seals instrumented with SDRs and sampled during 1992-1997.

Location	Date	SDRs										
		AdM	SubM	AdF	SubF	PupM	PupF	DNA	Blood	Fat	Whiskers	D_2O
Northern PWS												
Dutch Group/Lone I	May 95		1					5	5	5	5	
Northeastern PWS												
Gravina Island	Sep 94		1					3	3	3	3	
	Sep 95				1		1	2	2	2	2	
Olsen Bay	May 95				1			2	2	2	2	
	May 96							4	4	4	4	
	Jun 97							7	7	6	7	3
Central PWS												
Applegate Rocks	May 92		3	1					5			
	May 93	2						5	5			
	Sep 93							1	1		1	
	Sep 95							2	2	2	2	
	May 96				1			2	2	2	2	
	Sep 96				1			3	3	3	3	
	Jun/Jul 97					1	3	21	21	21	21	12
Bay of Isles	Sep 93	1						1	1		1	
Seal Island	May 92							1	3			
	May 93	3		1				7	7			
	Sep 93	2	1	1				10	10		10	
	May 96		1					3	3	3	3	
	Sep 96							4	4	4	4	
	Jun 97						2	2	2	2	2	2

Table 1. Continued.

Location	Date	SDRs AdM	SubM	AdF	SubF	PupM	PupF	DNA	Blood	Fat	Whiskers	D_2O
Southcentral PWS												
Channel Island	Sep 93	1						3	3		3	
	Sep 94	1	1		1			13	11	13	12	
	May 95							6	6	6	6	
	Sep 95							1	1	1	1	
	May 96							1	1	1	1	
	Sep 96		2	1	1			5	5	5	5	
	Jun 97							2	2	2	2	2
Green Island	Apr 94							1	1		1	
Little Green Isl.	Apr 94							1	1	1	1	
	Sep 95		1	1				9	9	9	9	
	May 96				2			6	6	6	6	
	Jun 97					1	2	6	6	6	6	6
Chalmers/Stockdale	Apr 94							8	8	7	8	
	Sep 94			3	1			10	10	10	10	
	May 95	1		2	1			9	9	9	9	
	Sep 95			2	1			6	6	6	6	
	May 96			2				6	6	6	6	
	Sep 96		1	1			1	5	5	5	5	
	Jun 97					2	1	11	11	11	11	6
	TOTAL	**11**	**12**	**15**	**11**	**4**	**10**	**194**	**199**	**163**	**180**	**31**

Table 2. Prince William Sound harbor seal trend count route.

Site #	Description	Status relative to EVOS
1	Sheep Bay	unoiled
2	Gravina Island	unoiled
3	Gravina Rocks	unoiled
4	Olsen Bay	unoiled
5	Porcupine Point	unoiled
6	Fairmount Island	unoiled
7	Payday	unoiled
8	Olsen Island	unoiled
9	Point Pellew	unoiled
10	Little Axel Lind Island	unoiled
11	Storey Island	oiled
12	Agnes Island	oiled
13	Little Smith Island	oiled
14	Big Smith Island	oiled
15	Seal Island	oiled
16	Applegate Rocks	oiled
17	Green Island	oiled
18	Channel Island	unoiled
19	Little Green Island	unoiled
20	Port Chalmers	unoiled
21	Stockdale Harbor	unoiled
22	Montague Point	unoiled
23	Rocky Bay	unoiled
24	Schooner Point	unoiled
25	Canoe Passage	unoiled

Table 3. Table of project activities for EVOS restoration project 064 by quarter, 1997-2000. Activities are designated as follows: F = field; L = lab; A = analysis; R = Report; X = other.

	Apr-Jun 98	Jul-Sep 98
FY 98: 1998 (98064)		
Satellite tag pups	F	F
Sample seals, pups and others (FAs)	F	F
Finish on "user friendly" pop model		A A R
Aerial surveys during the molt period		F
Retrieve ARGOS SDR data		X X
Analyze fish distribution/seal diving		A A A
Analyze SDR tag data	A A A	A A A
Hierarchical Bayes analysis of survey data		A A A

	Oct-Dec 98	Jan-Mar 99	Apr-Jun 99	Jul-Sep 99
FY 99: 1998-99 (99064)				
Analyze 98 survey data	A			
Meet with HS Commission	X			
Distribute HS Update	X			
Analyze fish distribution/seal diving	A A R			
Retrieve ARGOS SDR data	X X X	X X X		
Order SDRs for 1999 field season		X		
Attend EVOS workshop		X		
Coordination ADF&G NOAA		X		
Arrange logistics		X X X		
Analyze 98 seal/prey FA samples	L L L	L L L		
FA model development	A A A	A A A		
Prepare annual report and proposal		R R R		
Analyze 98 SDR tag pup data			A A A	A A A
Sample seals - pups and others (FAs)			F	F
Satellite tag pups			F	F
Aerial surveys during molt period				F
Hierarchical Bayes analysis of survey data				A A A

	Oct-Dec 99	Jan-Mar 00	Apr-Jun 00	Jul-Sep 01
FY 00: 1999-2000 (00064)				
Analyze 99 survey data	A			
Meet with HS Commission	X			
Distribute HS Update	X			
Attend EVOS workshop		X		
Analyze 99 seal/prey FA samples	L L L	L L L		
Final trend analysis 1989-1999		A A A	A A A	
Final SDR tag data analysis		A A A	A A A	
Final fatty acid analysis and interpretation		A A A	A A A	A A A
Final report and manuscript preparation			R R R	R R R

FY 99 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$116.4	$109.2
Travel	$9.8	$8.3
Contractual	$92.9	$91.3
Commodities	$29.4	$33.2
Equipment	$0.0	$0.0
Subtotal	$248.5	$242.0
General Administration	$24.0	$22.8
Project Total	$272.5	$264.8
Full-time Equivalents (FTE)	1.8	1.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
$175.0	unknown			

Dollar amounts are shown in thousands of dollars.

Comments:
This proposal is for an ongoing harbor seal study. It provides information on population trends, movements, and ecology of harbor seals, including changes in diet, in order to identify causes of the apparently ongoing decline among harbor seals in central PWS. The research component in FY 99 will emphasize pup seals and the analysis of previously gathered telemetry data on adults.

None of the costs identified in this budget are for NEPA compliance. Marine mammals projects obtain permits required under the Marine Mammal Protection Act from NOAA as part of routine operations. Costs for workshop and meeting attendance are identified under travel costs and total $1.6 K. There are no additional costs for professional conferences in FY 99. Community involvement (Harbor Seal Commission meeting) cost is $0.7 K.

The proposed FY 99 budget is within the guideline presented in the FY 99 Invitation to Submit Restoration Proposals. This project achieves major cost savings by collaborating with other studies and agencies to conduct this work. For example,ADF&G receives funds to conduct harbor seal studies in other parts of Alaska. This enables investigators to share costs for equipment, coomputers and software, as well as new methodologies and approaches to data analysis. Costs for fatty acid model development will be shared with Scotian Shelf research projects. Fatty acid samples to be used in comparisons of PWS and other geographic areas will be provided by other ADF&G harbor seal studies.

FY 99

Project Number: 99064
Project Title: Monitoring, Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 3 April 1998

FY 99 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
K. Frost	WBIII - Program Coordinator and Mngt	18K	8.0	6.5		52.0
L. Lowry	WBIV-Permits, Analysis & Interpretation	20J	3.5	7.0		24.5
R. DeLong	Analyst Programmer III-GIS Programming	17F	1.5	6.0		9.0
J. Ver Hoef	Biometrician II - survey statistical analysis	19F	1.0	6.4		6.4
G. Sheffield	WBI - data anlysis and graphics	14A	3.0	4.0		12.0
G. Pendleton	Biometrician II - sat tag analysis	19B	1.0	5.3		5.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		18.0	35.2	0.0	
					Personnel Total	$109.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1999
Fbks-Cordova for Aug surveys, 1 person	0.5	1	12	0.1	1.7
Fbks-Anchorage, tagging, 2 persons X 1 field trip	0.3	2	2	0.1	0.8
PWS-Anchorage 1-way charter, crew rotation	0.1	1	0	0.0	0.1
Portage-Whittier by train (2 vehicles per trip)	0.8	2	0	0.0	1.6
Fbks-Portage, personal vehicles	0.3	2	0	0.0	0.6
Fbks-Cordova?, Harbor Seal Commission, 1 person	0.5	1	2	0.1	0.7
Fbks-Anchorage, annual workshop, 1 person	0.2	1	5	0.1	0.7
Fbks-Anchorage, workshop no advance, 1 person	0.3	1	2	0.1	0.5
Fbks-Anchorage, coordination committee, 1 person	0.2	1	2	0.1	0.4
Rental car, Cordova for surveys			12	0.1	1.2
					0.0
					0.0
				Travel Total	$8.3

FY 99

Project Number: 99064
Project Title: Monitoring. Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

Prepared: 3 April 1998

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FY 1999
NOAA contract and ARGOS expenses for ARGOS satellite data, new FY 99 tags	10.0
Print/graphics (slides for workshops, report production, summary for villages)	0.3
Long distance phone calls	0.3
Postage (DHL, courier, etc.)	0.2
Trailer parking & launch fees, Whittier ($100/vehicle X 2 vehicles)	0.2
Aircraft charter 30 hrs @ $.23/hr	6.9
Vessel charter for tagging/sampling @ 1.8/day x 12 days	21.6
Lipid analysis contract with Dalhousie University	40.8
Freight and shipping of samples	1.0
Rutgers RSA for Bayesian survey analysis	10.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$91.3

Commodities Costs:	Proposed
Description	FY 1999
Fuel for boats and skiffs	1.0
Biopsy punches, flipper tags, epoxy. tag supplies, film, net	1.5
Small boat supplies (propellers, oars, oil, etc.)	1.5
Laboratory supplies (D2O, cryovials, vacutainers, etc.)	1.5
Repair supplies for skiffs, net, etc.	1.0
6 satellite tags @ $4.2/unit (from Wildlife Computers)	25.2
Misc. field and meeting supplies (waterproof notebooks, bindings, marine charts, batteries, etc.)	0.5
Computer supplies and software for graphics, GIS, and other analyses	1.0
Commodities Total	$33.2

FY 99

Project Number: 99064
Project Title: Monitoring. Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: ADFG

FORM 3B
Contractual & Commodities DETAIL

Prepared: 3 April 1998

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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
Equipment used by project, purchased with oil spill funds		
Leitz binoculars	1	ADF&G
HP LIID Printer	1	ADF&G
Compaq 286 Computer	1	ADF&G
Zodiac Raft	1	ADF&G
Equipment used by project, but purchased with non-oil spill funds		
20 ft Boston whaler	1	ADF&G
17 ft Boston whaler	1	ADF&G
Seal nets	1	ADF&G
2 486 computers + Plotter	1	ADF&G
Printer	2	ADF&G
Color printer	1	ADF&G

FY 99

Project Number: 99064
Project Title: Monitoring. Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: ADFG

FORM 3B
Equipment
DETAIL

Prepared: 3 April 1998