19.08.01 (13 of 16)

Development and Field Testing Rapid Diagnostic Test Kits for Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning
"Submitted under the BAA"

Project Number: 00482-BAA

Restoration Category:

Proposer: Jellett Biotek Limited

Lead Trustee Agency: ADEC

Cooperating Agencies:

Alaska SeaLife Centre: NO

Duration: 1st year, 3 year project

Cost FY 00: $180,700

Cost FY 01: $ 50,000

Cost FY 02: $ 30,000

Geographic Area: Prince William Sound, Kodiak

Injured Resource/Service: Clams, Mussels, Subtidal communities

ABSTRACT

This project involves the development and testing of rapid screening tests to detect two marine biotoxins that affect the Alaskan shellfishery, amnesic shellfish poisoning (ASP) and paralytic shellfish poisoning (PSP). These toxins can cause sickness and even death in individuals who consume contaminated shellfish. With a reliable field testing method, coastal communities and shellfisheries will be able to ensure shellfish is safe to eat before harvesting. This will lead to safer subsistence harvesting of shellfish which can replace the lost or decreased availability of injured resources such as harbour seals, sea lions, herring and ducks. Jellett Biotek has a working prototype of a rapid test for PSP and have the antibodies for an ASP test. We have applied to the ASTF for funding to help further develop and optimize these tests, thus making them available for field trials. The feasibility of establishing ongoing beach monitoring will be assessed.

INTRODUCTION

This project is being proposed to help ensure that shellfish is safe to harvest in communities within the Prince William Sound and Kodiak areas. The shellfishery can be a valuable food resource from a subsistence harvest perspective, as a replacement for other food sources that were affected by the oil spill. These species include harbour seals, sea lions, ducks and herring. The Prince William Sound and Kodiak Island areas suffer from serious outbreaks of paralytic shellfish poisoning (PSP) and occasionally amnesic shellfish poisoning (ASP). This project plans to develop and field test state of the art field screening tests for these two marine biotoxins. Marine biotoxins occur naturally when, under certain conditions, specific species of algae "bloom". These occurrences are frequently known as "red tides". Bivalves such as mussels and clams are filter feeders and will ingest this toxic algae and become toxic for human consumption. Harvesting and consuming shellfish at these times can cause illness and death to those who consume them, but the shellfish will subsequently clear the toxins and become safe to eat over time.

During the past Alaskan toxin season from April 1998 to December 1998, Jellett Biotek Limited received funding from the Alaska Science and Technology Foundation to field trial our current cell based test kits for PSP. This trial was very successful, particularly in laboratory settings, but pointed to the need for an easy to use, single use field test for PSP.

Jellett Biotek has submitted a proposal to the April 15, 1999 board meeting of the Alaska Science and Technology Foundation for the technical development of the rapid screening tests for ASP and PSP. The tests can be performed by relatively unskilled individuals and will provide visual qualitative (yes/no) results in less than 20 minutes.

Jellett Biotek is providing in kind contribution to this ASTF project of specialized antibodies to detect the two toxins, as well as substantial intellectual property. We in fact have a working prototype for the PSP rapid test and are confident that it can be optimized for the profile of toxin analogues found in Alaskan waters. We are also confident we will develop the rapid test for ASP by December 99, well before the expected field trial date of April 2000.

This current EVOS proposal focusses on the subsequent field trials of the rapid tests in communities within the Prince William Sound and Kodiak Island areas.

This project may be directly linked to the proposed Youth Intern Research Project (Youth Area Watch) for Kodiak Island and indirectly linked to clam bed restoration project.

NEED FOR PROJECT

A. Statement of the Problem

There has been a loss or reduction in available subsistence food resources in the oil spill affected areas with species such as harbour seals, sea lions, ducks and herring. With the availability of a cost effective, simple marine biotoxin testing technology, coastal communities can test to ensure the safety of shellfish beds, thus opening up this resource for safe subsistence harvesting. Current shellfish testing for all of Alaska is performed at the Alaska Department of Environmental Conservation (ADEC) regulatory lab in Palmer. This involves collecting

shellfish samples, shipping them to the lab, where the toxin extracted from the shellfish tissue is injected into live mice. The amount of time it takes for the mouse to die from respiratory paralysis is an indication of the amount of PSP toxicity present in the shellfish. The current regulatory limit is 80ug of saxitoxin per 100 grams of shellfish tissue. In the case of amnesic shellfish poisoning, or ASP, HPLC tests (high performance liquid chromatography) tests are done at the ADEC lab to ensure the shellfish samples are free of domoic acid, which causes ASP. Samples from commercial shellfisheries receive priority at the ADEC lab for testing under the state program, leaving many beaches and recreational shellfish areas without monitoring for PSP or ASP. The cost for having a PSP test performed by the ADEC lab is $125 per sample, if the sample is not covered under the state regulatory testing program. An ASP test is $100 per sample.

Jellett Biotek Limited plans to develop simple- to- use immunochromatographic tests (similar to home pregnancy tests) that will be used to screen for PSP and ASP within 20 minutes. These will be simple yes/no tests to indicate whether or not the shellfish is affected by these two marine biotoxins. These tests will not provide a quantitative result, and are not meant to replace the regulatory test for the commercial shellfishery, but will be a reliable initial screen for toxicity, at a projected cost of about one tenth the cost of the mouse bioassay and HPLC tests. Jellett Biotek plans to have these tests approved by global regulatory authorities (USFDA in the US) as a pre-screen for ASP and PSP.

B. Rationale/Link to Restoration

This project should be undertaken to help validate a rapid, inexpensive test for monitoring for marine biotoxins that affect the shellfishery in the Prince William Sound and Kodiak areas. By testing the shellfish beds in the area, windows of harvest opportunity may be found, making the harvesting of shellfish for subsistence or recreational purposes much safer. This may eventually lead to a cost effective, broadly based biotoxin monitoring program in areas currently not monitored for toxicity and permit access to the shellfish resource that is currently not available. The access to the shellfishery will help replace subsistence food resources lost or limited as a consequence of the oil spill in the affected areas. Examples of the affected species include harbour seals, sea lions, ducks and herring.

Enhanced public safety may result as individual harvesters will have access to a screening methodology that will help protect against harvesting contaminated product, leading to potential economic development in tourism or a commercial shellfishery in the restoration area.

The proposed field trials are an integral part of the development of the rapid tests as they will be tested in actual conditions by relatively inexperienced individuals. Jellett Biotek wants to demonstrate that these tests are simple, robust and effective at screening for PSP and ASP and protecting communities and individuals from harvesting contaminated shellfish.

The proposed trials will compare the efficacy of the rapid tests to the current regulatory testing methods that are recognized by the Alaska State government as being effective public health screens for these toxins.

C. Location

We have requested the assistance of the Ouzinkie Tribal Council, the Tatitlek IRA Council as well as the Kodiak Tribal Council in providing the field sites for these tests. We will select representative shellfish sites in the Prince William Sound and Kodiak Island. All coastal communities with potential shellfisheries may be affected by the results of these trials.

Community Involvement and Traditional Knowledge

This project will rely heavily on local knowledge of the tribal councils for identifying potentially important shellfish areas and for developing sample collection plans. This project will coordinate with the proposed Kodiak Youth Area Watch . Students in Kodiak Island will be trained to collect shellfish samples and perform the test procedures related to the project.

We will focus our efforts on areas that are large subsistence consumers of shellfish. Our tests will be designed to be extremely easy to use and we will provide a training session for the students and supervisors at field site locations.

Upon completion of the project Jellett Biotek will provide an easy to understand report on the efficacy of the field tests and their economics and ease of use. We will also assess the merits and costs involved in developing an ongoing shellfish monitoring program which incorporates this technology. This report will be widely distributed to interested community groups. We will develop commercialization strategies to ensure the tests are available in Alaska once the trial has been completed. Jellett Biotek will also make the trial results available on our web site and we will collaborate with the Kodiak Island Borough Community Development Department in promoting shellfish safety through the school system and other public awareness opportunities. We will arrange for at least one community seminar to discuss the trial results and the implications to the coastal communities and shellfisheries. We will attempt to organize ongoing shellfish monitoring programs using the assistance of tribal councils and other community groups. Hugh Short, Spill Area Wide Community Involvement Coordinator, has assisted in providing contacts to several tribal councils and economic development organizations in the affected communities.

PROJECT DESIGN

A. Objectives

The objective of the project is to demonstrate the efficacy, ease of use and cost effectiveness of the rapid screening tests for ASP and PSP during the FY 00. In the longer term this will enable shellfish resources in the affected communities to be monitored on an ongoing basis for health safety. It is expected that this will lead to the ability to exploit the resource for subsistence and recreational purposes. The shellfisheries may be a potential economic generator in the region.

B. Methods

Jellett Biotek has submitted a proposal to the April 15, 1999 board meeting of the Alaska Science and Technology Foundation to develop antibody based, rapid tests for PSP and ASP. If the proposal is approved, the test development process will take place between May and December, 1999. Once these tests are developed and tested with an in house trial at the DEC lab between January 00 and March 00, we will fine tune the tests and prepare for a larger EVOS field trial beginning in April 00 to September 00. Jellett Biotek will then analyze the data and prepare a report by November 2000(FY01). A community seminar will be provided on the trials prior to May 01, as well as recommendations on a beach monitoring program for the 2001 toxin season.

We are requesting EVOS funding of the field trial, to commence in October 99, when we will prepare the protocol and training materials for the field participant training session, that will occur in April or May 2000. In addition, rapid tests will be manufactured between January 00 and April 00, in preparation for the trials.

During the field trials, shellfish samples will be collected in the affected region, the samples split with one half of the sample going to the ADEC regulatory lab in Palmer for regulatory tests, and the other half of the shellfish sample tested in the field using the rapid tests. The results of the field tests will be compared to those obtained by the ADEC lab (mouse bioassay for PSP and HPLC test for ASP).

To demonstrate the robustness and reproducibility of the field tests, we have selected 4 field sites within the affected region. Each field site will perform a minimum of 100 field tests (50 shellfish samples, testing for both ASP and PSP) using the new rapid tests over the normal toxicity season of April to September. We will use a sampling procedure that will collect shellfish samples ensuring geographical distribution of the samples as well as diversity in shellfish species. Jellett Biotek will provide a training session to all participants to ensure they understand how to collect shellfish samples, perform the tests and report the results correctly.

An alternative to this approach would be to collect samples over the toxin season and "archive" the samples to be tested at a later date. Although more convenient and cost effective to do this, there are concerns that the toxin profile found in the shellfish may change over time. The data will be much better if the samples are tested by the ADEC lab and the field site at relatively the same time to ensure comparability in the data of the different test methods. The proposed approach worked very well in a previous trial using our cell based MIST™ kits for detecting paralytic shellfish poisoning.

C. Cooperating Agencies, Contracts and other Agency Assistance

We are requesting funding from the Alaska Science and Technology Foundation to assist us in the development of the rapid tests. It was decided to apply for assistance from the Exxon Valdez Oil Spill Trust Fund (EVOS) for the field trial portion of the project due the high level of community involvement that is required, and the fact that the affected areas have some of the highest levels of PSP found in the world. There appears to be a real need for a reliable, cost effective monitoring program at the community or even individual level.

Obviously the field trial portion cannot be done unless ASTF funds the test development portion or this project.

The private sector partners in this project will include Jellett Biotek, who will provide the rapid diagnostic tests, a training program in their use, technical and analytical support to the trials and project management and test kit commercialization strategies. The collaborating tribal councils and trained members of the Kodiak Youth Area Watch will collect shellfish samples, homogenize and split the samples, sending half into the ADEC lab in Palmer, and performing the rapid tests on the other half of the sample. They will also be responsible for reporting results to Jellett Biotek.

The ADEC lab in Palmer is a very important government partner in this project. They will perform the corroborative mouse bioassays, HPLC analysis and rapid tests on shellfish samples against which the field tests will be compared. Jellett Biotek worked closely with the ADEC last year in the field trials for our cell based MIST™ kits.

Schedule

Measurable Project Tasks for FY 00 (October 1, 1999 - September 30, 2000)

The following is a summary of the major tasks to be completed

October99 - December 99:	Develop trial protocol and training manuals for all field testing sites
January 00 -April 00:	JBL to produce sufficient rapid tests for trials (about 1000 tests)
April 00-May 00:	JBL will provide a training course for all trial participants in the shellfish sample collection and rapid test procedures. We will review popular harvesting sites and develop a shellfish sampling plan.
May 00 - September 00:	All trial participants will collect approximately 50 shellfish samples at each site, homogenate the tissue and send half of the tissue to the ADEC lab in Palmer. The site participant will perform both ASP and PSP rapid tests on each sample. Site participants will report test results to JBL. Jellett Biotek will coordinate testing with the DEC lab.
01 Fiscal year (October 1- September 30)	
October 00- November 00:	Jellett Biotek will analyze the data and prepare a report on the trial results and recommending future monitoring strategies
December 00 - April01 :	Jellett Biotek will provide a seminar to all trial participants and interested communities on trial results and ramifications.
April 15 01	Report to EVOS
April01	International Shellfish Toxicity conference - Presentation of Data
April 30	Submit articles to journals
April to June	Public Awareness Seminars - Alaska
April to May	Potential to begin beach monitoring program
March 02	Final report on pilot monitoring program

B. Project Milestones and Endpoints

The following are milestone dates and deliverables by that date:

Date	Deliverable
December 31, 99	complete written protocol for the trial, copies delivered to trial participants
April 30, 00	a minimum of 1000 spot tests manufactured and pre-tested, monthly delivery/testing schedule developed for all sites.
May 30,00	Training course for all sites completed and shipping schedule begun
September 30,00	All field testing will be completed and data analysis begun
FY01	
December 31,00	Report on trial completed and distributed to EVOS and trial partners
April 15,01	Annual report due to the Trustee Council
April30,01	Seminar on trials completed, recommendations for future actions regarding beach monitoring This seminar may be held in conjunction with a hazardous algal bloom conference held by the ASTF during this time period. Public awareness program for schools completed
May 31,01	Potential start date for pilot community beach monitoring program
December 31, 01	Completion of pilot monitoring program
March 31,02	Final report on monitoring program

C. Completion Date

All project objectives will be complete by March 31, 2002
Publications and Reports

There will be no manuscripts submitted for publication in FY00. The data from the trial will be ready for submission to TOXICON or the Journal of Association of Official Analytical Chemists by April 30, 2001.

Professional Conferences

We plan to present this data at a Harmful Algal Bloom Conference in Alaska. We also plan to present the data at one other major international conference in the year 2001.

Coordination and Integration of Restoration Effort

We will attempt to coordinate the sample collection procedures with other activities occurring in the area. We have asked Hugh Short, Spill Area Wide Community Involvement Coordinator, to assist us with this. Both the Ouzinkie and Tatitlek tribal councils have agreed to participate and we hope to work with the Kodiak Youth Area Watch to collect samples and perform the tests. Discussions have been held with the Kodiak Area Native Association (Frank Peterson) and the Kodiak Island Borough Community Development Department to collaborate on public information programs.

We will coordinate this trial with the ongoing biotoxin monitoring activities of the DEC lab to as great an extent possible to minimize the costs of the project.

Jellett Biotek has submitted a proposal to the Alaska Science and Technology Foundation to help fund the development of the ASP and PSP rapid tests. Jellett Biotek has included substantial in-kind contribution to the project through the provision of our specialized antibodies for test development as well as intellectual property already developed for the immunochromatographs. In addition, there may be considerable in- kind contribution from the trial sites in obtaining the shellfish samples and conducting the test.

Proposed Principal Investigator

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Principal Investigator

Dr. Joanne F. Jellett is a professional marine microbiologist and president of Jellett Biotek Limited. She is an entrepreneur and developer of the Maritime In Vitro Shellfish Test (MIST™) cell based bioassays for paralytic shellfish poisoning.
Dr. Jellett has conducted considerable research in marine invertebrate immunology and is a well known international expert and consultant in marine biotoxins. She has numerous scientific publications to her credit.

Dr. Jellett has completed specialized training in lateral flow immunoassay development and will be the technical leader in developing the rapid tests for ASP and PSP. Projects objectives to be met by Dr. Jellett include the development, testing and manufacture of prototype rapid tests for ASP and PSP. She will also provide technical advice to the field trials and be responsible for data analysis, report production and submission of articles for peer review and subsequent journal publication.

Other Key Personnel

Mr. Raymond Roberts will be the overall project manager and will be responsible for all economic analysis and business issues related to the trial and report and recommendations.

Nancy Morse will be the trial manager and responsible for trial protocol, training materials, and trial data management.

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$51.8						
Travel		$25.7						
Contractual		$50.0						
Commodities		$20.0						
Equipment		$1.1	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$148.6			Estimated FY 2001	Estimated FY 2002		
Indirect		$32.1						
Project Total	$0.0	$180.7			$50.0	$30.0		
Full-time Equivalents (FTE)		1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	ASTF		$311.9	In-Kind	$826.2			

Comments:
The FY2000 budget reflects the establishment of trials of rapid tests for ASP and PSP.

Jellett Biotek has submitted a proposal to the ASTF to help fund the development of rapid tests for ASP and PSP. The proposal requests $311.9K, with $826.2K as in-kind contributions. Long range funding requirements represent the potential for a community marine biotoxin beach monitoring program to be implemented, April 2001 to December 2001,and have the carry over of $30K in FY2002. Savings in labour may be possible by using students or volunteers to collect shellfish samples and perform the tests. This field trial is contingent upon receiving ASTF funding for assistance in the technical development of the rapid tests.

FY00

Prepared: March 31/99

Project Number: 00482-BAA
Project Title: Development and Field Testing of Rapid Diagnostic Test Kits for Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning
Name: Raymond L. Roberts, Jellett Biotek Limited

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRU...E COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	J. Jellett	Principal Investigator	1.5	6000.0		9,000.0
	R. Roberts	Project Manager	2.0	6000.0		12,000.0
	N. Morse	Data Manager	0.3	4800.0		1,440.0
	E. Belland	R&D Manager/Training	0.5	4000.0		2,000.0
	Vacant	ADEC technical Support	3.0	3000.0		9,000.0
	P. Panamarioff	Ouzinkie Trial Site	1.0	4000.0		4,000.0
	G. Kompkoff	Tatitlek Trial Site	1.0	4000.0		4,000.0
	Vacant	Kodiak Trial Site	1.0	4000.0		4,000.0
	Kodiak Youth Area Watch	Kodiak Youth Area Watch	1.0	4000.0		4,000.0
	A. Macmillan	Accounting/admin support	1.0	2400.0		2,400.0
						0.0
						0.0
		Subtotal	12.3	42200.0	0.0	
					Personnel Total	$51,840.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	Aifare - Halifax to Anchorage - Workshop Jellett/Roberts	2480.3	2	10	200.0	6,960.6
	Airfare - Halifax to Anchorage - Training session Jellett/Robert	961.0	2	10	200.0	3,922.0
	Trial site travel costs for training to Palmer	5000.0	1	12	200.0	7,400.0
	Miscelaneous travel for sample collection					2,000.0
	Car Rental (Jellett/Roberts)					1,000.0
	Airfare to Kodiak, Prince William Sound Destinations	1000.0	2	12	200.0	4,400.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$25,682.6

FY00

Prepared: March 31/99

Project Number:
Project Title: Development and Testing Rapid Diagnostic Test Kits for Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning

Name: Raymond L. Roberts, Jellett Biotek Limited

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Mouse Bioassay c PSP control - ADEC lab 200 samples @ $125/sample	25.0
HPLC tests for ASP control - ADEC lab 200 samples @ 100/sample	20.0
Analytical support for both ASP and PSP samples	5.0
Contractual Total	$50.0

Commodities Costs:	Proposed
Description	FY 2000
Courier costs for shipping samples/test kits	5.0
Purchase of immunochromatograph rapid test (Jellett Biotek) 1000 @ $15 each	15.0
Commodities Total	$20.0

FY00

Prepared:

Project Number:
Project Title: Development and Field Testing Rapid Diagnostic Kits for Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning
Name: Raymond L. Roberts, Jellett Biotek Limited

FORM 4B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
Extraction kits for shellfish tissue	4	130.0	520.0
Refills for extraction kits	8	20.0	160.0
Shipping vials (for DEC lab)	200	2.0	400.0
			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**	$1,080.0

Existing Equipment Usage: Description	Number of Units	

FY00

Prepared:

Project Number:
Project Title: Development and Field Testing of Rapid Diagnostic Test Kits for Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning
Name: Raymond L. Roberts, Jellett Biotek Limited

FORM 4B
Equipment
DETAIL

ter

Determining the Extent and Magnitude of Straying of Hatchery-Released Pink Salmon *Onchorynchus gorbuscha* in Prince William Sound

Project Number:	00487
Restoration Category:	Research
Proposer:	Alaska Department of Fish and Game
Lead Agency:	Alaska Department of Fish and Game
Cooperating Agencies:	U.S. Forest Service
Alaska SeaLife Center:	No
Duration:	1st year, 3-year project
Cost FY 00:	$215,900
Cost FY 01:	$215,900
Cost FY 02:	$62,000
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink Salmon

ABSTRACT

This project will estimate the degree of straying of hatchery-released pink salmon *Onchorynchus gorbuscha* in Prince William Sound (PWS). Specific strata encompassing streams used in high-profile studies funded by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) will also be formed. Otoliths will be sampled from pink salmon carcasses in streams located within each defined stratum. Otoliths of hatchery origin will be identified by specific thermal marks applied to fry at the four PWS pink salmon hatcheries in the Fall of 1998 and 1999. The proportion of PWS escapements comprised of spawning hatchery pink salmon will be estimated by stratum (geographic area and stream zone) and for the Sound as a whole. Specific attention will be paid to hatchery contributions to spawning escapements studied in previous EVOS-funded projects. The study will be repeated the following year (FY01) to evaluate straying for the odd-year class.

INTRODUCTION

In 1997, the first hatchery pink salmon bearing thermally marked otoliths returned to Prince William Sound. In a survey of 12 streams believed predisposed to straying, hatchery contributions to spawning escapements ranged from 10% to 91%, higher percentages occurring later in the spawning season (Joyce, unpublished data). Consistent with the findings of Sharr et al. (1995), coded wire tag recoveries made during the survey also indicated a substantial contribution of hatchery salmon to the spawning escapements. Although this study provided evidence of large-scale straying, it was not possible to expand the findings to the remainder of the sampled area because of the biased nature of the experimental design. Large-scale straying is interesting from a host of perspectives, ranging from the idea that domestically-selected traits may be transferred to wild populations (Waples, 1991; Ryman and Laikre, 1991; Allendorf and Ryman, 1987) to the notion that straying might enhance the productivity of wild systems. While such possibilities are intriguing, they are difficult to study and do not warrant consideration before a more comprehensive assessment of the extent and magnitude of straying in Prince William Sound has been undertaken. Such an assessment, using robust and easily implemented techniques, is described in this proposal.

An equally important issue is the relevance of straying to the interpretation of certain Natural Resource Development Assessment (NRDA) and restoration projects funded by the EVOSTC in response to the 1989 oil spill. Among these were projects F/S-2 and its successors (Bue et al., 1998), that reported embryo mortality in wild pink salmon streams to correlate with the oiling status of the stream. Also funded by the EVOSTC was study F/S-1 and related projects (Fried et al., 1997) that endeavored to provide improved pink salmon escapement information, and R94320D/95320D and R96196 (Seeb et al., 1996 and Habicht et al. 1998) that aimed to map genetic differences in wild pink salmon populations in the Sound. A common assumption made in these projects was that salmon viewed in, or sampled from escapements were native. Violation of this assumption has potentially serious consequences with respect to the interpretation of the data collected by the studies.

The aerial survey projects of Fried et al. (1997) involved compilation of extensive counts of live salmon within streams that were used in area-under-the curve methods to estimate total escapements. If stray fish do not reproduce successfully, observed escapements may not be meaningful in the context of future productivity. This factor is relevant to the use of the extensive escapement database developed by the EVOSTC aerial survey project and also to the interpretation of future aerial survey data.

In the egg-mortality field studies of Bue et al. (1998) embryos excavated from stream-beds of oiled streams were found to experience higher mortalities than those sampled from control streams. It is possible that hatchery pink salmon stray more into oiled streams than control streams, perhaps as a result of stream orientation effects (etc.). If hatchery fish also produce less vigorous offspring than their wild counterparts in the natural environment, it is possible that the observed oiling effects are a function of straying rather than oiling. Additionally, the laboratory experiments described in Bue et al. (1998), in which adult salmon were sampled from oiled and control streams and spawned in the laboratory, may have been compromised by stray hatchery pink salmon . While it is acknowledged that the extent of straying over the period of the mortality study will never be known, the finding of a correlation between oiling and straying among streams would raise questions regarding the role of oil in the observations.

For the genetic-mapping studies funded by the EVOSTC, it is possible that the observed genetic structure of salmon populations in upstream versus downstream areas are a function of hatchery-reared fish residing in intertidal areas, the observed structure having little to do with selection processes or genetic drift. Additionally, if streams are differentially susceptible to straying, observed differences in genetic structure between streams may be rooted in differences in the number of stray fish in the sampled populations, rather than selection or drift processes.

This proposal consists of two straying studies, one relevant to each of the even (FY00) and odd-year (FY01) brood classes. They will use properly randomized sampling methodologies to determine the extent of straying into upstream and tidal areas of spawning escapements in the Sound. A specific stratum will be formed to assess streams used by Bue, et al. (1998), Fried et al. (1997), Seeb et al. (1996) and Habicht et al. (1998). Should the proposed studies detect straying in these systems, analysis of the significance of the finding in light of the interpretation of results of previous studies will be warranted.

The project is linked to EVOS projects 97186 (*Coded Wire Tag Recoveries From Pink Salmon in Prince William Sound*), 97188 and 98188 (*Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon in Prince William Sound*), 94320D, 95320D and 96196 (*Genetic Structure of Prince William Sound Pink Salmon*), F/S-1, 9 and *60B (Injury to Spawning Areas (Fish/Shellfish NRDA Study 1) and Spawning Escapement Enumeration (Restoration Studies 9 and 60B) of Pink Salmon in Prince William Sound*) and F/S-2, 60C, 9003, 94191-1,95191A-1, and 96191A-1 *(Injury to salmon eggs and preemergent fry in Prince William Sound)*. It will also provide input to the Sound Ecosystem Assessment project.

NEED FOR THE PROJECT

A. Statement of Problem

Preliminary studies by Sharr et al. (1995) and a study using thermal otolith marks and coded wire tags in 1997 (Joyce, unpublished data) suggest that straying of hatchery-reared pink salmon in PWS may be pervasive. The effects of stray hatchery fish on wild populations may range from introduction of undesirable genetic material to simple supplementation of the invaded population. These studies were by no means comprehensive, and general conclusions were elusive. Before any effort is made to ascertain the consequences of straying to invaded populations, it is prudent to determine the extent and magnitude of the phenomenon. It is believed that this will be most effectively accomplished by randomized studies capable of providing district and area-specific estimates of the extent of straying

The knowledge that large numbers of hatchery-reared salmon stray into streams previously sampled by EVOSTC-funded projects may also have significant bearing on interpretation of the results from those studies. The projects are documented in peer-reviewed journals and annual and final reports that are freely and widely available. The embryo-mortality study, especially, has received significant exposure in EVOSTC-sponsored forums designed to disseminate study results to the public and scientific communities. It is argued that it is incumbent of the EVOSTC to study credible alternative hypotheses that explain the correlations between oiling and embryo mortalities, and the differences observed in the genetic-mapping studies. With respect to the

aerial survey study, the extent of straying needs to be documented for the sake of the historical database generated by the project and for the interpretation of future observations.

B. Rationale/Link to Restoration

Straying of hatchery pink salmon into wild stream systems has myriad consequences, ranging from effects on the genetic structure of invaded populations to the interpretation of data gathered in numerous EVOS Trustee Council damage assessment and restoration studies.

This study has a direct and clear link to the damage assessment and restoration phases established by the Trustee Council. As well as providing an inventory of the extent of straying Sound-wide, it will examine whether straying should be considered in the interpretation of the results of four major Trustee Council-funded projects. These are the embryo-mortality study of Bue et al. (1998), the aerial escapement studies of Fried et al. (1997) and the genetic mapping studies of Seeb (1996) and Habicht (1998).

Before effort is spent on determining the consequences of straying, be it either on the genetic integrity of wild populations or on the conclusions of previous EVOSTC-funded projects, it is considered prudent to determine the extent and magnitude of the phenomenon. The advent of thermal mark technology and its successful implementation by the Alaska Department of Fish and Game (e.g. Joyce et al., 1997) provides a readily available and tested methodology with which to make such a determination. The study will be most effectively accomplished by randomized studies capable of providing district and area-specific estimates of the extent of straying, with establishment of strata containing streams used in the embryo-mortality studies of Bue et al. (1998), the aerial survey study of Fried (1997) and the genetic mapping studies of Seeb et al. (1996) and Habicht et al. (1998).

C. Location

Carcass sampling will be conducted weekly on selected streams located in the Southwestern, Eshamy, Northern, Eastern, Southeastern and Montague Districts. Initial otolith processing will be conducted at the Cordova Otolith Processing Laboratory.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

There is considerable support for the project within the local community of Prince William Sound. A proposal for a pilot straying study was submitted to the Oil Spill Response Institute (OSRI) for funding in 1998, and received strong support from the Regional Planning Team. The latter is a body responsible for oversight of enhancement programs within Prince William Sound, and is comprised of local fishermen, members of the Prince William Sound Aquaculture Corporation and staff from the Alaska Department of Fish and Game. A newly formed group called the Sound Science Review Team (SSRT) has also given strong support to this type of project. The SSRT was composed of a variety of different government agencies, native groups, commercial fishing organizations, members of the University of Alaska, hatchery operators and other scientific groups.

Results of the study will be made available to the community through annual and final reports. Season summaries, which provide a synopsis of the fishing season, and which are made readily available to the local community, will also report the findings of the project.

Direct community involvement in the project will occur through the hiring of local residents into field positions, and the use of local vendors for logistical support.

PROJECT DESIGN

A. Objectives

Obtain accurate and precise estimates of the proportion of even and odd-year class hatchery-released pink salmon in Prince William Sound escapements :

-By spawning zone within and over geographic strata
-By geographic strata over spawning zone
-Over geographic strata and spawning zone
-For specific strata defined by streams sampled in prior EVOSTC projects

B. Methods

Sample Design

General Design. The proportion of hatchery-released pink salmon in PWS stream escapements will be estimated using otoliths extracted from fish sampled from streams randomly selected within predefined strata. A two-stage sampling design will be used within each stratum, with streams forming primary sampling units, and individual fish within streams forming secondary sampling units. When estimates are combined over strata, stream escapements will be used as weights. Estimates of the proportion of hatchery-released fish in stream escapements will be made by tidal area for each region and by tidal area for the Sound as a whole. Estimates will also be combined over stream area for each region and then over regions to provide a Sound-wide estimate of the total proportion of PWS stream escapements comprised of hatchery-released pink salmon. The stratum containing streams sampled by previous EVOSTC-funded studies will be treated in a manner identical to other strata, except that all primary units (streams) will be sampled, such that there will be no sampling variance associated with stream selection.

Stratification. Estimates of area-specific proportions of hatchery-released pink salmon in stream escapements are of interest, and PWS will be divided into five geographic regions using the boundaries of the Southwestern, Northern, Eastern, Southeastern, and Montague fishing districts. The streams within each region will be further stratified into those routinely monitored by the Alaska Department of Fish and Game aerial-survey program and those not routinely monitored. The groupings represent streams with larger and smaller escapements, respectively, and allow a more efficient sample allocation. A separate stratum will be established to determine straying in selected streams examined by Bue et al. (1998), Fried et al. (1997) , Seeb et al. (1996) and Habicht et al. (1998). All streams within the latter stratum will be sampled.

A pilot study conducted in 1997 found a relationship between distance of stream from a hatchery and the proportion of hatchery-released pink salmon in the stream escapement, and an alternative within-region grouping of streams by distance from a hatchery was considered. If the relationship between distance and straying is real, such a design could lead to reduced within-stratum variabilities, and higher precision of estimates. The relationship was considered too preliminary for use as a stratifying criterion at this time, however.

Stream Allocation Among Strata. A total of approximately 80-90 streams will be sampled Sound-wide. Division of the sample among strata will be made in order to minimize the variance of the overall estimate of the proportion of hatchery-released pink salmon in PWS escapements, and will take into account the number and productivity of streams within strata. Constraints will be incorporated into the minimization routine such that a minimum of 10 streams is sampled from each geographic region.

Within-Stream Sampling and Identification of Hatchery Fish. Thermal marks were applied to all hatchery-released pink salmon in the Fall of 1998 under project 98188. These marks will allow identification of hatchery pink salmon in escapements sampled during the 2000 return. Each selected stream will be sampled three to four times over the migration of 2000. At each sampling event, 75 otoliths will be collected from carcasses in both upstream and tidal zones of the stream, if they exist. To ensure that tidal spawners are sampled from the tidal areas, only dying fish guarding an intertidal redd will be selected. A single weighted otolith sample will be formed for each zone of a stream from the samples taken over the migration. The weights used will be formed from estimates of the sizes of the populations of fish from which the otolith samples were taken. Counts of live fish at each sampling event will be used with an area-under-the-curve method (English et al., 1992) to provide appropriate estimates of population size, and therefore weightings. Tidal escapements will be estimated as the difference between upstream and total escapements. The proportionally-allocated (weighted) sample will mimic a simple random sample taken from the entire stream escapement to the zone in question (Cochran, 1977). In addition to providing appropriate weightings for the construction of the within-stream samples, escapement estimates will also be used in Equations 1, 2, and 3.

Identification of selected otoliths will be made at either the Alaska Department of Fish and Game Cordova Otolith Reading Laboratory, or the Statewide Otolith Reading Laboratory in Juneau.

Estimation

An estimate of the proportion of hatchery-released pink salmon in the escapement of a given stream zone, z (upstream/tidal) for stratum, g, will be calculated using the ratio estimator of the population total. The resulting estimator is :

$$\hat{p}_{zg} = \frac{\sum_{i=1}^{n_g} M_{zgi} \frac{h_{zgi}}{m_{zgi}}}{\sum_{i=1}^{n_g} M_{zgi}} \qquad (1)$$

where M_{zgi} is the escapement for stream zone z in the i^{th} stream in stratum g, n_g is the number of streams sampled in stratum g, m_{zgi} is the number of otoliths sampled from M_{zgi}, and h_{zgi} is the

number of otoliths of hatchery origin found in m_{zgi}. The M_{zgi} will be estimated from frequent ground-based observations. While the ratio estimator used in Equation 1 is biased, its variance is routinely smaller than its unbiased counterpart; the latter is highly susceptible to variability in size of primary units (stream escapements).

A variance estimate for $\hat{p}_{zg}$ is given by:

$$\hat{V}(\hat{p}_{zg}) = \frac{1}{\left[N_g \sum_{i=1}^{n_g} \frac{M_{zgi}}{n_g}\right]^2} \left[\frac{N_g^2 \left[1 - \frac{n_g}{N_g}\right] \sum_{i=1}^{n_g} M_{zgi}^2 \left[\frac{h_{zgi}}{m_{zgi}} - \frac{\sum_{i=1}^{n_g} M_{zgi} \frac{h_{zgi}}{m_{zgi}}}{\sum_{i=1}^{n_g} M_{zgi}} \right]^2}{n_g (n_g - 1)} + \frac{N_g}{n_g} \sum_{i=1}^{n_g} \frac{M_{zgi}^2 \left[1 - \frac{m_{zgi}}{M_{zgi}}\right] \frac{h_{zgi}}{m_{zgi}} \left[1 - \frac{h_{zgi}}{m_{zgi}}\right]}{(m_{zgi} - 1)} \right] \quad (2)$$

where N_g is the total number of streams in stratum g.

An estimate of the proportion of hatchery-released pink salmon in stream zone z sound-wide, p_z, is calculated by weighting stratum estimates $\hat{p}_{zg}$ by w_{zg}, calculated from estimates of total escapements to the G strata into which Prince William Sound is divided:

$$\hat{p}_z = \sum_{g=1}^{G} \left[\frac{\frac{N_g}{n_g} \sum_{i=1}^{n_g} M_{zgi}}{\sum_{g=1}^{G} \frac{N_g}{n_g} \sum_{i=1}^{n_g} M_{zgi}} \right] \hat{p}_{zg} = \sum_{g=1}^{G} w_{zg} \hat{p}_{zg} \quad (3)$$

Sampling among the G strata is independent, and an approximate variance estimate is given by:

$$\hat{V}(\hat{p}_z) = \sum_{g=1}^{G} w_{zg}^2 \hat{V}(\hat{p}_{zg}) \quad (4)$$

In the above estimate of variance (Equation 4), the weightings w_{zg} are treated as constants, when they are in fact subject to sampling variation; repeated selections of streams will yield different weights. In addition, estimates $\hat{p}_{zg}$ are subject to the same sampling variation as the w_{zg}, and they are therefore correlated. Further, the w_{zg} are correlated among themselves because each component contains the same estimated total escapement in the denominator. The variance estimate for $\hat{p}_z$ should ideally account for these facts. Two solutions will be considered.

(i) Remove correlations between $\hat{p}_{zg}$ and w_{zg} by using aerial-survey data to generate weights, and explicitly account for covariances among the w_{zg}. The approach is to base stratum weights on aerial survey estimates of escapements into the sound; the aerial survey program is an independent sampling program and the weights w_{zg} generated from the program are independent of the $\hat{p}_{zg}$. If the aerial survey estimate for zone z in the g^{th} stratum is denoted by A_{zg}, and the aerial survey estimate of the total escapement to zone z in the sound is A_{zG}, the w_{zg} are given by A_{zg}/A_{zG}. The method of Goodman (1960) is then invoked, which yields the exact variance estimate of the product of the (independent) variables. An unbiased estimate of the variance of this product is $\hat{V}(w_{zg}\hat{p}_{zg}) = w_{zg}^2\hat{V}(\hat{p}_{zg}) + \hat{p}_{zg}^2\hat{V}(w_{zg}) - \hat{V}(\hat{p}_{zg})\hat{V}(w_{zg})$. To estimate $\hat{V}(w_{zg}) = \hat{V}(A_{zg}/A_{zG})$, the multivariate delta method is used along with an estimate of the covariance between A_{zg} and A_{zG}. The estimated Cov(A_{zg},A_{zG}) is derived as $\hat{V}(A_{zg})$. Aerial survey methodology provides $\hat{V}(A_{zg})$. Option (i) necessitates that surveys be made of streams selected from the strata not-routinely examined by the escapement-monitoring program.

While the problem of correlation between the $\hat{p}_{zg}$ and the w_{zg} has been solved, derivation of $\hat{V}(\hat{p}_z) = \hat{V}(\sum_{g=1}^{G} w_{zg}\hat{p}_{zg})$ still requires knowledge of the covariance among the w_{zg} $\hat{p}_{zg}$ over g. This is derived using the multivariate delta method. Hence we have:

$$\hat{V}(\hat{p}_z) = \sum_{g=1}^{G}\hat{V}(w_{zg}\hat{p}_{zg}) + 2\sum_{i=1}^{G}\sum_{j>i}^{G} C\hat{o}v(\hat{p}_{zi}w_{zi}, \hat{p}_{zj}w_{zj} \qquad (5)$$

(ii) Estimate $\hat{V}(\hat{p}_z)$ using the bootstrap method (Effron and Tibshirani, 1993). Modifications of Sitter (1992) and Rao and Wu (1988) to the simple bootstrap will be considered. The simple bootstrap method proceeds as follows (bootstrap quantities are denoted by '*'):

a) Resample streams with replacement.
b) From each resampled stream, resample otoliths with replacement.
c) Calculate w_{zg}^* and $\hat{p}_{zg}^*$ from resampled streams and otoliths.
d) Calculate $\hat{p}_z^* = \sum_{g=1}^{G} w_{zg}^*\hat{p}_{zg}^*$
e) Repeat a) through d) B times and calculate $\hat{V}(\hat{p}_z) = \dfrac{\sum_{i=1}^{B}(\hat{p}_{zi}^* - \bar{p}_z^*)^2}{B-1}$

Method (i) provides a closed form expression for the estimate, but depends on the delta-method approximation, knowledge of variances of aerial survey estimates, and additional aerial surveys. Method (ii) does not yield a closed form solution, but relies on fewer assumptions and given contemporary computing power is easily invoked.

An estimate of the proportion of hatchery-released pink salmon in stream escapements sound-wide is given by :

$$\hat{p} = \sum_{g=1}^{G}\sum_{z=1}^{Z} \frac{\frac{N_g}{n_g}\sum_{i=1}^{n_g} M_{zgi}}{\sum_{g=1}^{G}\sum_{z=1}^{Z} \frac{N_g}{n_g}\sum_{i=1}^{n_g} M_{zgi}} \hat{p}_{zg} \qquad (6)$$

A variance approximation will be provided by the bootstrap method.

To compare hatchery proportions between upstream and tidal zones within a stratum, the following model will be used:

$$p_{ij} = \mu + \beta_i + \tau_j + \beta\tau_{ij} \qquad (7)$$

where p_{ij} is the measured proportion of hatchery fish in the sample of otoliths taken from the i^{th} stream in the j^{th} stream zone, μ is the overall mean, β_i is a random effect of the i^{th} stream, τ_j is the fixed effect of the j^{th} stream zone, and $\beta\tau_{ij}$ is a random effect associated with the i^{th} stream and j^{th} stream zone. The model described in Equation 7 is commonly used in the analysis of experiments designed in randomized complete blocks. The effect of stream zone on the proportion of hatchery fish (1 df) will be tested using the $\beta\tau$ error mean-square. Since the analysis is based on proportions, appropriate attention will be paid to the nature of residual patterns, and the need for data transformations or weighting. If warranted, comparisons will also be made within strata.

Logistics

Field-sampling crews, each consisting of two people, will be stationed throughout Prince William Sound from 15 August through 15 September 2000. Crews will reside onboard an Alaska Department of Fish and Game vessel patrolling the Southwestern District; one crew will be stationed in Cordova, and a U.S. Forest Service crew will be stationed on another vessel located in the Northern District of the sound. In some instances, transportation to sampling locations will be by chartered aircraft using three, two-man crews to sample 10 to 12 widely scattered streams in an area. Collected otolith samples will be labeled and stored for later processing in Cordova. Otoliths will be processed in the Cordova Fish and Game Office Laboratory with confirmation second readings being performed at the Statewide Coded Wire Tag and Otolith Laboratory in Juneau.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Alaska Department of Fish and Game and the U.S. Forest Service will complete all work on this project. Thermal marks have been applied to pink salmon otoliths by the Prince William Sound Aquaculture Corporation and the Valdez Fisheries Development Association. Otoliths will be extracted in the field by Alaska Department of Fish and Game and U.S. Forest Service field crews, and then prepared and read at either the Alaska Department of Fish and Game Area Office Laboratory in Cordova or the Statewide Otolith Laboratory in Juneau.

SCHEDULE

A. Measurable Project Tasks for FY 00 (October 1,1999 - September 30, 2000)

May 1 - August 15, 2000	Project preparation.
August 15 - September 15, 2000	Field data collection.
September 15 - September 30, 2000	Otolith reading.
October 1, 1999 – April 15, 2001	Otolith reading, analyze data, write reports.

B. Project Milestones and Endpoints

FY00 Objectives:

Estimation of hatchery proportion in stream escapements for even-year class by stream zone within and over geographic strata, by geographic strata over stream zone, over geographic strata and stream zone and by prior EVOSTC-sampled streams (embryo mortality, genetic mapping and escapement monitoring studies) : Dec. 2000.

FY01 Objectives:

Estimation of hatchery proportion in stream escapements for even-year class by stream zone within and over geographic strata, by geographic strata over stream zone, over geographic strata and stream zone and by prior EVOSTC-sampled streams (embryo mortality, genetic mapping and escapement monitoring studies) : Dec. 2001.

FY02 Objectives:

Complete final report and write articles as warranted: September 30, 2002.

C. Completion Date

September 30, 2002.

PUBLICATIONS AND REPORTS

All work will be documented as a final report to the EVOS Trustee Council in 2002. Technical papers will be submitted to professional journals for publication as project findings dictate.

PROFESSIONAL CONFERENCES

Project results may be presented as either posters or oral reports at professional meetings (e.g. American Fisheries Society, Pink and Chum Salmon Workshop, EVOS Restoration Workshops).

NORMAL AGENCY MANAGEMENT

Although the Alaska Department of Fish and Game has been conducting pink salmon stock identification studies in PWS since 1987, the study proposed herein involves a special and specific problem not addressed through normal agency management. The determination of straying in streams studied in EVOSTC-funded projects is not 'Normal Agency Management'.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The project will be conducted jointly by the Alaska Department of Fish and Game, the U.S. Forest Service, the Prince William Sound Aquaculture Corporation, and the Valdez Fisheries Development Association. Edited data will be provided to the Information Modeling portion of SEA for incorporation into a centralized ecosystem database.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Not applicable.

PROPOSED PRINCIPAL INVESTIGATOR

Name	Timothy L. Joyce, Fishery Biologist III
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	Commercial Fisheries Management and Development Division
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Phone	(907) 424-3212
FAX	(907) 424-3235
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Employment:
Mr. Joyce was appointed as a Fisheries Biologist III with the Alaska Department of Fish and Game in Cordova in July of 1995. Prior to this appointment he worked for the State of Alaska as a hatchery manager for over 17 years at Kitoi Bay, the location of the largest multi-species salmon production facility administered by the state. From 1982 through 1987, Mr. Joyce conducted some of the initial half-length coded wire tagging work on emergent pink salmon fry, and co-authored an article titled 'Retention Rates of Half-Length Coded Wire Tags Implanted in Emergent Pink Salmon', published in the American Fisheries Society Symposium 7:253-258. Prior to his position at Kitoi Bay, Mr. Joyce worked in Sand Point, Alaska as a high school teacher, teaching aquaculture, fish culture and biology, and was responsible for a small demonstration hatchery run by the school district with Johnson O'Malley funds. Mr. Joyce also has extensive experience in warm water fish culture, gained while working as a Peace Corps volunteer for a United Nations development project in Africa administered by the Food and Agriculture Organization.

Other Experience:

Commercial herring spotter pilot, 1985 -1994
Research aid, Oak Creek Laboratory, Corvallis, OR. 11/71 - 6/73
Construction, 1964 - 1971

Education:

1973 - Bachelor of Science , Fisheries Science, Oregon State University.

OTHER KEY PERSONNEL

David G. Evans, Biometrician I

Affiliation	Alaska Department of Fish and Game
Mailing address	Commercial Fisheries Management and Development Division 333 Raspberry Rd. Anchorage, Alaska 99518
Phone	(907) 267-2123
FAX	(907) 267-2442
E-mail	Davide@FISHGAME.STATE.AK.US

Employment:
October, 1991 - present: Biometrician I with the Alaska Department of Fish and Game. Primary responsibilities: 1) Sample design and statistical procedures, 2) Oversight of the post season data analyses, 3) Co-author of interim and final reports, and professional papers.

Education:

1991 Master of Science, Statistics, Oregon State University
1988 Doctor of Philosophy, Soil Science, University of Guelph (Ontario, Canada)
1984 Master of Science, Soil Science, University of Guelph (Ontario, Canada)
1981 Bachelor of Science, Soil Science, University of Nottingham (U.K.)

Renate Riffe, Fishery Biologist II

Affiliation	Alaska Department of Fish and Game
Mailing address	P.O. Box 669, Cordova, Alaska 99574
Phone	(907) 424-3212
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Employment:
Since October 1994, Ms. Riffe worked as Assistant Project Leader on the coded wire tag and otolith projects. From June 1991 - October 1994, she was a biologist with the Alaska Department of Fish and Game, Sport Fish Division in Fairbanks, Alaska, and assisted in projects concerning abundance estimation and population evaluation of pike, grayling, humpback whitefish, least cisco, rainbow trout, burbot, chum salmon, and king salmon. From May 1982 - January 1991, she worked as a technician with the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division in Juneau, Alaska. Her primary duties

involved sampling commercial salmon fisheries and salmon escapements. She also developed scale pattern discriminant functions used in stock separation of Lynn Canal sockeye salmon and developed a computer model which simulated migratory timing of salmon escapements and evaluated truncated escapement counts. She has authored reports for the Alaska Department of Fish and Game on estimation of abundance and survival rates of round whitefish, has compiled data on the age and length data for rainbow trout in southwest Alaska, and on migratory timing of salmon in the Situk River, Alaska.

Education:
1994 Master of Science , Statistics, Colorado State University.
1987 Master of Science, Fisheries Management, University of Alaska, Fairbanks.
1981 Bachelor of Science, Fish Biology, Colorado State University.

Felipe Carrillo - Fisheries Biologist I

Employment:
Since May of 1997, Mr. Carrillo has worked as the laboratory supervisor and chief otolith reader at the Cordova Fish and Game Otolith Laboratory. He will continue to act in the same capacity in 1999 and 2000. In 1996, Mr. Carrillo worked on the coded wire tag project in Cordova as a technician, and scanned adult pink salmon for tags. He has had several years' experience as a crewman on purse seine vessels in Prince William Sound and at local processors. Mr. Carrillo was an observer for the Inter-American Tropical Tuna commission for two years.

Education:
1986: Bachelor of Science, Fish Biology, University of Sinaloa, Mazatlan, Mexico.

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2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$129.6
Travel		$1.3
Contractual		$51.0
Commodities		$11.0
Equipment		$0.0
Subtotal	$0.0	$192.9
General Administration		$23.0
Project Total	$0.0	$215.9
Full-time Equivalents (FTE)		2.5

LONG RANGE FUNDING REQUIREMENTS

		Estimated FY 2001	Estimated FY 2002		
		$215.9	$62.0		

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments:

This DPD expense sheet is for an area-wide survey to accertain the amount of hatchery straying within PWS. It also includes a significant stand-alone component to examine straying in up-stream/down-stream areas of the oiled and unoiled stream systems observed in previous EVOS studies.

FY00

Prepared:

Project Number: 00487

Project Title:Determining the Extent and Magnitude of Straying of Hatchery-Released Pink Salmon Onchorynchus gorbuscha in Prince William Sound

Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Renate Riffe	Fishery Biologist II	16F	5.0	5.6		28.0
David Evans	Biometricain I	17J	3.0	6.1		18.3
Felipe Carrillo	Fishery Biologist I	14C	3.0	4.5	1.0	14.5
Cordova Technicians	F&W Technician II	9A	19.0	3.2	8.0	68.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		30.0	19.4	9.0	
					Personnel Total	$129.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Attend EVOS Workshop	0.2	1	3	0.1	0.5
Biometric consultations	0.2	2	4	0.1	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.3

FY00

Prepared:

Project Number: 00487
Project Title: Determining the Extent and Magnitude of Straying of Hatchery-Released Pink Salmon Onchorynchus gorbuscha in Prince William Sound Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Air charter stream sampling	9.0
Vessel charter:Two vessels for 21 days at $1000 per day	42.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$51.0

Commodities Costs:	Proposed
Description	FY 2000
Otolith lab consumables (slides, slide boxes, glue, polishing cloth, etc)	10.0
Boat gas	1.0
Commodities Total	$11.0

FY00

Prepared:

Project Number: 00487
Project Title: Determining the Extent and Magnitude of Straying of Hatchery-Released Pink Salmon Onchorynchus gorbuscha in Prince William Sound
Agency: ADF&G

FORM 3B
Contractual & Commodities DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			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
Boiler modules (2 PWSAC, 1 VFDA, 1 ADF&G	4	Various
MZ6 Dissecting Microscope	2	ADF&G
DMLS Binocular Microscope	2	ADF&G
Labapol-5 grinders	2	ADF&G
Bar Code Scanner	1	ADF&G

FY00

Project Number: 00487
Project Title: Determining the Extent and Magnitude of Straying of Hatchery-Released Pink Salmon Onchorynchus gorbuscha in Prince William Sound
Agency: ADF&G

FORM 3B
Equipment
DETAIL

Prepared:

PROTOCOLS FOR LONG-TERM MONITORING OF SEABIRD ECOLOGY IN THE GULF OF ALASKA

Project Number:	00501
Restoration Category:	Research, Monitoring
Proposed By:	U.S. Geological Survey
Lead Trustee Agency:	DOI-BRD
Cooperating Agencies:	DOI-FWS
Alaska SeaLife Center	No
Duration:	1st year, 2-year project
Cost FY 00:	$69,400
Cost FY 01	$22,000
Cost FY 02	$0
Geographic Area:	Cook Inlet, Gulf of Alaska
Injured Resource:	Multiple resources

ABSTRACT

Some seabird populations damaged by the *Exxon Valdez* oil spill have not recovered, and populations will need to be monitored for many years to assess both recovery and ecological conditions affecting recovery. Detailed studies of individual seabird colonies and marine ecosystems in the Gulf of Alaska (GOA) have been conducted by the USGS and USFWS under the auspices of damage assessment and restoration programs of the EVOSTC. Much has been learned about factors influencing seabird populations and their capacity to recover from the spill in the GOA. As we move towards long-term monitoring of populations, however, we need to develop protocols and long-term monitoring strategies that focus on key parameters of interest and that are inexpensive, practical and applicable over a large geographic area.

INTRODUCTION

Some seabird populations in the Gulf of Alaska have undergone marked fluctuations during the past few decades, some of which were due to effects of the *Exxon Valdez* oil spill (Byrd et al. 1998, Piatt and Anderson 1996). Results of investigations conducted with funding of the EVOSTC during the period 1989-1999 have included damage assessment studies of populations (e.g., Nyeswander et al. 1993) and restoration studies to evaluate the ecological conditions affecting seabird recovery. The latter studies have focused on how food availability, environmental conditions, and biological constraints on seabirds at colonies affect overall population dynamics (e.g., Piatt et al. 1998, 1999; Zador and Piatt 1999, Robards et al. 1999, Roseneau et al. 1999).

In Cook Inlet, these detailed studies included many research components that required considerable funding and logistic effort. At sea, we have measured forage fish distribution and abundance (with acoustic, trawl and seine surveys) in relation to oceanography (assessed with AVHRR imagery, CTD profiles, and moored thermographs). At colonies, we have measured a range of seabird parameters including adult and chick diets, chick feeding rates, chick growth rates, adult time-budgets (foraging time, nest attendance), breeding phenology, breeding success (laying, hatching, fledging), and population size (plot and whole-colony censuses). In FY1999, the total budget for these studies was 959 K, of which 68% was provided by the EVOSTC and the remainder was provided by the USGS and USFWS. These figures do not include costs of in-kind agency support (vessels, equipment, facilities, etc.).

As the EVOSTC moves from restoration research programs to monitoring programs, a stated goal is to support long-term monitoring of marine ecosystems and species impacted by the spill in Prince William Sound and the Gulf of Alaska. The objectives and scope of a long-term monitoring program are still being evaluated (R. Spies, 1998 EVOSTC Annual Restoration Meeting), but it appears that the level of effort currently under way in the Gulf of Alaska would have to be scaled back under the projected EVOSTC monitoring budget. With the knowledge obtained during the past five years in Cook Inlet, we can develop a monitoring strategy that includes measurement of key parameters that provide statistically rigorous data on seabird population trends, productivity, etc., and on ecological factors influencing seabirds. We would like to design a program that is cost-effective and logistically practical, allowing the EVOSTC to expand seabird monitoring from Cook Inlet to other areas in the Gulf of Alaska for an extended period of time.

NEED FOR THE PROJECT

A. Statement of the Problem

For long-term "monitoring" of seabird populations, the level of detailed observations made at any given colony necessarily depends on the objectives of the monitoring program, and the effort

(person-days) that can be practically expended given logistic and funding constraints. Over the years, for example, a variety of methods have been devised to monitor seabird population trends and productivity (e.g., Nettleship 1976, Birkhead and Nettleship 1980, Piatt et al. 1988, 1990; Byrd 1989) and in almost all cases, a balance has been struck between the need for detailed information and time or logistic constraints. In some cases, options may be recommended for obtaining data at differing levels of resolution while retaining acceptable statistical power (e.g., Gaston et al. 1983, Hatch and Hatch 1989).

For a few of the parameters that were measured during the course of EVOSTC-funded seabird and forage fish studies (Table 1), standard protocols and analyses had already been developed for research and monitoring, and some of these methods were employed in Cook Inlet studies. For example, populations of Common Murres and Black-legged Kittiwakes can be monitored annually by counting index plots at least 5 times during the incubation and early chick-rearing period, and this provides enough statistical power to detect changes of 18-20% in populations between years (Hatch and Hatch 1988, 1989). Counting plots 10 times would allow detection of 12-14% changes in populations between years. At the three colonies in Cook Inlet (Barren, Chisik and Gull islands), 6-10 counts of plots were conducted in each year of EVOSTC-funded study (1995-1999), and future monitoring efforts would continue to use this protocol.

However, for most of the parameters measured in lower Cook Inlet under EVOSTC-funded studies (Table 1), standardized monitoring methods have not been established. Furthermore, we do not yet have a clear idea of how much statistical power we might retain under reduced sampling protocols. For example, if the EVOSTC would like to support a monitoring effort that continues to measure oceanographic parameters, plankton and fish abundance, then we need to identify which parameters are most useful to measure and what sample sizes are adequate to measure significant changes among years. We also need to consider options for sampling that can be supported by different levels of funding.

Similarly, if seabirds are to be monitored at colonies, which parameters would be most useful to measure and how would they be measured? In general, the Alaska Maritime National Wildlife Refuge (AMNWR) and other seabird researchers in Alaska have fairly well-defined protocols for measuring seabird breeding and population parameters (Table 1), but these are based on 3-4 month-long field seasons (e.g., Byrd 1989). While these two parameters would almost certainly be measured in any long-term monitoring strategy we develop for the EVOSTC, methods could be further refined to reduce costs and effort per colony, or allow for larger geographic coverage of colonies in the Gulf of Alaska. For example, a comprehensive measurement of breeding phenology calls for detailed (every 2-4 days) assessments of nest status (egg, hatch, chick, fledge) throughout the breeding season. Alternatively, one might be able to measure a sample of chicks from a one-time session during chick-rearing, and extrapolate backwards from measurements of body size to estimate mean laying and hatching dates. Similarly, a one-time census during chick-rearing could provide a precise index of kittiwake breeding success that— although less accurate than measures obtained through repeated status-checks of nests— would nonetheless yield adequate data for monitoring long-term trends in productivity (although it

would be less useful for assessing components of productivity). While we have collected data that would allow us to evaluate the reliability of "short-cut" methods for monitoring, we have yet to evaluate their practicality from the point of view of logistics or statistical power. Furthermore, we need to evaluate what is gained or lost by employing "short-cut" rather than comprehensive methods.

Therefore we propose a three-part study. First, we would conduct a 'desk-top exercise' to examine existing parameter datasets for statistical power and utility, and develop a series of protocols designed to meet differing funding and logistic scenarios. We would identify a 'minimum protocol' that includes measurement of the most valuable parameters for selected species in the shortest possible amount of time (e.g., 1-2 weeks), an 'intermediate protocol' which would identify which parameters could be successfully measured (and with what level of detail for which species) in some intermediate amount of time (e.g., 4-6 weeks), and a 'maximum protocol' which would identify work that could be accomplished over a full season (e.g., 12-20 weeks) but with reduced funding and personnel than currently supported under EVOSTC restoration studies. An important part of this process will be to identify what is gained or lost by choosing to use one method over another. Second, we would go into the field in FY00 and FY01 and apply the 'minimum' protocol at a selected colony to test it for logistic practicality and scientific value (i.e., quality control). Third, based on that experience, we would re-evaluate and re-design our protocols, and compile final monitoring protocols for all aspects of the project. Following this, we will develop and recommend a long-term monitoring strategy for the EVOSTC to consider for their future monitoring program. We envision applying different protocols to different colonies throughout the Gulf of Alaska depending on overall funding levels and logistic constraints inherent to individual colonies.

B. Rationale

Methodologies for measuring aspects of seabird ecology are constantly evolving as we gain insight into the meaning and utility of routinely collected data, and use new tools and technologies to simplify measures of routine parameters or to measure new parameters. For example, we can now measure sea surface temperatures and surface chlorophyll concentrations over the entire Gulf of Alaska on a daily basis through remote satellite sensors. We can measure temperature, salinity, chlorophyll concentration and turbidity of the entire water column in minutes with a CTD profiler. Seabird attendance, chick feeding rates and foraging trips can be monitored remotely with time lapse videography or real-time video relays. Food limitation and stress in seabirds can be evaluated by taking relatively simple measures of blood hormone levels.

Research conducted during the past five years under auspices of the EVOSTC in Cook Inlet has greatly expanded our knowledge of relationships between seabirds and their local environments. If the EVOSTC wants to continue to monitor seabird recovery in the Gulf of Alaska, then we need to distill what we have learned from our extensive studies and develop a streamlined monitoring program that is cost-effective while retaining the ability to compare results with those collected previously under APEX.

C. Location

The proposed work will be undertaken in offices of the USGS in Anchorage and the AMNWR in Homer, and field work will be conducted in lower Cook Inlet. The project's benefits will be realized throughout the EVOS area, in the form of enhanced understanding of seabird ecology, population trends and recovery.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Gull Island in Kachemak Bay is owned by the Seldovia Native Association (SNA). Limited subsistence use occurs during summer, with occasional egging and harvesting of juvenile birds. It is also a major tourist attraction for visitors to Homer. Permission to work on and around the island has been obtained under the provision that annual reports of findings be made available to the SNA. In the past we have performed several outreach activities to inform local citizens of our research, including: 1) distribution of flyers and posters describing our work to the SNA, tour boat operators, the AMNWR Visitor's Center, and the Pratt Museum, 2) presentations at public meetings, and 3) cooperation with the Pratt Museum in their video monitoring of seabirds on Gull and the Barren islands. Chisik and the Barren islands are managed by the AMNWR and we employ charter vessels from Homer to support field work there. Chisik Island supports a small, seasonal fishing community and we keep summer residents informed about the nature and purpose of our activities. Whenever possible, equipment and other resources will be acquired locally in the Homer area. Traditional and local ecological knowledge will be sought from fishermen and other residents, particularly on the topic of seabird and forage fish population trends.

PROJECT DESIGN

A. Objectives

1. Using data collected in Cook Inlet during EVOSTC-funded restoration projects, assess the statistical power and utility of measuring biological parameters (Table 1) under different monitoring scenarios.

2. Based on (1) and in consultation with other investigators, develop and compile written protocols for long-term monitoring of seabirds under different scenarios (minimum, medium, and maximum effort).

3. Based on (2) above, and other experience, develop a long-term monitoring strategy for seabirds in the Gulf of Alaska.

4. Quality control: Test the logistic practicality and likelihood of success for minimum monitoring scenarios in the field, and use these results to help develop and refine final long-term monitoring protocols for future application in the Gulf of Alaska.

B. Methods

Objective 1: First we will have a meeting to discuss and identify parameters that would be most useful for long-term monitoring of seabirds and ecological factors influencing their populations. Questions to be resolved for each parameter include (but are not limited to): 1) would it provide useful, meaningful information for long-term monitoring? 2) how frequently *can* samples be taken in a best case scenario, given appropriate logistic support? 3) how frequently *have* samples been taken in previous work? 4) what would be appropriate methods for evaluating the statistical power of different sampling scenarios?. In addition, we would need to define some working models for sampling scenarios. After considering logistic constraints, seabird breeding schedules, and species of concern, we will need to develop a consensus on what kind of field effort might reasonably be undertaken in 'minimum', 'medium' and 'maximum' scenarios— i.e., how long would a colony be visited (e.g., 1-2, 4-6, 10-16 week windows), how many people would be deployed, what kind of logistic support might be required (boats, planes, camps, etc.).

Following these discussions, data sets for the various parameters under consideration will be evaluated in several ways. First, we will consider whether each parameter *can* be measured under each scenario. For example, measurement of breeding parameters such as laying, hatching, *and* fledging success clearly cannot be accomplished in a 1-2 week visit. In contrast, one could measure fish abundance with beach seines at many temporal scales. Second, we will conduct a power analysis on appropriate parameters (using our historical data) to determine what level of sampling effort would be required to produce statistically useful results. For example, what level of beach seine sampling would be required to detect a 20% difference between years in forage fish CPUE? Similarly, how many days (and/or nests) must be monitored to detect inter-annual differences of 20% in chick-feeding frequency? This kind of analysis will provide a useful guide for determining which parameters *could* be usefully measured under different scenarios. Finally, some parameters might turn out to be of low value for statistical inference, but useful for ecological characterization. For example, low levels of trawl (or diet collection) effort might preclude detection of trends in fish abundance (or meal size), but may allow us to characterize prey (or diet) composition and/or detect significant changes in composition over time.

Objective 2. Following the completion of other objectives, we will solicit input from other investigators (e.g., from APEX projects in Prince William Sound) and compile the results of our work into a monitoring protocol manual. This document will outline which parameters can be measured under different operational scenarios and indicate what levels of statistical certainty may be expected under given sampling regimes. We will also identify what is gained or lost by choosing to conduct one scenario versus the others.

Objective 3. Based in part on results of objective (2), but also on other experience and knowledge about seabird colonies and logistics in the Gulf of Alaska, we will develop recommendations for a comprehensive monitoring strategy for seabirds in the Gulf of Alaska for use by the EVOSTC in planning a long-term monitoring program.

Objective 4. Quality Control: Based on our experiences with restoration projects to date, we have a clear idea of what can be accomplished during a full field season (with 3-4 persons) at colonies in lower Cook Inlet (Gull, Chisik, and Barren islands). Logistic and scientific protocols have already been established which, in general, should be easily streamlined for a 'maximum effort' monitoring scenario with few surprises. However, the same may not be true for 'minimum' protocol scenarios we develop. While we may develop 'minimum' protocols that seem reasonable on paper from the 'desktop' exercises outlined above, we are not so confident that these will translate seamlessly to field applications. Logistic problems that may be relatively easy to accommodate during extended field seasons (e.g., adverse weather/seas, equipment failure, travel delays, variable charter boat or plane schedules) may be more critical to success or failure of a 1-2 week study. Similarly, shifts in breeding phenology of birds could markedly influence our ability to measure some parameters (e.g., chick feeding rate or growth rate); or other biological factors (e.g., reduced attendance or nest abandonment) could reduce expected sampling rates for some parameters.

Therefore we propose to conduct field trials of 'minimum' protocols at one colony (Chisik Island) during FY00 and FY01 to help adjust our expectations of what can reasonably be accomplished in short periods of time. This 'quality control' exercise will ensure that our final recommendations for monitoring protocols are, in fact, both feasible and likely to provide quality scientific data. Two field seasons will provide an opportunity to test preliminary protocols developed for FY00, and revise methods of data collection or develop alternative methods for testing in FY01. For example, if we find that all-day behavioral watches currently in use for measuring attendance, feeding rates and foraging trip durations are too time-consuming or too dependant on weather, we could go back to our historical data and ask whether a sub-sampling protocol (e.g., watches during morning hours only) would be adequate to provide precise measures of these parameters. In any case, the methods employed in quality control field tests will depend on which protocols we adopt for the minimum effort scenario, and will be derived largely from existing methods already in use by EVOSTC-funded projects in Cook Inlet and Prince William Sound. Beyond this, field crews will be directed to avoid deviation from the designed protocols (methods, time, sampling effort) and provide suggestions for changes or improvements after work is completed. These recommendations will be incorporated in the final design of protocols and monitoring strategies.

Cooperating Agencies, Contracts, and Other Agency Assistance

USGS and FWS are cooperating on this project as an extension of their collaboration on EVOSTC (APEX) studies in lower Cook Inlet. Both agencies have collected data on different

colonies, and we will both benefit from planning and coordinating future monitoring methods. Personal Services contracts will be used for statistical consultation.

SCHEDULE

Measurable Project Tasks for FY 00

December 1:	Initial planning meeting and review of data needs
January 14-16:	Attend Annual Restoration Workshop
January-March:	Power analyses, data and protocol evaluation
March 1:	Coordination meeting
April 30:	Draft monitoring protocols completed, distributed for review
July:	Prepare for field work (2 weeks)
July-August:	Quality control field study (ca. 2 weeks)
August:	Revisions to monitoring protocols based on reviews and field study
September 30:	Revised draft of monitoring protocol

Project Milestones and Endpoints

By September 30, 2000, we will have a draft manual of monitoring protocols. During the winter of FY01, we will work on development of a monitoring strategy for the Gulf of Alaska (a separate objective from protocols). In summer of FY01 we will conduct another brief field study (July-August) using protocols that have been modified based on experiences in FY00. Following that, we would make final modifications to the monitoring protocol manual and the monitoring plan for the Gulf of Alaska. A final report will be completed by September 30, 2001.

Completion Date

All project objectives will be met by September 30, 2001.

PUBLICATIONS AND REPORTS

EVOSTC Annual Report FY00: "Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska"

EVOSTC Final Report FY01: "Protocols and strategies for long-term monitoring of seabird ecology in the Gulf of Alaska"

PROFESSIONAL CONFERENCES

Results of this project will be presented at the EVOSTC Annual Restoration Meeting in January, 2001.

NORMAL AGENCY MANAGEMENT

This research would not be conducted as a normal part of USGS or FWS research on seabirds.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed research issues are related to management and conservation of seabirds in Alaska as addressed by the U.S. Fish and Wildlife Service (USFWS) 'Seabird Management Plan' (USFWS Region 7, Migratory Bird Management). The proposed work will complement and be coordinated with: i) long-term studies conducted by the Alaska Maritime National Wildlife Refuge (AMNWR, USFWS Region 7), which includes annual monitoring of seabird productivity at 9 major seabird colonies throughout Alaska; ii) related studies (APEX) of seabird-forage fish interactions being supported by EVOSTC in Prince William Sound; and, iii) ongoing studies of seabird populations in areas of oil and gas development conducted by the Minerals Management Service (MMS) in Alaska and the Biological Resources Division of the USGS.

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PRINCIPAL INVESTIGATORS

Dr. John F. Piatt, Research Biologist (GS-14) with the Alaska Biological Sciences Center, Biological Resources Division, USGS in Anchorage. Since 1987, studied seabirds at colonies and at sea in Gulf of Alaska, Aleutians, Bering and Chukchi seas. Author on 75 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. Responsible for coordination of the project, analysis of historical data from Gull and Chisik islands, developing monitoring protocol and long-term monitoring plan, and field work on Chisik Island.

G. Vernon Byrd, Supervisory Wildlife Biologist (GS-13) with the Alaska Maritime National Wildlife Refuge, USFWS, in Homer. Over 25 years experience studying seabirds throughout Alaska, with focus on developing methodologies for monitoring populations and productivity. Currently coordinates long-term monitoring activities on nine permanent annual study sites in Gulf of Alaska, Aleutians, Bering and Chukchi seas. Responsible for coordination and oversight of developing the monitoring protocols and long-term monitoring plan.

Dave Roseneau, Wildlife Biologist (GS-11) with the Alaska Maritime National Wildlife Refuge, USFWS, in Homer. Over 25 years experience studying seabirds throughout Alaska, with focus on studying ecology of seabirds, analyzing population trends and developing methods for research and monitoring. Responsible for analysis of historical data from Barren Islands, and preparation of monitoring protocols and long-term monitoring plan.

OTHER KEY PERSONNEL

Arthur Kettle, Wildlife Biologist (GS-7), Alaska Maritime National Wildlife Refuge, USFWS. Analysis of Barren Islands data, protocol development, preparation of monitoring plan.

Thomas Van Pelt (GS-9), Alaska Biological Science Center, USGS. Analysis of Chisik Island data, protocol development, preparation of monitoring plan, field work.

Michael Shultz (GS-7), Alaska Biological Science Center, USGS. Analysis of Gull Island data, protocol development, preparation of monitoring plan, field work.

Dr. Alexander S. Kitaysky, Post-doctoral Fellow, University of Washington, Dept. of Zoology. Will assist with data analyses, protocol development and preparation of monitoring plan.

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Table 1. Some important parameters that were measured during EVOSTC-funded studies of seabirds and forage fish in Cook Inlet, 1995-1999.

Parameter	Method
Water properties	AVHRR imagery of sea-surface temperature
	CTD profiles of water column (temp, sal at depth)
	Moored thermographs (temp at depth)
1° and 2° production	SeaWifs imagery of surface chlorophyll (ng/ml)
	CTD Chlorophyll profiles with fluorometer (ng/ml)
	Vertical zooplankton tows (CPUE, mg/ml)
Fish abundance	Hydroacoustic surveys (mean backscatter/km2)
	Mid-water trawls (CPUE & % composition)
	Beach seines (CPUE & % composition)
	Bottom trawls (CPUE & % composition)
Seabird populations	Whole island census (total no./year)
	Index plot census (mean no./plot/year)
Seabird diet	Adult diet (% composition, mass)
	Chick meal (% composition, mass)
Seabird Breeding	Laying success (eggs/nest)
	Clutch size (eggs/pair)
	Hatching success (chicks/egg)
	Fledging success (fledglings/chick)
	Breeding success (fledglings/nest; from above work)
	Breeding success index (chicks/nest from 1 visit)
	Phenology (mean dates)
Seabird Behavior	Chick feeding rate (kJ/d)
	Foraging trip duration (min/day)
	Attendance (loafing) time (min/day)
Seabird Physiology	Adult body mass/condition (g/body size)
	Corticosteroid (stress) hormone levels (ng/ml of blood)
	Chick growth rate (g/day)
	Chick fledging mass/condition (g/body size)
Seabird survival	Annual return of banded adult birds (% per annum)

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$51.3
Travel		$4.9
Contractual		$2.0
Commodities		$1.2
Equipment		$2.2
Subtotal	$0.0	$61.6
General Administration		$7.8
Project Total	$0.0	$69.4
Full-time Equivalents (FTE)		1.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$22.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:
New Project. Funding would be disbursed separately to USGS and FWS for their components of the work.
Funds in FY01 would be for quality control field study (18K) and completion of final report (4K).

FY00

Prepared: 4/12/99

Project Number: ~~New~~ 00501
Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska
Agency: USGS, USFWS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Drew	USGS Wildlife Biologist	GS-12/2	1.0	5.6		5.6
Abookire	USGS Wildlife Biologist	GS-9/2	2.0	3.9		7.8
Van Pelt	USGS Wildlife Biologist	GS-9/2	3.0	3.9	0.6	12.3
Shultz	USGS Wildlife Biologist	GS-7/2	3.0	3.0	0.5	9.5
Piatt	USGS Wildlife Biologist	GS-14/1	1.0	0.0		0.0
						0.0
Kettle	FWS Wildlife Biologist	GS-7/2	2.0	3.3		6.6
Roseneau	FWS Wildlife Biologist	GS-11/5	1.0	5.1		5.1
Biotech	FWS Biological Technician	GS-5/1	2.0	2.2		4.4
Byrd	FWS Supervisory Biologist	GS-13/2	1.0	0.0		0.0
						0.0
						0.0
	Subtotal		16.0	27.0	1.1	
					Personnel Total	$51.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Coordination meetings in Anchorage (3 x Homer-Anc)	0.2	6	12	0.1	2.4
Field work (Anc-Homer 2x)	0.2	2	21	0.1	2.5
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$4.9

FY00

Prepared:

Project Number: New
Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska
Agency: USGS, USFWS

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU E COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Contract statistician (L. MacDonald)	2.0
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.0

Commodities Costs:	Proposed
Description	FY 2000
Field Work at Chisik (ca. 12 days)	
Food	0.4
Fuel	0.3
Misc. supplies	0.5
Commodities Total	$1.2

FY00

Prepared:

Project Number: New
Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska
Agency: USGS, USFWS

FORM 3B
Contractual & Commodities DETAIL

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2000
Misc. field equipment			1.0
Software for power analyses (e.g., "Power and Precision, nQuery Advisor) 2 copies			1.2
			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**	$2.2

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency
Boston Whaler	1	USFWS
Zodiac	1	USGS
Camp equipment	1	USGS
Telescope, Binocular	1	USGS
Video monitoring camera	2	USGS
Centrifuge	1	USGS
Generator	1	USGS
Climbing gear	1	USGS
Misc. scientific	1	USGS

FY00

Prepared:

Project Number: New
Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska
Agency: USGS, USFWS

FORM 3B
Equipment
DETAIL

00503

Native Village of Eyak

P.O. Box 1388
Cordova, AK 99574
907-424-7738 Fax 907-424-7739

April 15, 1999

Molly McCammon, Executive Director
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, AK 99501-3451

Dear Molly:

Enclosed is a restoration proposal to restore Orca Inlet. This project will restore Orca Inlet to the way it was when many of us were children. Much of our subsistence used to come from Orca Inlet. If we can restore the damage done to the inlet over the years, then we again will be able to use it for a large part of our subsistence needs.

As a Tribal Council, we are requesting technical assistance from EVOS for this proposal.

Sincerely yours

Bob Henrichs
President
Native Village of Eyak
Traditional Council

Orca Inlet Restoration Planning Project

Project Number:	00503
Restoration Category:	Enhance/Replace Subsistence Resources
Proposer:	Native Village of Eyak
Lead Trustee Agency:	Native Village of Eyak, a Federally Recognized Tribal Government
Cooperating Agencies:	DOI, ADFG, NMFS, EPA & CRRC
Duration:	1st year of a five year project.
Cost FY 00:	$215.6
Cost FY 01:	$226.3
Cost FY 02:	$237.7
Cost FY 03	$249.6
Cost FY 04:	$262.0
Geographic area:	Orca Inlet, Prince William Sound.
Injured Resource/Service:	Subsistence

Abstract:

Orca Inlet has become barren over the years. While it used to supply many of the subsistence resources to the residents of Eyak/Cordova, in recent years it has supplied very little. As a result of the processors dumping their fish waste and the Earthquake, the Inlet is dying. We need to come up with a plan to restore Orca Inlet to what is was when we were children.

Native Village of Eyak
Exxon Valdez Oil Spill Trustees Council
Cordova Inlet Restoration Planning Project
Budget Summary

Budget Category	Authorized FY 99	Proposed FY 00				
Personnel		120,332				
Travel		6,018				
Contractual		20,375				
Commodities		9,552	**Long Range Funding Requirements**			
Equipment		11,973				
Other		4,212				
Subtotal		172,462	Estimated	Estimated	Estimated	Estimated
Indirect		43,116	FY 2001	FY 2002	FY 2003	FY 2004
Budget Total	0	215,578	226,358	237,875	249,560	262,038
Full-Time Equivalent (FTE)		3.0	4.00	4.00	4.00	4.00

Native Village of Eyak
Exxon Valdez Oil Spill Trustees Council
Cordova Inlet Restoration Planning Project
Budget Detail Narrative

Salaries:				Proposed FY 00	2001	2002	2003	2004
Project Lead Biologist	The project lead biologist will work to research past trends in the Inlet and develop and implement the restoration plan in the future							
	Project Biologist	1 FTE @	70,500	70,500 (1 FTE)	74,025 (1 FTE)	77,726 (1 FTE)	81,612 (1 FTE)	85,693 (1 FTE)
Fisheries Technicians	Two part time research technicians will be needed to assist with the project and implement the planning and restoration work. (3 months/year)							
	Research Technicians	1 FTE @	39,950	19,975 .5 FTE	20,974 .5 FTE	22,023 .5 FTE	23,124 .5 FTE	24,280 .5 FTE
Total Salaries				90,475	94,999	99,749	104,736	109,973

Fringe:				
FICA	6.20%			
Medicare	1.45%			
FUTA	0.60%			
Alaska ESC	3.50%			
Workman's Comp.	5.25%			
Medical, Dental Vision benefits	16.00%	Proposed FY 00	2001	2002	2003	2004
Budgeted Fringe:	33.00% of salary.	29,857	31,350	32,917	34,563	36,291
Budgeted Personnel		**120,332**	**126,349**	**132,666**	**139,299**	**146,264**

Travel:
Travel will be needed to gather to discuss the project and prepare the restoration plan and implement the work

	Proposed FY 00	2001	2002	2003	2004
Lead Biologist Travel to meetings, and professional conferences	3121				
Research Technician Travel to conduct project	2,043				
Council Travel and Public Involvement Hearings	3,975				
Budgeted Travel:	**6,018**	**6,319**	**6,635**	**6,967**	**7,315**

Contractual

	Hours	Cost/Hr.	Proposed FY 00	2001	2002	2003	2004
Scientific review and consultation on planning and project design	100	85	8,500	8,925	9,371	9,840	10,332
Vessel Charter	125	95	11,875	12,469	13,092	13,747	14,434
Budgeted Contractual:			**20,375**	**21,394**	**22,463**	**23,587**	**24,766**

Commodities:

Supplies will be needed to accomplish the project. Office supplies, filing supplies, and presentation media will be required to track data and project information, products and materials.

	Cost Per Month	Months Needed	Proposed FY 00	2001	2002	2003	2004
Office Supplies, filing, data and other.	125	12	1,500	1,575	1,654	1,737	1,824
Project Field Supplies	2,013	4	8,052	8,455	8,878	9,322	9,788
Budgeted Commodities:			**9,552**	**10,030**	**10,532**	**11,059**	**11,612**

Equipment:

			Proposed FY 00	2001	2002	2003	2004
Testing and monitoring recording devices, lab and measurement equipment			7,788	8,175	8,584	9,013	9,464
Computer Equipment			4,187	4,396	4,616	4,847	5,089
Budgeted Equipment:			**11,973**	**12,571**	**13,200**	**13,860**	**14,553**
Other:							
			Proposed FY 00	2001	2002	2003	2004
	Cost Per Month	Months Needed					
Phone, fax, copies, office and lab space	351	12	4,212	4,423	4,644	4,876	5,120
Budgeted Other:			**4,212**	**4,423**	**4,644**	**4,876**	**5,120**
Total Direct Costs:			**172,462**	**181,086**	**190,140**	**199,648**	**209,630**
Indirect:							
Indirect is computed at our negotiated rate of 25%.							
			Proposed FY 00	2001	2002	2003	2004
Budgeted Indirect Costs:			**43,116**	**45,272**	**47,535**	**49,912**	**52,408**
Total Costs			**215,578**	**226,358**	**237,675**	**249,560**	**262,038**

00507

Native Village of Eyak

P.O. Box 1388
Cordova, AK 99574
907-424-7738 Fax 907-424-7739

April 15, 1999

Molly McCammon, Executive Director
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, AK 99501-3451

Dear Molly:

Enclosed is a restoration proposal for a Youth/Elders Subsistence Camp at Nuchek. As a result of the Exxon Valdez Oil Spill, the harvest of subsistence food is changing in the Oil Spill region. This proposal would allow the youth and elders of the region to address these changes.

As a Tribal Council, we are requesting technical assistance from EVOS for this proposal.

Sincerely yours

Bob Henrichs
President
Native Village of Eyak
Traditional Council

Nuchek Subsistence Camp Proposal

Project Number:	00507
Restoration Category:	Enhance/Replace Subsistence Resources
Proposer:	Native Village of Eyak
Lead Trustee Agency:	Native Village of Eyak, a Federally Recognized Tribal Government
Cooperating Agencies:	DOI, ADFG, NMFS & CRRC
Duration:	One year.
Cost FY 00:	$83.7
Geographic area:	Nuchek, Hinchenbrook Island, Prince William Sound.
Injured Resource/Service:	Subsistence

Abstract:

As result of the Exxon Valdez Oil Spill the availability of subsistence foods has changed. The residents of the Oil Spill Region are spending more time gathering Traditional Subsistence foods. A Subsistence Camp at Nuchek would allow the Youth and Elders to address these changes. Many of the people in the Region trace their ancestry back to Nuchek. As Chugach Alaska Corporation has built a facility at Nuchek and holds annual Spirit Camps, this would be an appropriate location for this Subsistence Camp.

Native Village of Eyak
Exxon Valdez Oil Spill Trustees Council
Nuchek Subsistence Camp
Budget Summary

Budget Category	Authorized FY 99	Proposed FY 00
Personnel		18,949
Travel		13,275
Contractual		2,500
Commodities		18,682
Equipment		9,862
Other		3,700
Subtotal		66,968
Indirect		16,742
Budget Total	0	83,710
Full-Time Equivalent (FTE)		3.0

Native Village of Eyak
Exxon Valdez Oil Spill Trustees Council
Nuchek Subsistence Camp
Budget Detail Narrative

Salaries:				Proposed FY 00
Project Coordinator	The project Coordinator 3 Months to Plan the Camp			
	Project Coordinator	1 FTE @	37,650	9,413 .25 FTE
Field Camp Counselor	Two Field Camp Counselors will be needed for 1 Month			
	Field Camp Counselor	1 FTE @	28,950	4,835 .167 FTE
Total Salaries				14,247

Fringe:		
FICA	6.20%	
Medicare	1.45%	
FUTA	0.60%	
Alaska ESC	3.50%	
Workman's Comp.	5.25%	
Medical, Dental Vision benefits	16.00%	Proposed FY 00
Budgeted Fringe:	33.00% of salary.	4,702
Budgeted Personnel		**18,949**

Travel:
Travel will be needed to gather to plan the project and to get the participants to and from camp.

	Proposed FY 00
Planning Travel	762
Camp Set Up Travel and Charters	3,275
Participant Travel 50 Participants	10,000
Budgeted Travel:	**13,275**

Contractual

	Hours	Cost/Hr.	Proposed FY 00
Elder subsistence teachers Stipends and project design	100	25	2,500
Budgeted Contractual:			**2,500**

Commodities:

Supplies will be needed to accomplish the project. Office supplies, filing supplies, and presentation media will be required to track data and project information, products and materials.

	Cost Per Month	Months Needed	Proposed FY 00
Office Supplies, filing, data and other,	250	3	750
Camp Food and Activities Materials	17,932	1	17,932
Budgeted Commodities:			**18,682**

Equipment:

	Proposed FY 00
Subsistence Hunting and Fishing Equipment	9,862
Budgeted Equipment:	**9,862**

Other:

	Cost Per Month	Months Needed	Proposed FY 00
Phone, fax, copies and office space	400	3	1,200
Spirit Camp Rental to Chugach Alaska	2500	1	2,500
Budgeted Other:			**3,700**

Total Direct Costs:	**66,968**

Indirect:

Indirect is computed at our negotiated rate of 25%.

	Proposed FY 00
Budgeted Indirect Costs:	**16,742**
Total Costs	**83,710**

Copper River Salmon Run Data Infrastructure Project

Project Number:	00508
Restoration Category:	Enhance/Replace Subsistence Resources
Proposer:	Native Village of Eyak
Lead Trustee Agency:	Native Village of Eyak, a Federally Recognized Tribal Government
Cooperating Agencies:	DOI, ADFG, NMFS, CRRC
Alaska Sea-Life Center:	No
Duration:	1st year, 5 year project
Cost FY 00:	$ 525.3
Cost FY 01:	$ 2,336.1
Cost FY 02:	$ 893.1
Cost FY 03:	$ 937.8
Cost FY 04:	$ 984.7
Cost FY 05:	$ 1,033.9
Geographic Area:	Copper River Watershed
Injured Resource/Service:	Subsistence

Abstract:

Project will protect and enhance the Salmon Runs on the Copper River to replace the lost subsistence resources in Prince William Sound. The project will install modern automated run monitoring and data collection equipment on all significant Copper River tributaries and will develop a base line data index to existing data systems over a five year period (a test year with a 5 year full data set over a full run cycle). The Copper River fishery is at risk because of a shift in resource use patterns. Harvest of Salmon, on or near spawning tributaries is increasing rapidly. This project will provide Salmon count data systems on the Copper River that can distinguish between species, provide genetic separation, monitor tributaries and transmit data in real time.

Introduction:

The restoration effort being proposed is to replace and prevent further loss of subsistence resources. The Copper River salmon runs have been used for tens of thousands of years to support our families. These resources are used to replace lost subsistence resources in Prince William Sound. Currently, the use of the Copper River salmon by subsistence and commercial fishermen is threatened by increased allocations for sport fishing and personal use fishing without adequate data systems to monitor this activity. A data management plan with the equipment to collect and maintain the run data based on professional scientific methods and the traditional knowledge of our elders is needed.

Need for the Project:

A: Statement of the Problem:

The Copper River salmon runs have been used for tens of thousands of years to support our families. These resources are used to replace lost subsistence resources. Currently, the use of the Copper River salmon by subsistence and commercial fishermen is threatened by increased allocations for sport fishing and personal use fishing by growing urban populations connected to the Copper Basin by the road system. If the use of the Copper River salmon runs for subsistence and commercial fishing is impaired either by over fishing in the up river spawning areas or by a shift in allocation because of the increased political power of the urban areas, the Native Village of Eyak will lose a major source of subsistence resources and commercial fishing income that has been used to replace the resources on Prince William Sound that have been damaged by the Exxon Valdez Oil Spill. Fish run data collection systems are weak from a standpoint of breaking out total sonar count fish to their tributaries of origin and distinguishing between Kings and Reds. This lack of data has forced managers to restrict the early and the most valuable commercial fishing time on the flats. Subsistence fishing at the mouth of the Copper is being further restricted. At the same time commercial fishing is being restricted, a much more liberal management policy is being implemented in the up river fisheries. Sport fishing on the Gulkana and Klutina have rapidly increasing participation and harvest rates. Personal use fishing in the Chitina area is also experiencing rapid expansion in both participation and harvest. There is not a comprehensive real time data system for the Copper River tributaries to manage the increased harvest in these areas. There needs to be a better data collection system at the mouth of the river and it needs to be coordinated with accurate systems on each of the major tributaries. This will allow for better management of individual runs and better protection for the diversity of the runs.

Threat of loss of the Copper River Run as a Result of Management Decisions Based on Inadequate Data:

The threat to the runs on the Copper and their use as a subsistence resource is very real as demands for the fish on all areas of the River increase from personal use and sport fishermen. With management data only collecting total fish and not distinguishing between Kings and Reds and individual runs, there is a real threat that smaller populations can be wiped out inadvertently by over fishing on the spawning beds, in the Chitina area, or by miscalculating an opener on the Copper River Flats. The risk of error increases as the fishing pressure from new fisheries up river continues to expand.

The popular dipnet fishery has become more organized and powerful. In 1997 they demanded and received an additional 100,000 fish. The Copper River Management Plan is up for review again this year and Federal takeover of management is also coming this year.

Even though the runs recently have been high on the Copper, many individual runs have been wiped out before Statehood, during the previous Federal management. According to Native elders, many of these individual runs have not recovered. Federal Management will again change the methods of decision making and the Native Village of Eyak needs to have a good data collection system that monitors not just total fish entering the river. The system needs to distinguish between species and be able to track actual arrival of genetically diverse runs on individual tributaries and be able to account for and monitor the effects of harvest activities on the spawning beds.

The Copper River fishery is the only fishery left for many people in the oil spill area since many of the other runs traditionally fished were impacted by the spill.

The Need for Better Management Data on the Copper River System:

The management of the Copper River Salmon Run is considered a model for success. Its success however, may be one of the biggest problems of the system. With increasing pressure on the up river areas due to increased support for promoting sport fishing opportunities, there is a great need for better data on the system. The lack of sonar data on the tributaries and data that distinguishes between Kings and Reds, has caused the fishery managers to increasingly restrict commercial and subsistence use. Because of increased demands on the up river fishery especially for Kings, this has resulted in even more restrictions on commercial fishing openings and subsistence fishing at the mouth of the Copper. The most valuable time of the harvest from a commercial and subsistence standpoint is the early openings. Managers are increasingly under pressure to close early openings for commercial fishing. Since subsistence fishing at the mouth of the Copper has been restricted to only times when the commercial fishery is open, this has restricted the subsistence harvest.

The sonar counting of the fish at Miles Lake and Wood Canyon count the main run at its source. The amount of fishing pressure on individual stocks in various tributaries is difficult to manage with our existing data system. Sonar data on the significant tributaries of the Copper is needed over a full run cycle of the Copper. This will give a baseline to correlate the Miles Lake sonar. This will greatly enhance the ability of managers to estimate run sub-populations. In addition, sonar equipment that can distinguish fish size and shape will be useful in collecting data on not just total run counts, but also on distinguishing Reds from Kings on the tributaries. This data will be very useful in determining the total King run and harvest levels of Kings. The issue of the total King harvest is one that the sport fishermen have used to support restrictions on early commercial fishing at the mouth. Better data on the total run, and how the run is harvested will allow better knowledge on the total escapement to the spawning beds and provide better data to manage the fishery at all points on the system. It may also show how the increased sport harvest of King Salmon is affecting the run and may allow the management of the fishery to better target harvest of particular species thus maintaining the resource sustainability.

B. Rationale/Link to Restoration

The work should be done because the Copper River salmon runs are a major subsistence and commercial resource that has been used by the Native Village of Eyak to maintain family food supplies and incomes in the wake of the loss of other opportunities in Prince William Sound as a result of the Oil Spill. Access by Native People to the Copper River run is now threatened by changes in resource use policy and the need for improved data collection technology. This proposal will protect the access to this resource by addressing the gaps in data needed for better run management.

C. Location

The project will be undertaken on the Copper River Watershed. The Native Village of Eyak will coordinate with the other seven Tribal Councils on the River Watershed for assistance with setting up data collection stations on the major tributaries.

Community Involvement and Traditional Ecological Knowledge:

Tribal governments will be involved by participating in the project in their areas. The Native Village of Eyak has been involved with the Trustees Council for many years.

Research and scientific data will be reported to the Villages on the Copper River through a newsletter an annual meeting of the Tribes along the Copper River, and our annual report to EVOS.

Project Design:

A. Objectives:

This project has one objective:

1: Develop a baseline Salmon run data set for Kings and Reds for every major tributary on the Copper River Watershed over a complete five year run cycle and index it to existing data systems.

B. Methods:

Specific Hypotheses to be tested:

1: Sub Populations of Salmon on the Copper River system can be better managed and the total run management can provide better sustained yield if good run data on all major tributaries is available in a real time manner that distinguishes between Kings and Reds.

Methods used:

Establish automated sonar counters with electronic recording and data transmission capabilities that can distinguish fish count and electronically interpret and record estimated fish size and shape at the following river systems:

Tasnuna, Bremner, Tiekel, Chitina, Tonsina, Klutina, Tazlina, Gulkana, Gakona, Sanford, Chistochina, Indian, Ahtel Creek, Slana, Tanada Creek (and Copper above).

The data from each sonar will be recorded and transmitted to a central data base. This will be used with other statistical sampling, test fisheries, sport fish creel census, harvest ticket reports, commercial catch data and tag recovery data. This data will be correlated to the Miles Canyon sonar, the Wood Canyon sonar and other current data collection systems such as end of season aerial surveys. This will be used to determine individual drainage run timing and how to index each run at the Miles Canyon sonar counter and other existing data systems.

C. Cooperating Agencies, Contracts, and Other Agency Assistance:

We plan to coordinate this project with the Alaska Department of Fish and Game and/or National Marine Fisheries, US Fish and Wildlife Service (DOI), and BIA (DOI) Depending on who is involved with the management of the Copper River fishery during the five year project period.

We are not planning to contract a significant portion of the work to the private sector. We will hire fisheries biologists as employees and/or consultants.

Schedule:

A. Measurable Project Tasks for FY 00 (10/1/99 to 9/30/00):

Goal: Develop a baseline Salmon run data set for Kings and Reds for every major tributary on the Copper River Watershed over a complete five year run cycle and index it to existing data systems.

a:	October 1 - October 31	Hold organizational meeting to get direction from elders on fisheries management plan.
b:	October 1 - October 31	Develop list of important issues on data project at elders meeting.
c:	October 1 - October 31	Designate Tribal Fisheries Management Plan/Data work team.
d:	October 1 - October 31	Hire fisheries biologist.
e:	October 1 - December 31	Develop a Tribal fisheries management data plan that addresses the list of important issues addressed by the Tribal Elders.
f:	November 1 - December 31	Meet with Alaska Department of Fish and Game Fisheries Management Personnel, the Alaska Board of Fisheries, US Fish and Wildlife Personnel, and National Marine Fisheries Personnel and get input from scientific experts in these departments regarding the design of the data system to meet scientific standards and the needs of these departments.
g:	November 1 --December 31	Define maximum benefit/minimum cost data gathering locations and data needs for the fishery.
h:	November 1-December 31	Establish cooperative agreement to coordinate research so efforts of ADF&G and Eyak will compliment each other and fill in needed data gaps.
g.	November 1 - January 31	Design data gathering sonar system and data system that will capture sonar data for Kings and Reds.
h.	November 1 - January 31	Design data storage, transmission system and central data base using store and forward technology, radio/cell phone and other technology that is developed during the project period.

i.	May 1 - September 30	Install test system at one tributary and monitor results.
j.	August 1 - September 30	Design and plan system installation for FY 01 for full implementation on all major tributaries of the Copper River.
k.	September 1 - September 30	Report results to Tribal members, the Native American Fish and Wildlife Society, Trustees Council and cooperating agencies.

B. Project Milestones and Endpoints:

Goal :		Develop a baseline Salmon run data set for Kings and Reds for every major tributary on the Copper River Watershed over a complete five year run cycle and index it to existing data systems.
	Milestone:	Test data for one tributary completed September 30, 2000.
	Milestone:	Full Data for all Tributaries Completed each year September 30, 2001, 2002, 2003, 2004 and 2005.
	Milestone:	Annual Data Report published by April 15, following each year end. Final project report and full data analysis for the test year and 5 full years published by April 15, 2006.

C. Completion Date:

The project work will be completed by September 30, 2005. Final project report and data analysis for the full project period will be published by April 15, 2006.

Publications and Reports:

A manuscript will be submitted at the end of field work for FY 00 on the results of the test sonar counts on the tributary selected in the Copper Basin by April 15, 2001. An annual project report with annual data analysis will be published by April 15, following each year end. A final project report and full data analysis for the test year and 5 full years will be published by April 15, 2006.

Professional Conferences:

The results of the FY 00 field work and project design will be shared at the Native American Fish and Wildlife Society. The society will be updated annually.

Normal Agency Management:

The Trustee Council should fund this project because the Copper River is one of the last sources of subsistence resources for the Native Village of Eyak and protecting this resource for use in the absence of lost resources as a result of the oil spill is paramount.

Coordination and Integration of Restoration Effort:

The project will be coordinated with other restoration projects through the Community Facilitator at the Chugach Regional Resources Commission. We will participate with other projects when

possible to share equipment, materials and transportation. We will work with the Alaska Department of Fish and Game to target the most critical data need areas and to focus our efforts to complement the research and management efforts of this agency on the Copper River.

Explanation of Changes in Continuing Projects:

Not applicable (New Project).

Proposed Principal Investigator:

Robert Henrichs, President
Native Village of Eyak
P.O. Box 1388
Cordova, AK 99574
Phone: 907-424-7738
Fax: 907-424-7739
email: rhenrichs@tribalnet.org

Robert Henrichs is a strong leader in his community and understands the need to maintain solid fishery management of the Copper River and the need for better data. He has the ability to insure that qualified personnel will be staffed for the project and will insure that the work of specialists and scientists is closely monitored and reported on.

Other Key Personnel:

There will be a highly qualified lead fisheries biologist who will design the sonar data gathering system and recruit the assistance of qualified fisheries technicians to assist with the design and implementation of the system in a professional manner.

Literature Cited:

Morstad, Szarzi, Hoffmann, "Management of Salmon Stocks in the Copper River; A Report to the Alaska Board of Fisheries"; December 8-14, 1996; Cordova, Alaska.

Following the budget are graphs that were published in the above cited report. These graphs demonstrate the large increase in the fishing pressure placed on the Copper River System in recent years.

Native Village of Eyak
Exxon Valdez Oil Spill Trustees Council
Copper River Copper River Salmon Run Data Infrastructure Project
Budget Summary

Budget Category	Authorized FY 99	Proposed FY 00					
Personnel		200,032					
Travel		19,045					
Contractual		17,000					
Commodities		21,000	**Long Range Funding Requirements**				
Equipment		162,000					
Other		1,200					
Subtotal		420,277	Estimated	Estimated	Estimated	Estimated	Estimated
Indirect		105,069	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Budget Total	0	525,346	2,336,070	893,134	937,790	984,680	1,033,914
Full-Time Equivalent (FTE)		3.0	4.00	4.00	4.00	4.00	4.00
Other Funds		30,700	32,235	33,847	35,539	37,316	39,182

Comments:

Indirect: 105,069
25% per our negotiated Indirect Rate.

NEPA Compliance 0
categorically excluded

Report Writing 9,767
1 month project biologist salary, fringe
and indirect on the above

Publications (budgeted in commodities, 1,000
amount allowed per instructions)

Community Involvement:
10% of Lead Biologist Time, Fringe, Annual Gathering
Cost plus indirect on the above. 20,394

Professional Conferences:

Native American Fish and Wildlife Society
Air Fare, Per Diem, Indirect 3,335

Workshop Attendance

Annual Restoration Workshop
Air Fare, Per Diem, Indirect 1,668

Technical Review Session
Air Fare, Per Diem, Indirect 1,255

Native Village of Eyak
Exxon Valdez Oil Spill Trustees Council
Copper River Copper River Salmon Run Data Infrastructure Project
Budget Detail Narrative

Salaries:				Proposed FY 00	2001	2002	2003	2004	2005
Project Lead Biologist	The project lead biologist will work to accomplish the baseline salmon run data set for all major tributaries of the Copper. This individual will work with the Council and fisheries management biologists and other professionals to build the data collection model and pilot test it in FY 00. This individual will implement a full data collection project from FY 01 through FY 05. Project lead biologist will also work to insure project objectives are met, timeline adhered to and budgeted costs are maintained.								
	Project Biologist:	1 FTE @	70,500	70,500 (1 FTE)	74,025 (1 FTE)	77,726 (1 FTE)	81,612 (1 FTE)	85,693 (1 FTE)	89,978 (1 FTE)
Fisheries Technicians	One full time and three part time Fisheries technicians will be needed in FY 00 to assist with building and installing the sonar counter system on a test tributary and exploring and planning for locations of similar systems for FY 01 at proposed major tributary sites. Fish technicians will also collect and summarize electronic data and build meaningful reports from the data with recommendations to the project biologist. One Fisheries Technician will be employed for 12 months and three Fisheries Technicians will be employed for 4 months in FY 00. 7 technicians will operate the full system from 01 through 05 (6 for 4 months per year and one for 12 months per year).								
	Fisheries Technicians	1 FTE @	39,950	79,900 (2 FTE)	125,843 (3 FTE)	132,135 (3 FTE)	138,742 (3 FTE)	145,679 (3 FTE)	152,963 (3 FTE)
Total Salaries				150,400	199,868	209,861	220,354	231,372	242,941
Fringe:									
FICA		6.20%							
Medicare		1.45%							
FUTA		0.60%							
Alaska ESC		3.50%							
Workman's Comp.		5.25%							
Medical, Dental Vision benefits		16.00%		Proposed FY 00	2001	2002	2003	2004	2005
Budgeted Fringe:		33.00% of salary.		49,632	65,956	69,254	72,717	76,353	80,171
Budgeted Personnel				**200,032**	**265,824**	**279,115**	**293,071**	**307,725**	**323,112**

Travel:
Travel will be needed to gather to discuss the project and prepare the Tribal Fisheries Data Plan. There will be an annual Tribal gathering for10 members. In addition, there will be travel necessary by the Lead Biologist to meet with agencies and coordinate activities. Because of our remote geographic dispersal, travel is a costly, but essential portion of the request we are making. The travel assistance is essential to allow the group the ability to dialog with each other on the significant issues and to generate solid underpinning documents for the Tribal Fisheries Data Plan. Travel is needed to accomplish all project goals. The Lead Biologist and technicians will need to travel to field sites and between communities to monitor the project and accomplish the field work.

	Number of Units (Miles/P-D Days)	Cost per Unit	Proposed FY 00	2001	2002	2003	2004	2005
Lead Biologist Travel, Mileage Chitina-Anchorage 6 round trips 504 miles round Trip	3,024	0.31	937					
Air Fare RT. Cordova-ANC 3 trips at $172	3	172	516					
Anchorage Per diem, 6 days	6	165	990					
Technician Travel, Mileage Chitina Anchorage, 6 round trips 504 miles round trip. Basin mileage, 100 per day average for four months	15,024	0.31	4,657					
Annual Gathering of Copper River Tribes, 10 members, 475 miles/member	4,750	0.31	1,473					
Annual Gathering Air Fare, 3 members 1 trips RT. Cordova-ANC $172	3	172	516					
Annual Gathering Per Diem, 10 members, 3 days	30	165	4,950					
Native American Fish and Wildlife Society 4 participants								
Air Fare Cordova-Anchorage RT. 4 participants	4	172	688					
Anchorage Per Diem 3 days (@165) 4 participants	12	165	1,980					
Annual Restoration Workshop 2 participants								
Air Fare Cordova-anchorage, RT. 2 participants	2	172	344					
Anchorage per diem 3 days 2 participants	6	165	990					
Technical Review Session 2 participants								
Air Fare Cordova Anchorage RT. 2 participants	2	172	344					
2 days Anchorage Per-Diem (@165) 2 participants	4	165	660					
Budgeted Travel:			**19,045**	**19,997**	**20,997**	**22,047**	**23,149**	**24,306**

Contractual

	Hours	Cost/Hr.	Proposed FY 00	2001	2002	2003	2004	2005
In Kind work by Council members conducting meetings, and working on Tribal Fisheries data Plan. 10 members 100 hours each $25 per hour average value. Provided in kind. $25,000 in kind/year.	1000	25	In Kind	In Kind	In Kind	In Kind	In Kind	In Kind
Scientific review and consultation on data gathering system design.	200	85	17,000	17,850	18,743	19,680	20,664	21,697
Budgeted Contractual:			**17,000**	**17,850**	**18,743**	**19,680**	**20,664**	**21,697**

Commodities:

Supplies will be needed to accomplish the project. Office supplies, filing supplies, and presentation media will be required to track data and project information, products and materials.

	Cost Per Month	Months Needed	Proposed FY 00	2001	2002	2003	2004	2005
Office Supplies, filing, data and other.	250	12	3,000	3,150	3,308	3,473	3,647	3,829
Summer Field Camp Food, fuel, parts and scientific Supplies (4500/month per camp, 1 camp in 00, 3 camps 01 through 05, 5% inflation factor)	4,500	4	18,000	56,700	59,535	62,512	65,638	68,920
Budgeted Commodities:			**21,000**	**59,850**	**62,843**	**65,985**	**69,285**	**72,749**

Equipment:

We will need Salmon sonar equipment, data storage, data transmission remote power supplies, and other data gathering equipment. FY 00 will require one set up for a test tributary. FY 01 will require set up for all remaining major tributaries of the Copper. It is estimated that there will be savings in 01 when purchasing equipment for the entire system because of our experience in 00 and volume purchasing capability. 00 equipment estimated at $125,000, FY 01 15 additional sites at 80% of 00 single system cost with no inflation factor, 02 through 05 estimated at 20% of 00 and 01 cost with a 5% inflation factor.	Proposed FY 00	2001	2002	2003	2004	2005
	125,000	1,406,250	321,563	337,641	354,523	372,249
Field Camp Equipment 1 portable camp set up in 00, 3 portable camp set ups in 01 . (includes temporary building/wall tents, generator, temporary water, waste disposal, communications)	12,500	39,375				
22 foot Aluminum River Boat with Jet Engine (one in 00, two in 01)	24,500	49,000				
Budgeted Equipment:	**162,000**	**1,494,625**	**321,563**	**337,641**	**354,523**	**372,249**

Other:

	Proposed FY 00	2001	2002	2003	2004	2005
We will need to rent the community Hall for two days per year cost is 250 per day This will be provided in kind by the community $500 in-kind per year.	In Kind	In Kind	In Kind	In Kind	In Kind	In Kind
Office space 350 per month 12 months This will be provided in kind by the community 4,200 in kind per year	In Kind	In Kind	In Kind	In Kind	In Kind	In Kind
Cell Phone and Data Communications Services for transmitting and storing daily electronic count data $50 per month per site plus Cordova data station. (2 sites in 00, 17 sites 01-05, 5% inflation factor).	1,200	10,710	11,246	11,808	12,398	13,018
Budgeted Other:	**1,200**	**10,710**	**11,246**	**11,808**	**12,398**	**13,018**
Total Direct Costs:	**420,277**	**1,868,856**	**714,507**	**750,232**	**787,744**	**827,131**

Indirect:

Indirect is computed at our negotiated rate of 25%.

	Proposed FY 00	2001	2002	2003	2004	2005
Budgeted Indirect Costs:	**105,069**	**467,214**	**178,627**	**187,558**	**196,936**	**206,783**
Total Costs	**525,346**	**2,336,070**	**893,134**	**937,790**	**984,680**	**1,033,914**

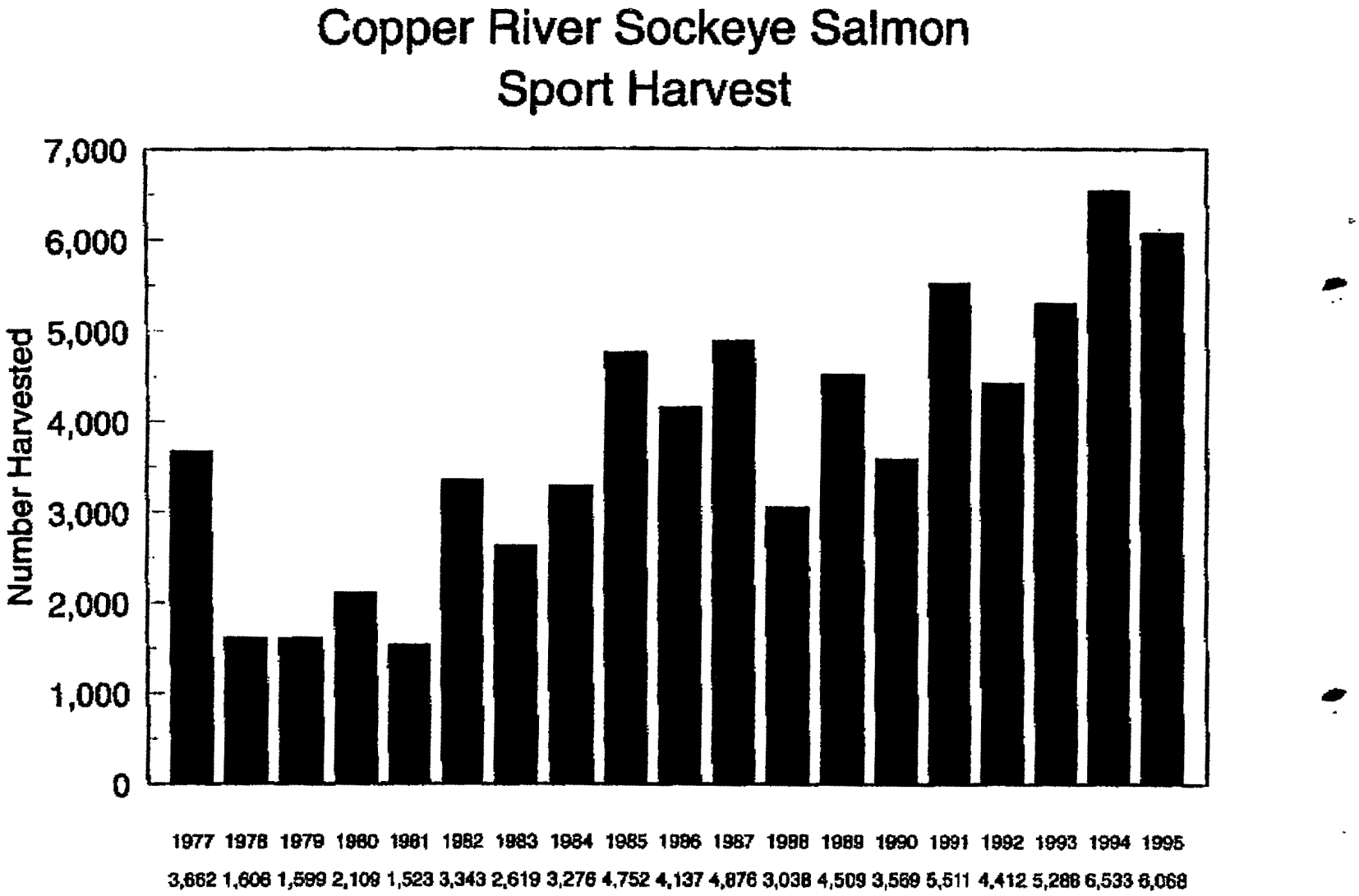

Figure 17.-Sport harvest of sockeye salmon in the Copper River, 1977-1995.

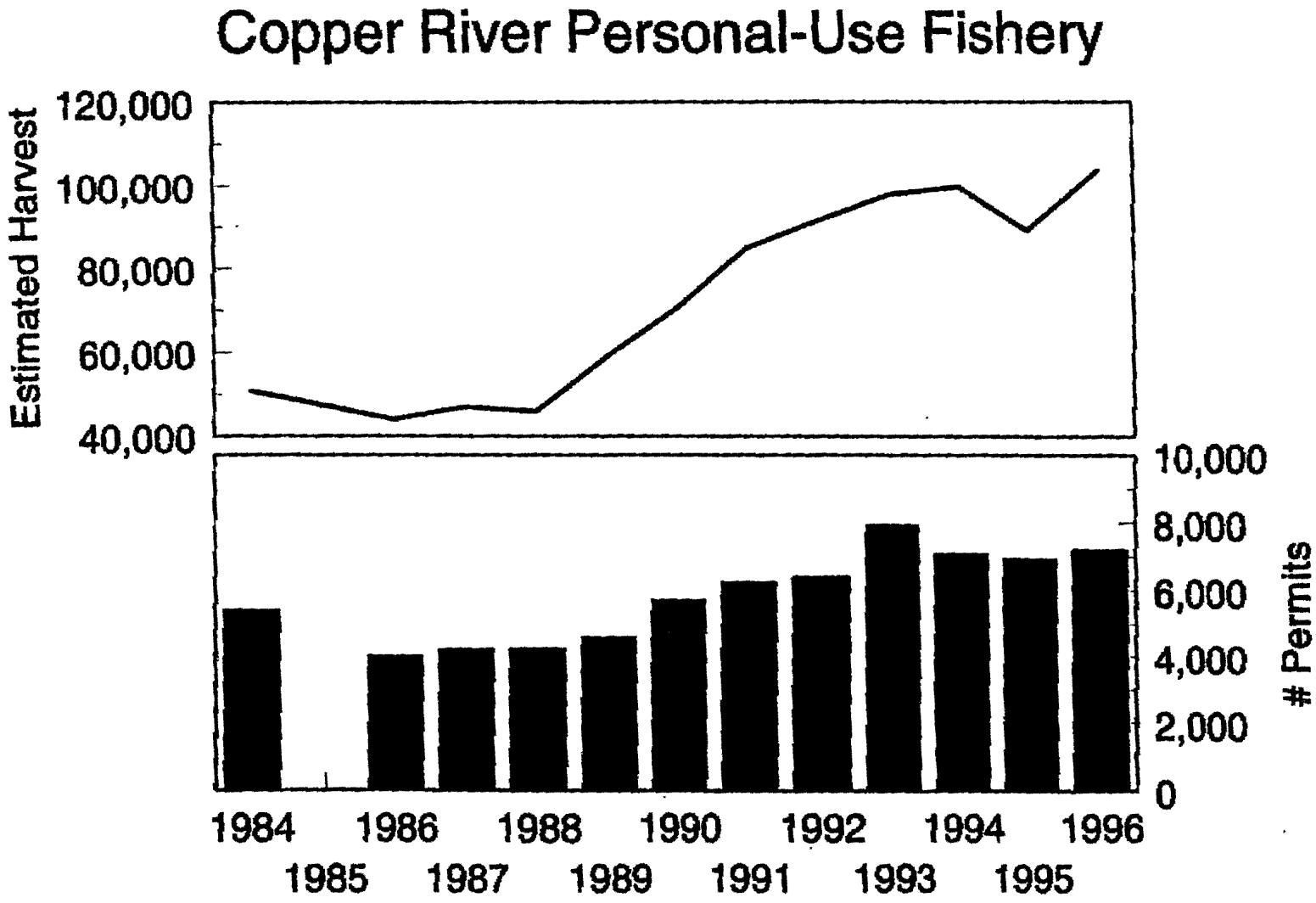

Figure 9.-Harvest and number of permits issued during the Copper River personal use fishery, 1984-1996.

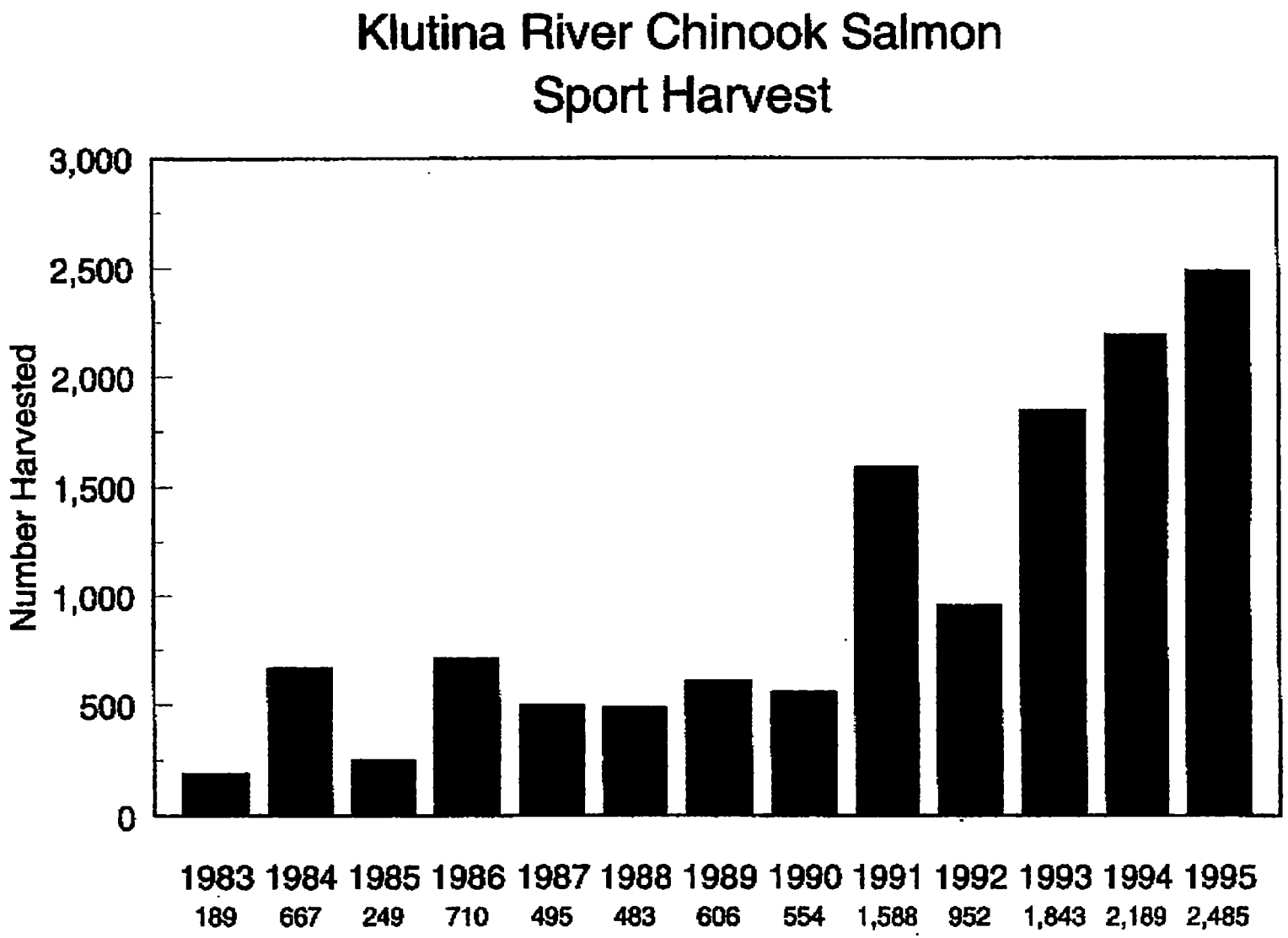

Figure 16.-Sport harvest of chinook salmon in the Klutina River, 1983-1995.

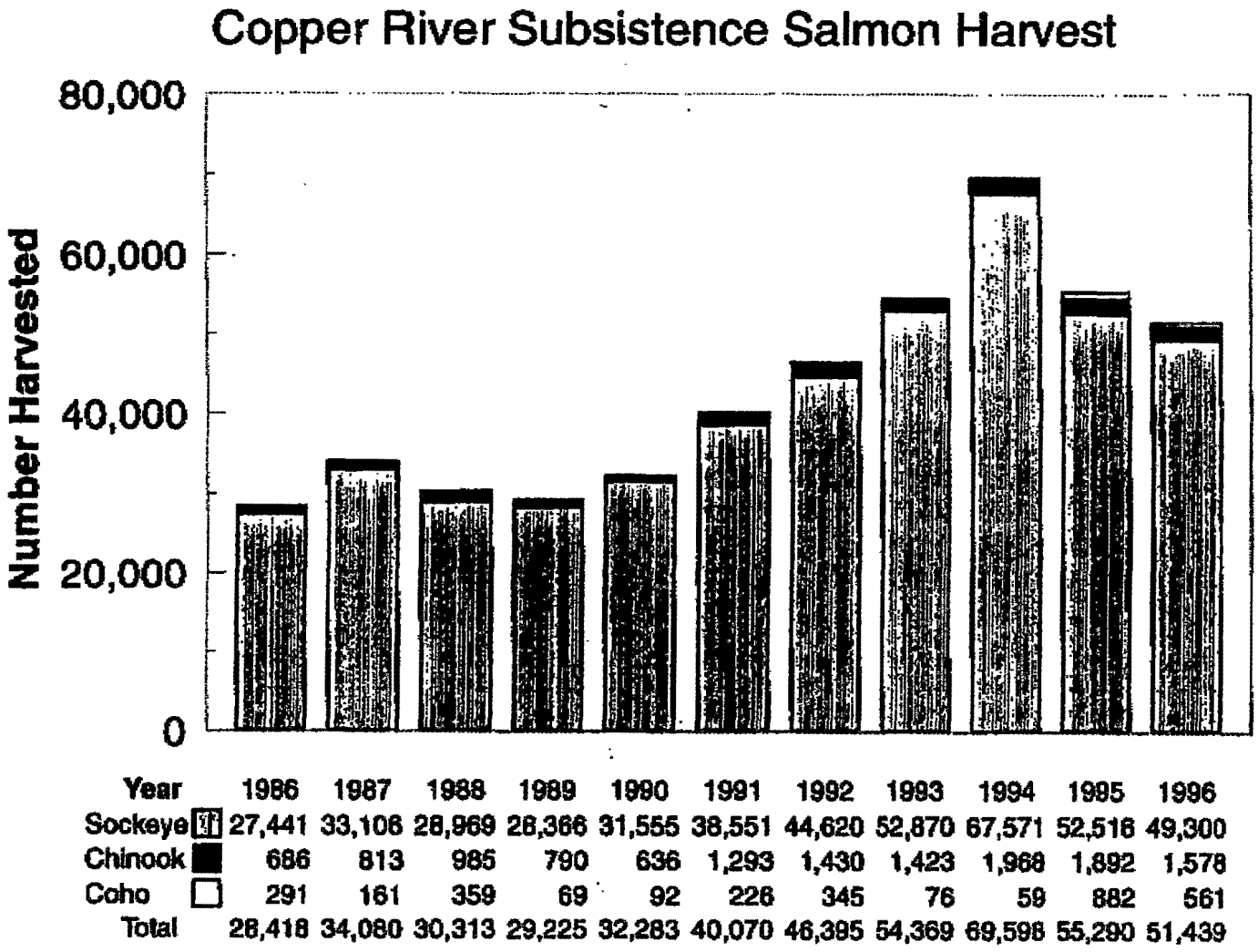

Figure 12.-Harvest of salmon by species in the Upper Copper River District subsistence fishery, 1986-1996.

Long-Term Monitoring of Harbor Seal Populations: Development of an Experimental Design

Project Number:	00509
Restoration Category:	Monitoring
Proposer:	Robert J. Small, ADF&G
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	None
Alaska SeaLife Center:	No
Duration:	1st year, 1-year project
Cost FY 00:	$55.3
Cost FY 01:	None
Cost FY 02:	None
Geographic Area:	EVOS spill area
Injured Resource/Service:	Harbor seal

ABSTRACT

An experimental design for a long-term monitoring program of harbor seal (*Phoca vitulina richardsi*) populations in the EVOS spill area will be developed. Current monitoring programs include aerial population trend and abundance surveys, and land-based counts at a key index site (Tugidak Island). These current monitoring programs will be evaluated based on sampling design, accuracy and precision, and their application to the management and conservation needs of harbor seals. Revisions to the methodology of current programs will be made based on new research results concerning stock structure, population trends, and life history characteristics, and advances in marine mammal survey and abundance assessment.

INTRODUCTION

This project proposes to evaluate the experimental design currently used to monitor harbor seal (*Phoca vitulina richardsi*) populations in the EVOS spill area, and to subsequently develop a revised experimental design based on new research results on harbor seal biology and advances in marine mammal survey and abundance assessment. This proposal is linked to restoration project 064: Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska (Frost *et al.* 1998). The results of project 064, and results of similar studies by ADF&G on the Kodiak Archipelago have documented the severe decline of harbor seals in the Gulf of Alaska, and additionally provided insights on population structure based on genetic research and movement and haulout patterns. These new results raise questions concerning the efficacy of the current monitoring program relative to the management and conservation of harbor seals in the spill area. Specifically, are the current monitoring programs designed to collect information that will provide the most robust estimates of population trend and abundance that are representative of harbor seals within the spill area? Such population estimates are critically important as they determine, in part, the status of harbor seals in the Gulf of Alaska under the Marine Mammal Protection Act and the Endangered Species Act.

NEED FOR THE PROJECT

A. Statement of Problem

The harbor seal is an injured resource that is not recovering. In the Gulf of Alaska and PWS, harbor seal numbers declined substantially from the late 1970s through the early 1990s (Pitcher 1990, Hoover-Miller 1994, Frost *et al.* 1998). Specifically, the number of seals decreased by approximately 90% between 1976 and 1992 on Tugidak Island (Pitcher 1990, Lewis *et al.* 1996), located southwest of Kodiak Island, and in PWS numbers decreased by 63% between 1984 and 1997 (Frost *et al.* 1998). Recently, population trend surveys indicate the percent change per year in aerial counts has stabilized for the Kodiak Archipelago over the 1993-1997 period (Small *et al.* 1998a), whereas in PWS trend survey results indicate counts decreased 4.6% per year from 1990 through 1997 (Frost *et al.* 1998). Land-based counts on Tugidak Island have increased 8.9% per year from 1992-1997; however, the affect of environmental covariates (e.g., date, time of day) that are known to influence counts has not yet been determined (Small *et al.* 1998a, Frost *et al.* 1999).

The information on harbor seal population status presented above is a result of monitoring programs within the spill area that began over 20 years ago, initially with land-based counts conducted on Tugidak Island by ADF&G. Subsequently, ADF&G established aerial survey routes designed to estimate population trend in PWS (1984) and the Kodiak Archipelago (1993). Additionally, the National Marine Fisheries Service (NMFS) has conducted aerial surveys to estimate the abundance of harbor seals across the seals' statewide range since 1991. The results of these survey efforts have provided invaluable information regarding the population status of harbor seals within the spill area. However, the location of trend survey routes were determined, primarily, on logistical constraints; not, on statistical sampling theory. In addition, knowledge of harbor seal biology and life history characteristics was relatively limited when the current monitoring programs began. Recently, advances have been made in marine mammal survey and assessment methods (Garner *et al.* 1999), and in the understanding of harbor seal stock structure, movement and haulout patterns, and molting phenology within the spill area that is pertinent to

population monitoring (Frost *et al.* 1998, Small *et al.* 1997 & 1998b). This new information raises concerns about whether the current monitoring programs are based on the most appropriate experimental design to provide the best information on harbor seal populations within the spill area.

For example: Are haulout sites within trend survey routes representative of the general trend survey area? Seals are no longer present at some haulout sites within the trend survey routes: should these sites be deleted from the survey and replaced with other sites? Both trend and abundance surveys have been performed in mid to late August, when it was assumed that the peak number of seals hauled out in association with the annual molt. Yet, molting phenology is not well known for most areas: how large is the potential bias in abundance estimates if surveys are not conducted when the majority of seals are hauled out? Similarly, different age and sex cohorts haulout at different periods during the molt (Jemison *et al.* 1998): what cohort should surveys focus on, and when is the peak molt period for that cohort?

B. Rationale/Link to Restoration

Knowledge of population status (e.g., trend and abundance) is fundamental to assessing recovery. As the harbor seal is a resource that is not recovering, well designed monitoring programs for harbor seals are essential for accurate restoration assessments and management strategies. Recognizing the need to enhance and improve the design of monitoring programs, this project will provide the information necessary to determine when and how monitoring should be conducted. In addition, the new design will determine how the transition from the current monitoring program to a new long-term monitoring program should occur without a loss of information on the present status of the population.

C. Location

The geographic focus of the majority of research projects on Alaskan harbor seals over the last decade has been in the PWS and Kodiak Archipelago regions, in addition to Southeast Alaska. Fortunately, this project will thus be able to utilize the large and diverse databases generated from harbor seal research within the EVOS spill area. The application of the project will result in benefits within the spill area, and will also be applicable throughout the range of the harbor seal in Alaska. Communities with individuals interested in the cultural and economic value of harbor seals will be affected by the project, as they will be provided with an improved assessment of seal population status and trends.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

The application of the project is to assess harbor seal population status and trends in the most effective and scientifically sound manner. Recognizing that harbor seals represent a valuable cultural and economic resource to some community members, the development and implementation of the revised monitoring program will be discussed with members of the Alaska Native Harbor Seal Commission (ANHSC). ANHSC members will also be asked to share pertinent traditional and local knowledge concerning harbor seal numbers and distribution so that relative information may be incorporated into the project.

PROJECT DESIGN

A. Objectives

1. Determine which haulout sites best represent all haulouts within a general trend survey area (e.g., PWS), recognizing logistical and technological constraints.

2. Determine the spatial extent, if any, that population trend estimates can be extrapolated from a trend survey area to surrounding areas.

3. Determine if an additional trend route is required to adequately assess population trends within the spill area.

4. Estimate the statistical power associated with population trend estimates.

5. Determine which haulout sites within an existing trend route should be deleted, and which new sites should be included, when the trend route no longer best represents the general survey area.

6. Determine if counts at large glacial haulout sites (e.g., Columbia Bay) should be collected simultaneously with counts at traditional terrestrial sites, recognizing the logistical constraints in obtaining counts at the two different haulout substrates.

7. Determine the influence of environmental covariates (e.g., date, time of day, time of low tide) on population abundance estimates.

8. Estimate the bias resulting from abundance surveys conducted outside of the peak molt period, and determine how to account for this bias in the associated abundance estimate.

9. Determine if trend and abundance surveys should be conducted when the greatest numbers of seals are hauled out during the molt period, or, when the greatest number of yearlings and subadults are hauled out.

10. Determine if counts from either trend or abundance surveys can be used to estimate the maximum net productivity level (MNPL), and thus an assessment of whether stocks are at optimum sustainable population (OSP) size.

11. Determine if an additional index site (e.g., Tugidak Island) is required to adequately assess population trends within the spill area, and the appropriate sampling design for such sites.

B. Methods

This project is designed to determine the most appropriate methods to monitor harbor seal population status within the spill area. The current experimental design to monitor population status will be evaluated based on existing information on the spatial and temporal variation in the abundance and distribution of harbor seals and recent advances in marine mammal survey and assessment methods. Recommendations for revisions to the experimental design will be based on the relevant statistical theory of sampling and surveying, knowledge of harbor seal biology, and policy considerations.

Examples of pertinent hypotheses to address and analyses to perform include:

1. Haulout sites within existing trend survey routes are stratified within the survey area by haulout substrate and seal abundance.

2. Abundance surveys are performed at the optimum interval based on an expected level of precision and minimizing the probability of incorrectly classifying a stock relative to the management goals of the MMPA (see Wade and DeMaster 1999).

3. Simulations will be performed to examine the increase in variation (i.e., coefficient of variation) and negative bias in abundance estimates based on surveys conducted outside the peak molt period.

4. Simulations will be performed to assess whether conducting trend surveys earlier in the molt period (when peak numbers of subadult seals haul out) would result in population trend estimates more indicative to potential changes in population dynamics.

Based on these examples, numerous methods will be reviewed and implemented to fulfill the project's objectives.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The large majority of this project will be contracted to either a university faculty member or postdoctoral fellow, with necessary supporting information provided by ADF&G and NMFS biologists. A contract is necessary to ensure that an individual recognized as having substantial knowledge in the statistics of population survey and assessment design conducts the research, and that this individual can devote sufficient time to the project. The contract will be established as a cooperative agreement between ADF&G and most likely either the University of Alaska–Fairbanks or the University of Washington.

Once the contractor has been selected and the cooperative agreement established, ADF&G and NMFS biologists will meet with the contractor to clarify the objectives and exchange needed databases. Thereafter, Robert Small will oversee the development of the work to ensure that the milestones are successfully completed on schedule.

SCHEDULE

A. Measurable Project Tasks for FY 00 (October 1, 1999 – September 30, 2000)

October 31:	Selection of contractor and establishment of cooperative agreement completed
November 1-June 30:	Evaluation of existing monitoring programs completed
September 30:	Development of new experimental design completed and integrated into monitoring programs.

B. Project Milestones and Endpoints

November 30:	Acquisition of databases from ADF&G & NMFS completed

December 1-February 28:	Evaluate PWS and Kodiak trend route survey design
April 31:	Recommendations for revisions to PWS and Kodiak trend route survey design completed
May 1-June 30:	Evaluate NMFS abundance survey design
August 31:	Recommendations for revisions to NMFS abundance survey design completed
September 30:	Recommendations for remaining objectives completed, and final report submitted

C. Completion Date

All of the project's objectives will be completed by the end of FY 00.

PUBLICATIONS AND REPORTS

The final report will be completed at the end of FY 00. Once this report is completed, ADF&G and NMFS personnel will determine if a manuscript should be considered for publication, and will provide any additional funding necessary to cover the costs of the publication.

PROFESSIONAL CONFERENCES

Travel funds for conference attendance are not being requested.

NORMAL AGENCY MANAGEMENT

ADF&G is not required to conduct this project by statute or regulation. NMFS funded a workshop on the "Population assessment of harbor seals in Alaska" in November 1995 (Small 1996), which provided a brief overview of the monitoring programs, and a thorough review of the population status of Alaskan harbor seals. In addition, specific recommendations were generated from the workshop, several of which are very similar to some of the objectives listed in this proposed project (e.g., objectives #1-4). ADF&G and NMFS personnel have pursued and completed several of the other workshop recommendations. However, a lack of available statistical expertise has prohibited the completion of the remaining workshop recommendations, as well as the other objectives listed in this proposal. ADF&G and NMFS currently conduct research on harbor seals within the spill area, including population assessment, but do not have sufficient funding or the available technical expertise to pursue all the objectives of this project. Thus, funds are requested from the Trustee Council.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated with three harbor seal research programs: (1) Trustee Council restoration project 064: Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska. Kathy Frost, the principal investigator of project 064, is a co-investigator of the proposed project, and has provided consultation and advice on this DPD. (2) Harbor Seal Investigations in Alaska, the ADF&G statewide harbor seal research program

funded through funds allocated by the U. S. Congress, and administered by NMFS. Robert Small, principal investigator of this ADF&G program, is the other co-investigator of the proposed project. (3) NMFS Polar Ecosystems program, based at the National Marine Mammal Laboratory. John Bengtson is the project leader for this NMFS program, and David Withrow leads the NMFS harbor seal abundance survey effort. John and David are also the principal cooperators for the ADF&G statewide harbor seal program.

All of these personnel will provide databases and knowledge on harbor seal distribution and abundance within the spill area, and advice on issues relative to the evaluation and revision of the monitoring programs. ADF&G and NMFS will be requesting funds through their inter-agency proposal process to supplement the financial support requested from the Trustee Council to provide the selected contractor with a full year of salary and benefits.

PRINCIPAL INVESTIGATORS

Dr. Robert J. Small is a marine mammal biologist and principal investigator of the ADF&G statewide harbor seal research program. He has published numerous articles on the population ecology of vertebrates, and authored the 1996 Alaska Marine Mammal Stock Assessments. He previously conducted statistical analyses of harbor seal population trend data, designed a population model of Alaskan harbor seals, and convened a workshop on the assessment of Alaskan harbor seal populations. He has experience with administration of wildlife research and conservation programs, and supervision. Dr. Small will be responsible for the general oversight and direction of the project, in addition to providing the Kodiak Archipelago trend survey and Tugidak Island index site databases.

Kathy Frost is a marine mammal biologist who has conducted extensive research on marine mammals throughout Alaska since 1975. She is the principal investigator of Trustee Council restoration project 064: Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska. She has monitored harbor seals in PWS for over a decade, and is very familiar with the distribution and abundance of seals in PWS, and thus the issues relative to the monitoring of those seals. Kathy will be responsible for providing PWS trend survey databases and application of her knowledge towards the development of the revised experimental design.

OTHER KEY PERSONNEL

Dr. John Bengtson, Dave Withrow, and Dr. Peter Boveng of the National Marine Mammal Laboratory (NMFS) in Seattle, Washington, will provide the contractor with pertinent databases for the evaluation of the abundance survey program and be available for discussions on the development of the revised experimental design.

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2000 EXXON VALDEZ TR EE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$5.9
Travel		$2.2
Contractual		$40.0
Commodities		$1.0
Equipment		$2.5
Subtotal	$0.0	$51.6
General Administration		$3.7
Project Total	$0.0	$55.3
Full-time Equivalents (FTE)		0.1
Other Resources		$24.0

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Comments:

This project will develop an experimental design for a long-term monitoring program of harbor seal populations in the EVOS spill area, based on new research results concerning harbor seal stock structure, population trends, and life history characteristics, and advances in marine mammal survey and abundance assessment. This project should be conducted to ensure that populations of the harbor seal, a resource that is not recovering, are monitored in the most effective and scientifically sound manner. The results of this project will have affects on community members that derive cultural and economic value from harbor seals by improved assessment of this resource. In addition, the results of this project will be applied throughout the range of the harbor seal in Alaska. No portion of the project cost is for NEPA compliance, publications, professional conferences, or community involvement. Costs associated with restoration workshop attendance, technical review session attendance, and report writing will be minimal and covered by the ADF&G statewide harbor seal program from Anchorage. The proposed funding listed under "Other Resources" is what the cooperating agencies (ADF&G and NMFS) will request in their upcoming inter-agency proposals to provide the selected contractor with a full year of salary and benefits to complete the project.

FY00

Project Number: 00509
Project Title: Long-Term Monitoring of Harbor Seal Populations: Development of an Experimental Design
Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 14-Apr-99

2000 EXXON VALDEZ TR EE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Robert J. Small	Wildlife Biologist III	18C	0.5	5.2	0.0	2.6
Kathy J, Frost	Wildlife Biologist III	18K	0.5	6.5	0.0	3.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	11.7	0.0	
					Personnel Total	$5.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Contractor to travel from Fairbanks to Seattle to meet with harbor seal					0.0
biologists to obtain databases and discuss current monitoring programs	0.4	3	10	0.1	2.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.2

FY00

Prepared: 14-Apr-99

Project Number: 00509
Project Title: Long-Term Monitoring Of Harbor Seal Populations: Development of an Experimental Design
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TR EE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
Eight months (0.7 FTE) salary and benefits of a University Post-Doc with recognized and substantial knowledge in the statistics of population survey and assessment design, to devote sufficient time and focus on the evaluation and revision of harbor seal population monitoring programs within the spill area.	
RSA to UAF	
Salary and Benefits: 8 months @ $4.0/month	32.0
University overhead: 8 months @ $1.0/month	8.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$40.0

Commodities Costs:	Proposed FY 2000
Description	
Statistical software and associate license	1.0
Commodities Total	$1.0

FY00

Prepared:

Project Number: 00509
Project Title: Long-Term Monitoring of Harbor Seal Populations: Development of an Experiment Design
Agency: ADF&G

FORM 3B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TI EE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
Personal Computer	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: Description	Number of Units	Inventory Agency

FY00

Project Number: 00509
Project Title: Long-Term Monitoring of Harbor Seal Populations: Development of an Experimental Design
Agency: ADF&G

FORM 3B
Equipment
DETAIL

Prepared: 14-Apr-99

Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA

Project Number:	00510
Restoration Category:	Research
Proposer:	Coastal Resources Associates, Inc. NOAA Auke Bay Laboratory University of Alaska Fairbanks Western Ecosystem Technologies, Inc.
Lead Trustee Agency:	NOAA (Submitted Under BAA)
Cooperating Agencies:	ADFG, NOAA
Alaska SeaLife Center:	No
Duration:	1st year, 3-year project
Cost FY 00:	$132,700
Cost FY 01:	$75,400
Cost FY 02:	$1,200
Cost FY 03:	None
Cost FY 04:	None
Geographic Area:	Prince William Sound
Injured Resource/Service:	Intertidal Communities

ABSTRACT

This project will examine the state of recovery of key habitats and representative injured species within the intertidal zone in Prince William Sound. Sampling will be conducted at intertidal sites within the sheltered rocky habitat that were previously sampled as part of the Coastal Habitat Injury Assessment program. In addition, sampling will be conducted at representative sites sampled by the NOAA Hazmat team. These data, along with those previously collected during the Coastal Habitat and NOAA Hazmat programs, will be evaluated to assess that status of recovery. In addition, in a collaborative effort with NOAA Hazmat, we will provide an overview of methods for assessing recovery and make recommendations for future monitoring.

INTRODUCTION

Intertidal habitats are still considered among the resources that have not fully recovered from injuries resulting from *Exxon Valdez* Oil Spill (EVOS). This evaluation is based largely on the results of Coastal Habitat studies funded by the *Exxon Valdez* Oil Spill Trustee Council (Highsmith *et al.* 1994, 1996) and on studies conducted by the NOAA Hazmat group in evaluating various cleanup methods (Houghton *et al.* 1996, 1997)

The Coastal Habitat study sampled at a relatively large number of randomly selected sites. This allowed inferences concerning injury and recovery from the sampled sites to the larger area of the Sound affected by the spill. These results suggest that many of the dominant invertebrates and plants in the intertidal had not recovered fully as of 1991. The status of recovery of representative taxa, based on the persistence of significant differences between oiled and reference sites, is given in Table 1.

Table 1. Intertidal taxa with significant differences between oiled and reference sites in Prince William Sound in Spring 1991. Habitats are SR = Sheltered rocky, CT = Coarse textured, ES = Estuarine, and ER = Exposed rocky. Tidal heights are H = High, M = Middle, and L = Lower intertidal zone. X = significantly greater at reference sites, O = Significantly greater at oiled. (From Stekoll *et al.* 1995.)

	Habitat Type and Intertidal Zone											
Taxa	SR			CT			ES			ER		
	H	M	L	H	M	L	H	M	L	H	M	L
Fucus gardneri	X	X	X	X	X	X	X	X			X	
Tectura persona	X				X							
Cthamalus dalli	O	O	O							O		
Balanus glandula	X				X	O	X	X		O		
Semibalanus balanoides	X				X	X		X			X	
Mytilus trossulus				X	X	X					X	
Littorina sitkana	X						X					
Littorina scutulata		O		X	X	X		X				

Recovery varied by habitat and tidal height, but all eight numerically dominant taxa (one plant and seven invertebrates) showed signs of incomplete recovery within at least one habitat and tidal zone. Differences between oiled and reference sites were most evident in the upper intertidal zone in sheltered rocky habitats and in the middle intertidal zone on coarse textured beaches. In each of these habitats and tidal heights, patterns of abundance for six of the eight taxa indicated a lack

of complete recovery. Unfortunately, only results on data collected through 1991 have been fully reported (Highsmith *et al.* 1996) and as a result, the status of recovery past 1991 remains uncertain.

The NOAA studies provide some evidence that suggests that the lack of recovery of intertidal resources persisted through 1995 (Table 2).

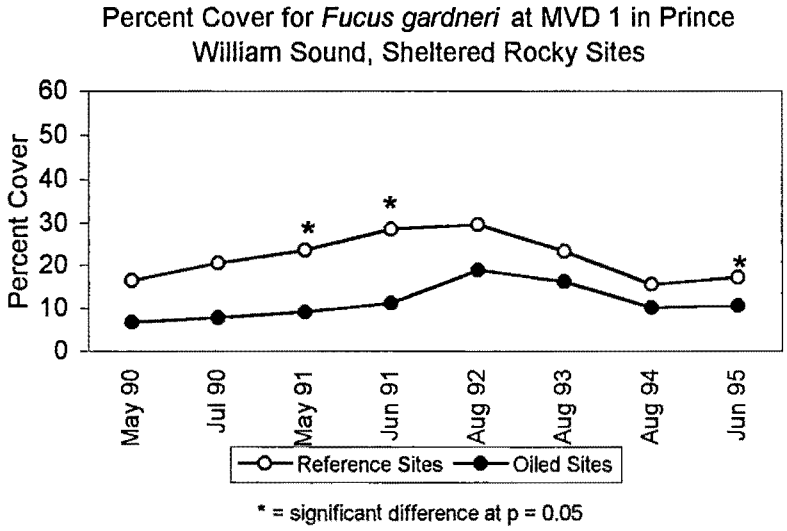
Table 2. Ratios of mean abundance of intertidal taxa at unoiled (N=2) and oiled and cleaned (N = 3) rocky shores in Prince William Sound in 1995. Asterisks indicate significant differences between oiled and control sites ($P < 0.10$). Data are from Houghton *et al.* (1997). H = High intertidal, M = Mid intertidal.

Taxa	H	M
Fucus gardneri	3	1.7
Lottidae (limpets)	6*	0.6
Cthamalus dalli	12	0.3
Balanus glandula	8	0.7
Semibalanus balanoides	250*	1.5
Mytilus trossulus	1.5	1.5
Littorina sitkana	2	3.2
Littornia scutulata	4	0.8

For example, limpet populations in the upper intertidal zone were significantly reduced at oiled and cleaned sites after the spill, and remained about six times higher at reference sites than at oiled and cleaned sites in 1995 (Houghton *et al.* 1997). In the upper intertidal zone, eight taxa had higher mean densities at oiled sites. However, due to small sample sizes (two reference and three oiled and cleaned sites) and associated low power to detect differences, means differed significantly for only two taxa. While the NOAA study provides a lengthy time series of observations, it is difficult to make strong statements about recovery status based on these data because, in addition to the low power, the sites were chosen in order to examine the efficacy of various cleanup methods. The potential biases in site selection make it difficult to make strong inferences from observations made at these selected sites to the Sound as a whole.

Some of the Coastal Habitat sites have been revisited by M. Stekoll, R. Jenne, M. Lindeberg, and S. Saupe since 1991, but only the data on percentage cover by *Fucus gardneri* that were collected through 1994 have been fully analyzed and reported (Stekoll and Deysher 1998, 1999). In the upper intertidal region in Prince William Sound in 1994, percentage cover by *Fucus* remained slightly higher at reference sites, but did not differ significantly. However, unpublished data from

1995 (M. Lindeberg and S. Saupe) indicate that there was significantly higher *Fucus* cover at reference sites, suggesting that populations of *Fucus* in the upper intertidal zone may not have fully recovered (See figure below).



The differences in mean percentage cover changed only slightly between 1994 and 1995, but the data were less variable in 1995 providing more power to detect a significant difference. These analyses are clearly preliminary, but point out that all existing data need to be evaluated, and a more current survey needs to be conducted, in order to assess the status of recovery within the intertidal community.

NEED FOR THE PROJECT

A. Statement of Problem

The status of recovery of critical intertidal resources remains largely unknown. Understanding the recovery process, and evaluating methods for determination of injury and recovery are critical to developing future monitoring plans.

B. Rationale/Link to Restoration

The data concerning the status of recovery of intertidal and nearshore subtidal resources is important in determining whether future restoration efforts are required. Also, these data are extremely valuable in that they can be used to design effective monitoring of these critical habitats.

C. Location

Studies will be conducted in Prince William Sound. However, data from the Kenai/Cook Inlet and Kodiak/Alaska Peninsula regions will also be evaluated in assessing monitoring methods.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The projects are based on data gathered throughout the damage assessment and restoration phases of the *Exxon Valdez* Oil Spill studies funded by the Trustees. Past work has been presented at various public meetings sponsored by the council. It is anticipated that manuscripts produced will be the basis of future presentations at Trustee sponsored restoration workshops.

PROJECT DESIGN

A. Objectives

The objectives of the proposed study are to evaluate the status of recovery of injured resources in the intertidal zone in Prince William Sound, and to provide guidance for future monitoring within these habitats.

B. Methods

Sampling

Sampling will be conducted at five pairs of oiled and unoiled sites within the sheltered rocky habitat that were previously sampled as part of the Coastal Habitat program (Highsmith *et al.* 1996, Stekoll *et al.* 1996). In addition, we will sample at six sites (three oiled and cleaned and 3 unoiled) used by NOAA to assess effects of various cleanup methods within this habitat. Sampling will be conducted in June 2000.

The percent cover of bare substrate, *Fucus gardneri*, and other algae will be estimated as described in Stekoll *et al.* (1996). Seven dominant epifaunal invertebrates, including the mussels (*Mytilus trossulus*) three barnacles (*Balanus glandula, Cthamalus dalli, and Semibalanus balanoides*), two perwinkle snails (*Littorina sitkana and Littorina scutulata*) and one limpet (*Tectura persona*) will be counted. Sampling will only be conducted in the upper (MVD 1) and middle (MVD 2) intertidal zones because of restrictions in sampling time, and because most of the observed injuries that persisted through 1991 occurred in these upper and middle zones. We will not sample at coarse textured, exposed rocky, or estuarine sites primarily because of cost considerations. Exposed and estuarine sites were eliminated because these habitats are relatively rare in the Sound and injuries appeared less prevalent there. Injuries to a large number of taxa were observed on coarse textured beaches, but we elected to sample at the sheltered rocky sites instead because: 1) injuries were somewhat similar in the two habitats, 2) there were considerable unpublished data gathered from sheltered rocky sites between 1991 and 1998, and 3) NOAA Hazmat sites were more comparable to CHIA sheltered rocky sites than to coarse textured beaches.

At each tidal level at each site, the percent cover of algae and counts of invertebrates will be made within six quadrats measuring 40 by 50 cm. Methods used for determining percent cover and estimating density will be the same as used in 1991 Coastal Habitat Injury Assessment (CHIA) surveys, except that only non-destructive sampling (without scrapping rocks surfaces) will be employed.

Data analysis - Assessment of recovery

The recovery of the intertidal community will be assessed by comparing the density or percent cover of each taxa at oiled and control sites used in CHIA studies. Statistical tests will be conducted on matched pairs of sites to evaluate if differences (injuries) detected in 1990-91 are still present. Evaluation of the magnitude of differences will be conducted for each matched pair of sites using confidence intervals on the ratios of means. These confidence intervals will allow us to place the burden of proof of "no difference" on the data. That is, do the data prove that differences have disappeared, that the differences are still present, or that the data lack sufficient precision to assess the issue of continuing differences?

Unfortunately, with the incomplete time series of data on the CHIA sites, assessment of "recovery" over the broad area of PWS is difficult. Analysis will be conducted that compare the results of sampling at NOAA and CHIA sites using both NOAA and CHIA sampling methods. If the methods are comparable (have high correlation), and if both sets of sites show similar patterns with respect to recovery, then inferences made from the longer time series of sampling at NOAA sites may be used to infer the state of recovery over broader areas within the Sound.

Recommendations for future monitoring

Recommendations will be made regarding the type of sampling that is advised in future intertidal and shallow subtidal monitoring. Indicator species will be selected based on 1) their function within the system, 2) their relative importance, either trophically or structurally, their susceptibility to injury, and the expected level of power to detect change of a reasonable magnitude with reasonable sampling effort. This will require a combination of power analyses and judgment based on knowledge of the system and the role of species within the system.

Metrics used to assess the effects of disturbance to the system will be based on the above analyses plus data from other programs (E.g., NVP analyses of mussel growth by O'Clair and sea urchin growth by Dean) in order to recommend efficient means of monitoring.

It is anticipated that a recommendation will be made that will incorporate limited sampling of key metrics for representative species at fixed sites, plus continued studies that develop efficient long term monitoring tools (E.g., remote sensing), or explore processes important to the evaluation of monitoring data.

Personnel and project management

The project will be conducted by a team of scientists who have been directly involved in the coastal habitat studies funded by the Trustees. The work will be coordinated by Coastal Resources Associates, Inc. (CRA). Dr. Thomas Dean, President of CRA will serve as project leader. Key individuals in the Coastal Habitat Injury Assessment program will serve as co-principal investigators: Drs. Steve Jewett and Mike Stekoll of the University of Alaska, Dr. Chuck O'Clair of NOAA, and Dr. Lyman McDonald of WEST, Inc. Other key members of the technical staff include Mandy Lindeberg, Susan Saupe, Dennis Jung, and Michelle Bourassa who have been instrumental in the collection and analysis of intertidal and subtidal data since the inception of the Coastal Habitat program.

Responsibilities for each of the contractors is as follows:

Coastal Resources Associates, Inc. (P.I. Dean)
- Manage the project
- Provide for all logistical support for field sampling efforts
- Assist in sampling and data analysis
- Serve as lead on a manuscript describing the status of recovery

University of Alaska, Fairbanks (P.I.s Jewett and Stekoll)
- Assist in sampling
- Assist in manuscript preparation

NOAA Auke Bay Laboratory (P.I. O'Clair)
- Assist in sampling
- Assist in manuscript preparation

Western Ecosystem Technologies, Inc. (P.I. McDonald)
- Prepare databases of existing data
- Conduct preliminary analyses to assess key habitats and species for monitoring
- Merge existing data with new data obtained in 2000
- Analyze data to assess the status of recovery
- Serve as lead on a manuscript describing methods for assessing recovery and recommendations for future monitoring

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This proposal is being submitted under BAA by Coastal Resources Associates, Inc. However, it is anticipated that a portion of the funding will be directed to the University of Alaska (with contract administration for that portion of the contract conducted by Alaska Department of Fish and Game), NOAA, and WEST (under a BAA with NOAA). Separate budgets are submitted for each of these organizations.

This proposal also will, in part, be a collaborative effort with the NOAA Hazmat group (See attached letter from G. Shigenaka, NOAA Hazmat). They have sampled intertidal sites in Prince William Sound on a more or less continuous basis since 1990, and have agreed to work collaboratively. We will share data and cross reference sampling methods by sampling a subset of 6 sites using both CHIA and NOAA methods in 2000. As part of this collaborative effort, a meeting will be held in Seattle in 2000 with both NOAA Hazmat personnel and this project's PIs in attendance. It is anticipated that more integrated products (E.g., A joint publication on methods of assessing recovery) may result from this meeting.

SCHEDULE

A. Measurable Project Tasks for FY 00 (October 1, 1999 - September 30, 2000)

Sampling will be conducted in summer 2000, and data will be entered and partially analyzed by October 1, 2000. A progress report will be prepared at that time, and a final report and two manuscripts will be completed in FY2001. A description of these is given under "Publications and Reports" below.

B. Project Milestones and Endpoints

All field work will be completed by July 2000, and all data will be entered and databases established by September 30, 2000. Two manuscripts will be completed by April 2001. It is anticipated that the manuscript will be reviewed, revised and submitted for final acceptance by September 2001.

Responsibilities for specific products are as follows:

Coastal Resources Associates, Inc. (P.I. Dean)
Progress report at the end of the first contract year
A manuscript describing the status of recovery

University of Alaska, Fairbanks (P.I.s Jewett and Stekoll) and NOAA Auke Bay Laboratory (P.I. O'Clair)
None

Western Ecosystem Technologies, Inc. (P.I. McDonald)
A manuscript describing methods for assessing recovery and recommendations for future monitoring

C. Completion Date

It is anticipated that the project will be completed by September 2001. Some funding may be required in FY02 for publication costs.

PUBLICATIONS AND REPORTS

Two manuscripts will be prepared and will serve as the final report for the project. Anticipated titles, authorship, and journals for submission are as follows:

Status of recovery of intertidal communities twelve years after the *Exxon Valdez* Oil Spill. TA Dean, SC Jewett, M Lindeberg, C O'Clair, S Saupe, G Shigenaka, and M Stekoll (anticipated submission to Marine Pollution Bulletin)

Methods of assessing recovery following disturbance and implications for monitoring: Examples form the intertidal following the Exxon Valdez Oil Spill. L McDonald, TA Dean, SC Jewett, C O'Clair, M Stekoll. (anticipated submission to Biometrics).

A progress report will be submitted to the Trustee Council in September 2000 summarizing field sampling efforts of the previous summer and summarizing findings from a joint meeting with NOAA Hazmat contractors and project administrators to discuss methods of assessing recovery and recommendations for future monitoring.

PROFESSIONAL CONFERENCES

No funding is being requested for attendance at professional conferences in FY00.

NORMAL AGENCY MANAGEMENT

This project has been developed through collaboration of private sector, NOAA, and University of Alaska scientists. None of the proposers have management responsibility. However, it is anticipated that publications produced will be widely utilized in future management decisions.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The scientists involved in the preparation of manuscripts have worked collaboratively in previous Trustee funded investigations of injury and recovery in coastal habitats.

Several of the authors are also participants in other large ecosystem studies funded by the Trustees. Thomas Dean, Stephen Jewett, and Charles O'Clair are principal investigators for the Nearshore Vertebrate Predator Project and Lyman McDonald serves as consulting statistician for both the Nearshore Vertebrate Predator and APEX projects. The APEX and especially the Nearshore Vertebrate Predator Project have large components that deal with coastal habitats, and new findings produced by these studies will be considered when preparing manuscripts. It is also anticipated that information presented in the manuscripts, along with the information gained in ongoing research and monitoring efforts, will be integrated and utilized in developing future monitoring plans for coastal habitats.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

None

PROPOSED PRINCIPAL INVESTIGATORS

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BIOGRAPHICAL SKETCHES FOR PRINCIPAL INVESTIGATORS

Dr. Thomas A. Dean is President of the ecological consulting firm Coastal Resources Associates, Inc. (CRA) in Vista, CA. Dr. Dean has over 20 years of experience in the study of nearshore ecosystems, and has authored over 20 publications, including several dealing with impacts of the *Exxon Valdez* oil spill on subtidal populations of plants and animals. He has extensive experience in long-term monitoring studies, and has played a major role in both intertidal and subtidal EVOS investigations since 1989.

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 McDonald, B.S., M.S. Oklahoma State University, Ph.D. 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. Charles E. O'Clair, B.S. in Zoology from the University of Massachusetts, Ph.D. in Fisheries from the University of Washington. He is currently a Fishery Research Biologist with the National Marine Fisheries Service, Auke Bay Laboratory in Juneau, Alaska. He has over 16 peer-reviewed scientific publications. His research experience includes nine years of damage assessment and restoration process research related to the *Exxon Valdez* Oil Spill. Other research experience includes 12 years of field and laboratory work on the effects of oil pollution and logging practices on marine benthic invertebrates and research on the ecology and behavior of Dungeness, king and Tanner crabs.

Dr. Michael Stekoll is a Professor of Chemistry and Biochemistry at the University of Alaska Southeast, and the School of Fisheries and Ocean Sciences at the University of Alaska Fairbanks. He has served as the Principal Investigator for the coastal habitat injury assessment (CHIA) study and Herring Bay experimental and monitoring studies that examined the impacts of the EVOS on intertidal and subtidal algae. His specialties include studies of *Fucus, Macrocystis*, and other seaweeds in Alaska.

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Stekoll, M.S. and L.E. Deysher. 1999. Response of the dominant alga *Fucus gardneri* (Silva) (Phaeophyceae) to the *Exxon Valdez* oil spill and cleanup. Submitted manuscript.

BUDGETS

Budgets for individual contractors are attached. A summary of the overall project's budget is as follows:

Contractor	2000	2001
Coastal Resources Associates, Inc.	59,100	25,000
NOAA Auke Bay Laboratory	21,500	11,300
UAF - Fairbanks	14,100	5,900
UAF - Juneau	15,000	6,300
Western Ecosystem Technology, Inc.	23,000	26,900
Total	$132,700	$75,400

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Response and Restoration
7600 Sand Point Way NE BIN C15700
Seattle, WA 98115

April 12, 1999

Dr. Thomas A. Dean
Coastal Resources Associates, Inc.
1185 Park Center Dr., Suite A
Vista, CA 92083

Dear Tom

I enjoyed having the opportunity to chat with you at the Anchorage EVOS Symposium about your work and the possibility of our establishing a much greater degree of collaboration and integration between the CHIA research and our HAZMAT long-term monitoring effort in Prince William Sound. As I mentioned, this is a concept we have long discussed internally in our program but have been stymied to trying to determine a way to implement it. I am therefore very pleased that you are proposing to revisit some of the sheltered rocky CHIA sites as well as some of our sites in an effort to develop an integrated perspective on recovery of the intertidal.

I believe that more closely linking our programs will benefit all of us in ways that exceed the sum of the data. I am particularly excited that we would be able to bring together two of the most knowledgeable statisticians in the environmental monitoring field (Lyman McDonald and John Skalski) to help us understand what the combined datasets can and cannot tell us, and to what extent the data from one program can be used to augment that from the other. I recognize, of course, that we have distinctly different approaches in our respective programs; yet I am certain there are insights to be shared.

We would be happy to assist you in the proposed work by providing epibiota data from our program and by locating our sites and stations in the field. Moreover, I believe that both discrete efforts would benefit from a collaborative planning and brainstorming session that could conceivably take place in early 2000 in conjunction with the regularly scheduled field and strategic planning meeting we anticipate for the HAZMAT program. One of the proposed products for your program is a series of recommendations for future monitoring, which is very similar to our tentatively scheduled reporting product for the year 2000: Insights and guidance for sampling design. Again, I think we both benefit by tossing around ideas and approaches in this kind of informal "peer review."

I'm willing to back up my enthusiasm for increased collaboration with material support, although it's not yet clear to me what form and what level would be required to facilitate our mutual interests. I know I have the support of the managers here in HAZMAT as well as our NOAA rep in the Restitution Program process.

In summary, I fully support your proposal to the Trustee Council and offer the resources of our monitoring program to assist in whatever way we reasonably can. Please let me know how we can help.

Sincerely,

Gary Shigenaka
Marine biologist
NOAA/HAZMAT

2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel	$0.0	$21.6
Travel	$0.0	$2.1
Contractual	$0.0	$14.4
Commodities	$0.0	$1.0
Equipment	$0.0	$0.0
Subtotal	$0.0	$39.1
Indirect		$20.0
Project Total	$0.0	$59.1
Full-time Equivalents (FTE)	0.0	3.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$25.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:

Indirect costs calculated as follows:
Indirect costs = Overhead + General and Administrative costs + Fee
Overhead = 59.5% of personnel costs
G&A = 12.85% of personnel + overhead + other direct (excluding contractual)
Fee = 4% of Total Direct + Indirect (excluding contractual)

No overhead or fees are charged on contractual costs

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Thomas A. Dean - Coastal Resources Associates, Inc.

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	T.A. Dean	Senior Scientist, P.I.	2.0	8.0	0.0	16.0
	S. Saupe	Field Assistant	1.0	3.7	0.0	3.7
	D. Jung	Field Operations Manager	0.5	3.7	0.0	1.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	3.5	15.4	0.0	
					Personnel Total	$21.6

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	RT - San Diego to Anchorage	0.6	1	2	0.20	1.0
	RT- San Diego to Seattle	0.3	1	4	0.15	0.9
	Mileage and parking	0.1				0.1
	Car rental	0.1				0.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$2.1

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Thomas A. Dean - Coastal Resources Associates, Inc.

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU E COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
Vessel charter for 12 days @ $1,200/day	14.4
Contractual Total	**$14.4**

Commodities Costs:	Proposed FY 2000
Description	
Misc. replacement materials for intertidal studies -- data sheets, clipboards, rain gear, boots, site-levels, rebar, hammer drills, etc. Plus freight charges for equipment/sample shipping.	1.0
Commodities Total	**$1.0**

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Thomas A. Dean - Coastal Resources Associates, Inc.

FORM 4B
Contractual & Commodities DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units
None	

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Thomas A. Dean - Coastal Resources Associates, Inc.

FORM 4B
Equipment
DETAIL

2000 EXXON VALDEZ TRL E COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel	$0.0	$15.9
Travel	$0.0	$2.6
Contractual	$0.0	$0.0
Commodities	$0.0	$0.6
Equipment	$0.0	$0.0
Subtotal	$0.0	$19.1
General Administration	$0.0	$2.4
Project Total	$0.0	$21.5
Full-time Equivalents (FTE)	0.0	0.2

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$11.3	$0.0		

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments:

FY00

Prepared: 4/13/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations
Agency: NOAA Auke Bay Laboratory- Charles O'Clair

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
C.E. O'Clair	Fisheries ResearchBiologist	12	1.0	8.7		8.7
M. Lindeberg	Fisheries ResearchBiologist	9/2	1.5	4.8		7.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	13.5	0.0	
					Personnel Total	$15.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Juneau/Anchorage - RT	0.4	2	2	0.2	1.2
Juneau/Seattle - RT	0.6	1	4	0.2	1.4
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.6

FY00

Prepared: 4/13/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations
Agency: NOAA Auke Bay Laboratory- Charles O'Clair

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
none	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 2000
Description	
Misc. Field Supplies	0.6
Commodities Total	$0.6

FY00

Prepared: 4/13/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations
Agency: NOAA Auke Bay Laboratory- Charles O'Clair

FORM 3B
Contractual & Commodities
DETAIL

2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
none			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Prepared: 4/13/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations
Agency: NOAA Auke Bay Laboratory- Charles O'Clair

FORM 3B
Equipment
DETAIL

2000 EXXON VALDEZ TRI E COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$8.3						
Travel		$1.6						
Contractual		$0.0						
Commodities		$1.4						
Equipment		$0.0						
Subtotal	$0.0	$11.3			Estimated FY 2001	Estimated FY 2002		
Indirect		$2.8						
Project Total	$0.0	$14.1			$5.9			
Full-time Equivalents (FTE)		1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

The indirect rate is 25% TDC as negotiated by the Exxon Valdez Oil Spill Trustee Council with the University of Alaska.

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Stephen C. Jewett - University of Alaska - Fairbanks

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
S. Jewett	PI / Research Professor		1.0	8.3	0.0	8.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	1.0	8.3	0.0	
					Personnel Total	$8.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
RT Fairbanks to Anchorage		0.3	1	2	0.15	0.6
RT Fairbanks to Seattle		0.4	1	4	0.15	1.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.6

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Stephen C. Jewett - University of Alaska - Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
None	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2000
Description	
Misc. field supplies	0.2
Fuel for skiff	0.6
Skiff repair/maintenance	0.6
Commodities Total	$1.4

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Stephen C. Jewett - University of Alaska - Fairbanks

FORM 4B
Contractual & Commodities DETAIL

New Equipment Purchases:			
Description	Number of Units	Unit Price	Proposed FY 2000
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:		
Description	Number of Units	
Two skiffs purchased with EVOS funds	2	

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Stephen C. Jewett - University of Alaska - Fairbanks

FORM 4B
Equipment
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel	$0.0	$9.7
Travel	$0.0	$2.1
Contractual	$0.0	$0.0
Commodities	$0.0	$0.2
Equipment	$0.0	$0.0
Subtotal	$0.0	$12.0
Indirect	$0.0	$3.0
Project Total	$0.0	$15.0
Full-time Equivalents (FTE)	0.0	1.0

LONG RANGE FUNDING REQUIREMENTS	
Estimated FY 2001	Estimated FY 2002
$6.3	$0.0

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments:

The indirect rate is 25% TDC as negotiated by the Exxon Valdez Oil Spill Trustee Council with the University of Alaska.

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Michael Stekoll - University of Alaska - Fairbanks

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRU E COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
M. Stekoll	Associate Professor of Chemistry and Biochemistry		1.0	9.7		9.7
		Subtotal	1.0	9.7	0.0	
					Personnel Total	$9.7

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
					0.0
RT Juneau to Anchorage	0.4	1	2	0.20	0.8
RT Juneau to Seattle	0.7	1	4	0.15	1.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.1

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Michael Stekoll - University of Alaska - Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRI E COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
None	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2000
Description	
Misc. field supplies	0.2
Commodities Total	$0.2

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Michael Stekoll - University of Alaska - Fairbanks

FORM 4B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units
None	

FY00

Prepared:

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Michael Stekoll - University of Alaska - Fairbanks

FORM 4B
Equipment
DETAIL

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$0.0	$10.5						
Travel	$0.0	$1.0						
Contractual	$0.0	$0.0						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$0.0	$11.5			Estimated FY 2001	Estimated FY 2002		
Indirect		$11.5						
Project Total	$0.0	$23.0			$26.9	$0.0		
Full-time Equivalents (FTE)	0.0	1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
L. McDonald	Senior Scientist, P.I.		0.5	7.9	0.0	4.0
M. Bourassa	Biometrician I		1.5	4.3	0.0	6.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	2.0	12.2	0.0	
					Personnel Total	$10.5

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
RT Denver to Seattle		0.4	1	4	0.15	1.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.0

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
None	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2000
Description	
None	
Commodities Total	$0.0

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

FORM 4B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRU: : COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	
None		

FY00

Prepared: 4/8/99

Project Number: 00510
Project Title: Recovery of Intertidal Communities and Recommendations for Future Monitoring - Submitted Under BAA
Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

FORM 4B
Equipment
DETAIL

SYNTHESIS OF CONSERVATION BIOLOGY INFORMATION, AND TRANSFER OF THE INFORMATION TO RESOURCE MANAGERS AND UNIVERSITY STUDENTS

Project Number:	00511
Restoration Category:	Ecosystem Synthesis; Information transfer to resource managers and stakeholders Transition to long-term monitoring and research program
Proposer:	Alaska Natural Heritage Program Environment and Natural Resources Institute University of Alaska Anchorage
Lead Trustee Agency:	
Cooperating Agencies:	
Alaska SeaLife Center:	Yes
Duration:	1st year, 3-year project
Cost FY 00:	$222,900
Cost FY 01:	$214,000
Cost FY 02:	$220,000
Geographic Area:	Anchorage, Seward
Injured Resource/Service:	All specie and ecosystem resources

ABSTRACT

The project would develop a state of the art data-system to track the health of species and ecosystems damaged by the oil spill, evaluate the recovery of each, and transfer the information to resource managers and university students. Only information specific to *conservation biology*—population numbers, processes, etc.—would be synthesized. This entails integrating disparate data from multiple studies that often reached conflicting results. The health of each damaged resource would be evaluated using the data-system results. Thorough presentations that translate the concepts of conservation biology in relationship to the damaged resources would be developed for resource managers and university students (two courses)

INTRODUCTION

The Alaska Natural Heritage Program (AKNHP) is proposing to synthesize information specific to the field of *conservation biology* for species and ecosystems damaged by the Exxon Valdez oil spill (EVOS). The information would be incorporated into a data-system to evaluate the recovery of species and ecosystems, and transferred to resource managers and students through educational programs and an Internet Web page. The field of conservation biology provides the scientific and technical means for the protection, maintenance, and restoration of species, ecosystems and the ecological processes that support them. It represents a marked divergence from past management techniques in that the conservation of species and ecosystems are addressed at multiple spatial and temporal scales.

The project would require two Research Associates for three years. One position would concentrate on marine conservation biology issues, and the other position on the terrestrial-marine interface such as seabirds and forage fish. They would join the State of Alaska's and the University of Alaska's primary conservation biology database program that tracks threatened species and ecosystems, the Alaska Natural Heritage Program. The proposed budget (see Project Budget pages) would not be adequate to complete the project. AKNHP and the University of Alaska Anchorage (UAA), consequently, would contribute $49,000 of personnel time to make up the difference in the first year, and an equal amount in each subsequent year.

The introduction addresses the development of three products:

1. Develop a data-system that integrates information needed to evaluate the recovery of species and ecosystems damaged by the Exxon Valdez oil spill.

2. Evaluate the recovery and conservation status of the damaged resources using the data-system and a synthesis of the available literature.

3. Transfer the synthesized conservation biology information to resource managers and university students.

In addition, the use of the data-system as a model for long-term monitoring of species and ecosystems in the northern Gulf of Alaska is discussed.

A. EVOS Conservation Biology Data-system

A data-system would be developed to track the health of species and ecosystems in the oil spill affected area, conduct conservation biology analyses, and to transfer the information to resource managers and students. The state of the art data-system would integrate data, computer programs and technology, and applied and theoretical conservation biology techniques. Information on species and ecosystems damaged by the Exxon Valdez oil spill—listed in table 1—would be synthesized into the data-system. This entails taking disparate data from multiple studies that often used different methods and reached conflicting results, and synthesizing the information.

Table 1. The project would address the following reduced list of injured species and ecosystems by recovery status, and five of the nine resource clusters identified by the EVOS Trustee Council.

Resource Clusters	*Not Recovering*
Pink Salmon Project	Cormorants
Herring Projects	Harbor Seals
Sockeye Salmon Program	Harlequin Ducks
Cutthroat & Dolly Varden Trout Projects	Killer Whales
Marine Mammal Program	Marbled Murrelets
	Pacific Herring
Recovered	Pigeon Guillemot
Bald Eagle	Sea Otters
Recovering	*Recovery Unknown*
Common Murres	Black Oystercatchers
Intertidal Communities	Clams
Mussels	Common Loon
Pink Salmon	Cutthroat Trout
Sockeye Salmon	Designated Wilderness Areas
Subtidal Communities	Dolly Varden
	Kittlitz's Murrelet
	River Otter
	Rockfish

The EVOS data-system would be flexible to meet restoration needs by using several computer software programs. These include programs to process remotely sensed data (ERDAS Imagine), geo-referenced data (ArcInfo, ArcView), computer models developed in various formats, and tabular and textual data. The information in the data-system would be linked with The Nature Conservancy's central scientific databases that deals with biodiversity issues. This approach ensures that all components of the system would be addressed for the EVOS information outreach and implementation of conservation biology.

Information incorporated into the data-system would be specific to species and ecosystem conservation. A hierarchical approach would be used to organize the information based on genetics (if available), species, and ecosystems at multiple spatial and temporal scales. Genetic and species information would be synthesized by tracking trends in distinct populations using a Geographic Information System (GIS), past and present population locations, causes of population fluctuations, restrictions in gene or population flow, food source, and food source perturbations (Seeb et al. 1997). Ecosystem information would include such subjects as perturbation, process, and ecosystem delineation. To be included in the data-system, however, the ecosystem information would need to be critical to the survival of species damaged by the oil spill, or the ecosystem itself was damaged and its recovery and health must be tracked, such as oiled intertidal zones (Holland-Bartels 1998).

The data-system, although powerful, does not provide an easy means of transferring data to resource managers and students due to difficulty in use. The results, consequently, would also be placed into ArcView, a program that is user friendly, widely used by resource managers and

students, and has the ability to integrate different types of spatial and temporal information. The ArcView results would then provide an easy means of making the results available to resource managers and students.

B. Evaluate Recovery of Damaged Resources

An evaluation of species and ecosystem recovery would be made based on synthesized information and the results of the data-system. Some species and ecosystems have thorough EVOS Trustee Council funded research programs such as those developed for killer whales (C. Matkin and E. Saulitis), harbor seals (K. J. Frost), and sea otters (J. L. Bodkin and B. E. Ballachey). AKNHP would not duplicate their results but would provide a unique evaluation of recovery based on all the conservation biology data pertinent to the damaged resource. This would include close coordination with the appropriate resource experts.

For spatial concerns, issues would be addressed ranging from population fluctuations, distribution change, the size of an area needed to maintain species, habitat diversity and its relationship to species diversity, and the effect of disturbance size—ranging from an oiled beach to El Nino—on the maintenance of species and ecosystem diversity (Eggeling 1947, MacArthur 1958, Rosenzweig 1992). Temporal issues critical for conserving species and ecosystems would be evaluated including changes in species composition and processes over time at multiple scales—daily, seasonally, successional, and evolutionary time (Whittaker 1970, Sepkoski 1984). The causes of species extinction—environmental accidents and competition between species—would also be addressed and linked to the spatial and temporal concerns needed to maintain healthy species and systems (Simpson 1953, Park 1962, Bush and Howard 1986).

C. Transfer Information to Resource managers and students

Development of the EVOS conservation data-system by itself—including the ArcView product—is not adequate for transferring the information to resource managers and students. The information must be interpreted and synthesized into a cohesive educational product that easily translates the concepts of conservation biology and the status of damaged resources to the audience. An information outreach, consequently, in addition to the data-system is necessary. The EVOS information outreach would be composed of presentations, the data-system and an Internet Web page described below.

Resource Managers Information Outreach

The information would be transferred to resource managers in the oil-affected area through presentations, ranging from one hour to full day courses. A one to two day technical course would be developed describing what data is available, how to access it, importance of the results, and a review of the recovery status of the various damaged resources. Demonstrations and instructions on how to use the data-system—both the ArcView version and full data-system—would be presented. The one-hour presentations would be geared to review the status of various resources and program descriptions. Presentations would, in addition, be given to communities and groups interested in the oil spill affected area such as Port Graham, Valdez, and the Audubon Society.

Various educational technical tools would be utilized and developed from the available EVOS information—with permission of the authors—in order to demonstrate conservation biology techniques. These include GIS layers and computer models showing the distribution of various species in relation to their predators and prey (such as developed by the Nearshore Vertebrate Predator [NVP] study), oil spread predictive models, marbled murrelet habitat models, etc. These layers would, when possible, be integrated into a format, such as ArcView, that would enable resource managers to manipulate the data and explore different results.

University Student Information Outreach

Two courses would be developed to transfer EVOS conservation biology information to university students. The primary educational materials would be the research conducted through EVOS Trustee Council funded projects, and educational technical tools (computer models, GIS layers, etc.). The two AKNHP incumbents would work in close coordination with personnel from the University of Alaska Fairbanks, UAA, Prince William Sound Science Center and the Alaska SeaLife Center. This coordination would enable the incumbents to maximize the use of existing research facilities, and to coordinate with educational outreach programs such as the Discovery Education programs at the Alaska SeaLife Center. Part of the project would be to determine what courses would be appropriate for an outreach, but at this time we feel the following courses would be most appropriate: *Conservation Biology in the North Gulf of Alaska and South-central Alaska*, and *Restoration Ecology Following the Oil Spill of the Exxon Valdez.* The following are descriptions of each course.

Conservation Biology in the North Gulf of Alaska and South-central Alaska would examine factors that lead to the maintenance of species, speciation and extinction. Ecosystems of the north Gulf of Alaska and south-central Alaska—including climate, oceans, and terrestrial environments—would be described, how they function, their stability, and how these systems interact and feedback on each other. Disturbance factors would be discussed such as the Exxon Valdez oil spill. The course would emphasize marine species stability and the tools of conservation biology (gap analysis, representativeness assessment, hierarchical classification, etc.).

Restoration Ecology Following the Oil Spill of the Exxon Valdez would emphasize lessons learned from the Exxon Valdez oil spill, and restoration ecology following oil spills. The Alaska SeaLife Center would be visited to observe how critically injured or sick animals are treated and studied for the purpose of improving rehabilitation techniques. Students would also board a ship to observe and participate in conservation techniques such as seabird censusing, phytoplankton and zooplankton sampling, glacier-marine ecosystem interactions, visit an oiled beach, and discuss estuarine processes. Other subjects would include restoring over fished populations, effects of land management policies (timber harvesting, dams) on anadromous fish health, and the restoration of marine mammal and seabird populations.

Web Page

The Web page would be designed specifically to house and distribute the data-system results. Hot links to other government agency and private group Web pages that are concerned with biodiversity issues in the oil spill affected area would be made, such as The Nature Conservancy, U. S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

The physical location of the Web page would depend on whether the EVOS Trustee Council wants the Web Page in-house or at AKNHP.

C. Long-term Goal of the EVOS Conservation Biology Program

UAA's ultimate goal is to have a permanent EVOS conservation biology program for the northern Gulf of Alaska housed at the Alaska Natural Heritage Program. Consequently, at the completion of the project UAA and the EVOS Trustee Council would evaluate the project and a decision would be made on whether to permanently fund the program with support from both UAA and the EVOS Trustee Council. If the program is continued past its initial three years it would become a primary method to manage and synthesize EVOS long-term monitoring data in the field of conservation biology, and to alert government agencies and the public to species declines and damaged ecosystems for the northern Gulf of Alaska.

A long-term program provides other advantages. For example, it would enable the two incumbents to participate in field monitoring efforts of resources damaged by the oil spill. The data-system would allow tracking and monitoring of critical biological concerns not damaged by the spill such as declining populations within the study area, invasive non-native marine-intertidal species, and additional species and systems susceptible to the oil spill. Another potential project would be the identification of marine and terrestrial regions and processes critical to the maintenance of biodiversity in the oil spill affected area. These studies—called ecoregional analysis—are now being conducted throughout North America, and would help the EVOS Habitat Protection program identify and protect habitats that would benefit the recovery of injured resources.

NEED FOR THE PROJECT

A. Statement of Problem

The project would address two problems:

1. Information specific to conservation biology for the EVOS study area has not been fully synthesized for the purpose of tracking the health of species and ecosystems, and for conducting analyses using conservation biology techniques.

2. The available EVOS information in the field of conservation biology is not being adequately transferred to the people most in need of the information, resource managers and university students seeking education in conservation techniques.

Need to Synthesize Information

Species and ecosystems damaged by the Exxon Valdez oil spill need to be monitored to provide warning of possible species declines and the degradation of ecosystems. Most of North America has databases—primarily the national network of Natural Heritage Programs—to track the health of species and ecosystems. A thorough data-system of this type does not exist for the Exxon Valdez oil spill region.

Some EVOS oil damaged species and ecosystems have excellent research programs associated with them, such as Steller's sea lion and the killer whale. The proposed data-system would not duplicate their results but would work with the researchers to ensure a collaborative understanding of species status. The majority of species and systems, however, have only scattered and inconsistent population data from multiple studies using different methods, and often reaching conflicting results. Spatial and temporal gaps in any data set are the norm rather than the exception. In fact, many of the EVOS studies— Sea Ecosystem Assessment (SEA), Alaska Predator Ecosystem Experiment (APEX), and NVP—will end soon leaving a temporal gap in any field data useful for monitoring efforts. The proposed synthesized information, however, is the best attempt available to understand species and system recovery, to identify and fill data gaps, and to assess resources from a conservation biology context.

Need to Transfer Information

A problem that the EVOS Trustee Council has identified is the ongoing need to "transfer study results to resource managers and stakeholders so that they can take full advantage of what has been learned through the EVOS program (EVOS Trustee Council 1999). " The information transfer tends to be between researchers and not to resource managers and university students. Also, there is no system in place to transfer the proposed EVOS data-system results and conservation biology information to resource managers and students.

B. Rationale/Link to Restoration

The project would help the recovery of damaged resources by providing an accurate and cost-effective means to monitor the recovery of species and ecosystems in the spill-affected region. This program allows the public and resource managers the ability to view the recovery of the oil effected area from both a coarse (ecosystem) and fine (genetic and species) ecological framework. The data would also be used to determine what marine and terrestrial areas are most important to protect because of their biological significance. As new research and monitoring projects begin or end there needs to be a permanent method to synthesize the results for the purpose of tracking species and ecosystem health.

The project should also be done because monitoring the health of species and systems is important for both economic and biodiversity issues, especially because the two are closely linked in the oil spill affected area. Most of the coastal villages are heavily dependent on the fishing industry, especially Native American subsistence harvests. The Web of life links the smallest to the largest species—phytoplankton to salmon to brown bears—and any loss or decline in this web can have profound effects to the ecosystem and to the economics of the region.

The transfer of EVOS information to Alaska's youth is also critical for maintaining healthy ecosystems in the region. The importance of the transfer of EVOS knowledge for the education of Alaska's college students cannot be overstated. Species and ecosystem recovery requires well-educated and informed people in such fields as restoration ecology, conservation biology and ecosystem biology. Access to one of the most comprehensively studied marine-terrestrial systems in North America—the Exxon Valdez oil spill study area—provides an extremely powerful conservation biology educational capability.

C. Location

This project would be conducted at the Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage. AKNHP's office is located off-campus at 707 A Street, Anchorage, Alaska.

All communities in the oil-affected area would realize benefits by having access to the data-system through a Web page and direct mailing. Resource managers that work in the oil spill affected area and south-central Alaska would have access to the data-system and presentations would be given describing the information and system. Alaskan college students studying conservation biology and the consequences of the Exxon Valdez oil spill would have the ability to take courses on the subject at UAA.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Communities would be informed about the project through the information transfer effort. This includes presentations of EVOS conservation biology results to community groups and resource managers, and two university courses. Presentations would be given to many communities in the oil-affected area including Tatitlek, Chenega, Seward, Homer, Port Graham, and Kodiak. This community information outreach includes communication of the results in non-technical terms.

All relevant information—including traditional knowledge—would be incorporated into the data-system. Hugh Short and Dr. Henry P. Huntington of the Chugach Regional Resources Commission would be contacted to understand the current status of traditional knowledge and how to access it. AKNHP has a strong history of working with Native American groups and villages and would continue this tradition during the proposed project. Examples of this work include a current project with the Bristol Bay Native Association to develop environmental indicators for the Nushagak-Mulchatna watershed, and a project on medicinal flora of the Alaska Natives (Garibaldi 1999).

PROJECT DESIGN

A. Objectives

1. Synthesize information specific to the field of *conservation biology* from the Exxon Valdez oil effected area into a data-system designed to monitor and evaluate species and ecosystem recovery.

2. Evaluate the recovery and conservation status of the damaged resources using the data-system and a synthesis of the available literature.

3. Transfer the conservation biology information to resource managers and university students through an information outreach, educational programs and a Web page.

B. Methods

The following is a summary of the methods, and the major steps of the project are given in figure 1. Data would be gathered on oil spill damaged species and ecosystems regardless of source or age. The information would be synthesized into a data-system composed of a suite of application software including image processing, geospatial data analysis and word processing. Recovery of the damaged resources would be evaluated. The information would then be transferred to resource managers, and university students through presentations, university courses and a Web page.

Data-system Development

Prior to developing the data-system, resource agency personnel and other groups—local and national environmental groups—would be contacted to determine what conservation information would meet their needs. The coordination between agencies and AKNHP would include reviewing each field to be entered in the system. Many of the information categories that would be proposed to the resource agencies and other groups for incorporation into the data-system are given in Table 2. This before-development contact would ensure that the new system could use existing data sets, that the EVOS data-system would be transferable to resource agency databases, and to ensure acceptance of the data-system by resource agencies in Alaska. The process would be repeated after a draft of the data-system had been developed.

Table 2. Examples of types of information that would be incorporated into the data-system:

Species Information	*Ecosystem Information*
Population size by area, year and season	Ecosystem description
Population range by year and season	Ecosystem distribution
Species health and trend	Ecosystem health and trend
Habitat requirements	Ecosystem needs
Protection status	Protection status
Threats to species	Threats to ecosystem
Inventories needed	Inventories needed
Suggested protection needs	Suggested protection needs
Species rarity ranking	
Species-important life history components	*Bibliographic Information*
Food source range by year and season	Abstract
Food source status	Citation
Food source size	Results or conclusions
	References.

The EVOS data-system would be built on the best qualities of the most widely used conservation biology database in North America, the Biological Conservation Database developed by The Nature Conservancy and Heritage Programs. The data-system would be adapted specifically for the northern Gulf of Alaska, and improved to reflect the most current concepts for sustaining species and systems. In the data-system, each species and ecosystem would be treated separately for the evaluation of their health and restoration. The data layers, however, would be interactive because a single layer may be critical for the maintenance of several species, ecosystems and processes.

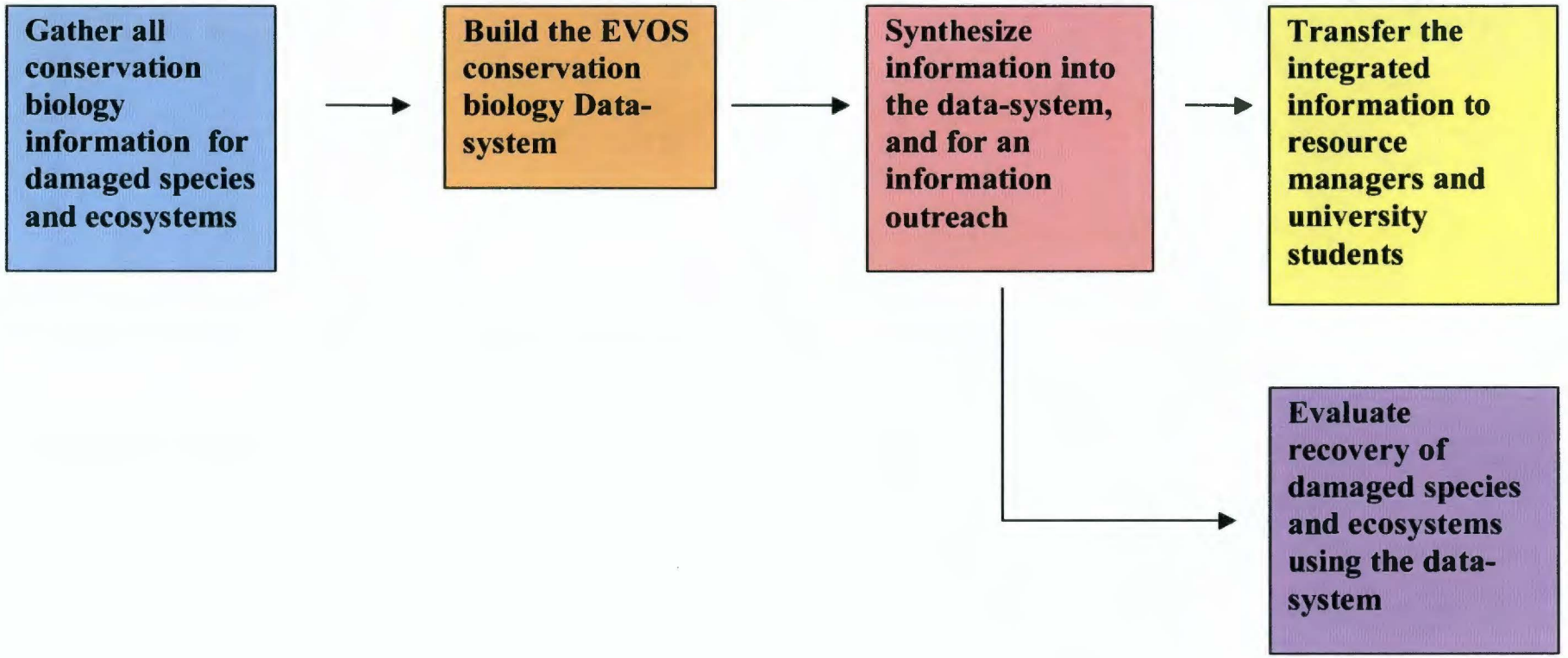

Figure 1. Major steps and products for the EVOS conservation biology program

Existing data, GIS layers, remote sensed images, and other information needed to develop the species and ecosystem component would be gathered from a variety of federal, state and private sources. This includes data from other databases such as the EVOS Research and Restoration Project Database, AKNHP, and NMFS. Hardcopy maps and data would be reviewed and digitized using ArcInfo GIS software. To provide consistency and the ability to process between maps AKNHP would integrate pertinent GIS maps into a common format and projection. For those data that are automated but do not reside as a GIS layer formatting would be performed to import the data with associated coordinate and attribute information. The program ERDAS Imagine would be used for remote sensed data, and computer models would be incorporated as appropriate. The relational database Access would be the used for the entry of tabular information, and Microsoft Word would be used for textual data entry. Conversion and statistical packages enabling the conversion and transfer of information between platforms would be incorporated.

For any species or ecosystem the user would be able to access several coarse scale maps of the northern Gulf of Alaska for orientation purposes including bathymetry, and satellite imagery (Landsat or Spot), and zoom in on any region of interest. Finer scale layers such as species range, haulouts, bird colonies, seasonal locations, and habitat based on predictive models would be included. Ancillary data per location would include such variables as population size, dates of occurrence, causes of population change, photographic records, etc. Each species and ecosystem project and its various layers would be linked to other species and ecosystem projects and layers. Certain data layers and computer models would remain in their original formats due to conversion problems or the need to retain the data in more powerful programs or in programs best adapted for their use. This also includes textual data that would be better transferred in a word processing format.

A single ArcView Project would be developed for each damaged species or ecosystem. If possible, computer models developed by researchers would be converted to an ArcView script.

A full bibliography would also be included. Fortunately, most citations have already been compiled through various sources (USGS-Biological Resources Division (BRD) Prince William Sound Ecosystem Initiative, Cook Inlet Information Management System, Kachemak Bay Ecological Characterization, and AKNHP's Biological Conservation Database). AKNHP would work cooperatively with these groups to ensure a thorough integration of the bibliographies.

Evaluate Recovery of Damaged Resources

An evaluation of species and ecosystem recovery would be made based on research results, data, and results of the data-system. Summaries for species and ecosystems that have thorough research programs—such as for killer whales (C. Matkin and E. Saulitis), harbor seals (K. J. Frost), and sea otters (J. L. Bodkin and B. E. Ballachey)—would be integrated to evaluate recovery,. The issues listed in table 2 would be addressed in the evaluations of recovery. Other issues to be addressed would be area size, habitat diversity, and the effect of disturbance size on the maintenance of species and ecosystems. Temporal issues include changes in species composition and processes over time at multiple scales—daily, seasonally, successional time, and evolutionary time.

Final statistical tests are not given because AKNHP is proposing to integrate data for monitoring purposes instead of proposing a specific *field* monitoring project that employs a single method to all data collected. Consequently, the type of statistics AKNHP would use for trend evaluations is dependent on the availability and accuracy of the data. The following, nonetheless, are some standard statistical tests that could be used. For single site or absolute population measures, statistics with strong statistical power would be used such as analysis of variance, or comparing the slope of the expected regression line (stable) versus the observed slope. When multiple factors are involved—such as when evaluating ecosystem recovery—statistical tests such as multiple regression or ordination techniques would be used. These are not necessarily the strongest statistical tests, but they do enable the researcher to evaluate whether there is a trend or difference between years or sites. To test for a change in species distribution, a variance from the poisson distribution test would be used. Statistics for extrapolating spatial information from limited data would include trend interpolation analysis and surface-analysis functions found in the geospatial program ArcInfo.

Transfer of information

Presentations and courses for the transfer of information to resource managers and university students would be developed concurrently. The presentations would be developed by the incumbents and oriented towards the appropriate audience.

Educational tools would be developed from the available EVOS information—such as APEX and SEA—with permission of the authors. These include GIS layers and computer models showing the distribution of various species in relation to their predators and prey, oil spread predictive models, and marbled murrelet habitat models. Output from the EVOS data-system, such as species trend analysis, would also be used. These layers would be integrated into a format (ArcView) that would enable students to manipulate the data and results.

A Web Page would be developed to include downloadable map graphics, textual descriptions, and data files for each species and ecosystem. The first step would be to design the overall site (Interface Design) for the project, emphasizing a user-friendly environment with easy downloading capabilities. Page templates would be created and contain downloadable files such as Access, Microsoft Word, E00, ArcView.apr, and ArcInfo_view. The interactivity of the Web site would then be tested. The final step would be to transfer the Web site to the EVOS server (if desired by EVOS Trustee Council), and test the page to insure that the dynamics of the site and its links continue to function on the World Wide Web.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

No other Trustee agency is requesting funds for the project. Development of the Web Page would be contracted to the private sector.

SCHEDULE

The following is an estimation of the percent time the two incumbents would devote to complete each project objective: data-system 60% of time, evaluation of species and ecosystem recovery 20%, and transfer of the information to resource managers and university students 20%.

A. Measurable Project Tasks for FY 00 (October 1, 1999 – September 30, 2000)

November 1:	Hire two conservation biologists
December 1:	Consult with resource managers and other groups about data-system
January 1:	Design data-system
January 18:	Attend EVOS symposium
February 1:	Resource managers and other groups' review proposed data-system design
June 9:	Attend Society for Conservation Biology meeting
July 1:	Finish collecting data and information
September 30:	For six of the damaged resources, complete synthesis of data and integrate information into the data-system

B. Project Milestones and Endpoints

September 30, 2001:	Completion of the objective "synthesize information specific to the field of *conservation biology* from the Exxon Valdez oil effected area into a data-system designed to monitor and evaluate species and ecosystem recovery."
September 30, 2002:	Completion of the objective "Evaluate the recovery and conservation status of the damaged resources using the data-system and a synthesis of the available literature."
September 30, 2002:	Completion of the objective "Transfer the conservation biology information to resource managers and university students through an information outreach, educational programs and a Web page."

The following is the Fiscal Year 2001 schedule.

January 1:	Develop preliminary teaching tools and aids (computer models, GIS, remote sensed information, data)
March:	Attend EVOS symposium
April 15:	Submit annual report (FY OO findings)
May 15:	Give presentations to resource managers, communities, and teach the two university courses using preliminary synthesized data and findings
June:	Attend Society for Conservation Biology meeting
September 15:	Complete a prototype Web page
September 30:	Complete synthesis of data and information into the data-system for all damaged resources

The following is the Fiscal Year 2002 schedule.

January 1:	Complete modification and development of teaching tools and aids
March:	Attend EVOS symposium
April 15:	Submit annual report (FY O1 findings)

May 15:	Give presentations to resource managers, communities, and teach the two university courses using the full data-system and teaching tools
June:	Attend the Society for Conservation Biology meeting
September 1:	Update the EVOS conservation biology data-system
September 15:	Complete the Web page
September 30:	Evaluate the recovery and conservation status of damaged resources.

C. Completion Date

September 30 2002:	All objectives completed.
April 15, 2003:	Submit final report (FY O2 findings)

PUBLICATIONS AND REPORTS

A minimum of two manuscripts would be submitted for publication during the course of the project. The title of the manuscript, name of the peer-reviewed journal, and date of submittal are given below.

Integrated ecosystem recovery following the spill of the Exxon Valdez;
Conservation Biology; 2001

Evaluation of the damaged resources using the EVOS conservation biology data-system;
Conservation Biology; 2002

If the project were continued indefinitely past the first three years, the data-system would be used for research purposes and more publications for peer-reviewed journals would be developed, such as identifying areas of critical biological concern in the oil spill affected area using ecoregional analysis.

PROFESSIONAL CONFERENCES

Exxon Valdez Oil Spill Symposium, March 2000, Anchorage, Alaska.
One paper would be presented on the initial steps in the development of the EVOS conservation biology data-system.

2000 Annual meeting of the Society for Conservation Biology, 9-12 June 2000, University of Montana, Missoula, Montana.
One paper would be presented on the development of the EVOS conservation biology data-system.

Exxon Valdez Oil Spill Symposium, March 2001, location unknown.
Two papers would be presented evaluating the recovery of specific species and ecosystems using the data-system.

2001 Annual meeting of the Society for Conservation Biology, June 2001, location unknown. Two papers would be presented evaluating the recovery of specific species and ecosystems using the data-system.

Exxon Valdez Oil Spill Symposium, March 2002, location unknown.
Two papers would be presented: one on the synthesized results evaluating the recovery of the oiled area as a whole, and one paper evaluating recovery of specific species and ecosystems.

2002 Annual meeting of the Society for Conservation Biology, June 2001, location unknown. Two papers would be presented: one determining the accuracy of using data-systems to evaluate resource recovery, and the other evaluating the recovery of the oiled area as a whole.

NORMAL AGENCY MANAGEMENT

Not applicable

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed project would be integrated with other restoration efforts by synthesizing their results into the data-system. There would be a concerted effort during the first year of the project to obtain additional funds for a statewide extension of the data-system from all interested State and Federal agencies. The agencies would be contacted and asked to contribute money and resources to ensure the conservation of biological diversity in Alaska and its marine environments. The statewide project would provide direct rewards to the EVOS data-system in the form of monetary contributions to data management and maintenance of the system, especially on a long-term basis.

PROPOSED PRINCIPAL INVESTIGATOR

Initially, Keith Boggs would be principal investigator. When the two incumbents (marine biologist; terrestrial-marine ecologist) are hired for the project they would become co-principal investigators. The two new personnel are needed for the project because all AKNHP personnel are involved in other projects and cannot devote the time necessary to complete this new project in a timely manner.

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PRINCIPAL INVESTIGATOR

The qualifications of Keith Boggs in relation to this project are in project management and the coordination of databases. He has experience as principal investigator coordinating multiple projects at UAA, and is currently principal investigator on three projects, two with the Environmental Protection Agency and one through the USDI National Park Service. Past projects ranged from describing tidal marshes, to conducting representativeness assessments using GIS (Boggs and Shephard 1999, Duffy et al. 1999). His experience in coordinating databases includes involvement with a current National Park Service project that integrates satellite image processing, GIS, Web Page and database programs to develop a Web based satellite map product. He is also knowledgeable of the various programs used to maintain and distribute AKNHP information (ArcInfo, ArcView, Biological Conservation Database).

AKNHP's experience and abilities provide significant qualifications for completing the project at the highest level of quality possible. AKNHP is a leader in the field of conservation biology in Alaska, maintaining the only statewide database on rare species and ecosystems and completing numerous conservation biology projects. This database—developed by The Nature Conservancy and Natural Heritage Programs—has proved highly effective in tracking species and ecosystem health in many countries and most of North America. AKNHP also has extensive experience producing products in the field of conservation biology and a few examples follow. It has completed a rare plant species database for Alaska, including a book on rare plants and their habitats in cooperation with the University of Alaska Fairbanks (Lipkin and Murray 1997). Dr. David Duffy—former manager of AKNHP—is the coordinator for the APEX project and many of its products were developed through AKNHP. AKNHP ecology personnel have produced taxonomic vegetation classifications and satellite maps for the National Park Service, and conducted evaluations of ecological representativeness for the National Forest Service (Boggs and DeVelice 1997, Shephard 1995). AKNHP zoology personnel have conducted seabird and marine mammal projects (Sherburne 1993, Wilbor 1999, Gotthardt 1999). Project results have been published in both government agency publications and peer reviewed journals.

Another major reason for the success of the national network of Heritage Programs has been the acceptance of its methods and monetary support from BRD, USFWS, National Forest Service, and most State Departments of Natural Resources and Fish and Game Departments. AKNHP also has close ties with The Nature Conservancy—cooperating on conservation projects—, UAA's Environmental Studies Program, and the University of Alaska Fairbanks. UAA's and AKNHP's location in Alaska's population center would also enable the EVOS conservation biology information outreach to reach the majority of Alaskan students and residents.

AKNHP is part of UAA, yet has a distinct mission—tracking Alaska's biodiversity—and is relatively independent of University demands such as teaching and committees. This allows AKNHP to be cost effective and highly efficient. AKNHP would also be cost-effective because some of the needed information is already in-house. For example, AKNHP has information on 12 of the 29 species and ecosystems that are proposed for monitoring. AKNHP also has the computer resources and personnel to efficiently conduct the project. Computer resources includes a Sun Unix Ultra with ArcInfo software, HP series E color plotter, HP color LaserJet 5M, ArcView/Spatial Analyst, Pentium PC's with Excel, Microsoft Word, Access databases (plus others), Macintosh Internet software and a scanner. Personnel include people with expertise in database management, ArcInfo, ArcView, satellite image processing (ERDAS Imagine) and Web page development.

Responsibilities of Principal Investigators
The two Research Associates hired for the project would divide project duties based on their background. One position would concentrate on marine conservation biology issues, and the other position on the terrestrial-marine interface. In general, the marine conservation biologist would compile information on marine and anadromous fish, whales, and marine systems such as the intertidal zone. The terrestrial-marine incumbent would concentrate on seabirds, other sea mammals, their interaction with the marine system, and important terrestrial systems. The presentations and courses would be developed and taught cooperatively by the two incumbents.

OTHER KEY PERSONNEL

Julie Michaelson would coordinate the data entry and format of the data-system. Her qualification in relation to this project is her expertise in summarizing Alaskan biological information into a GIS format that is useful for end users. Her current position is as data manager for AKNHP, and she also has extensive experience as a principal investigator. She is currently working on the creation of the zoological database layers that reside in the ArcInfo GIS system running on the SUN UNIX work station. Another project is creating GIS data-layers for the EVOS funded APEX study. She has constructed all export files that have been used to create the Internet graphics and has had extensive experience in the transfer of data into a variety of textual and graphic formats across platforms.

Gerald Tande would oversee development of the EVOS conservation biology Web page. He developed the AKNHP Web page (www.uaa.alaska.edu/enri/aknhp_web/index.html) and is the Web master for AKNHP and the Environment and Natural Resources Institute.

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2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$150.4
Travel		$3.3
Contractual		$10.0
Commodities		$0.0
Equipment		$14.6
Subtotal	$0.0	$178.3
Indirect		$44.6
Project Total	$0.0	$222.9
Full-time Equivalents (FTE)		3.2
Other Resources		$49.0

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$214.0	$220.0		
Dollar amounts are shown in thousands of dollars.					
		$50.0	$50.0		

Comments:
Indirect cost: AKNHP is part of the University of Alaska and has used the 25% indirect rate.

The following costs are for participating in various project functions in FY 2000:
$27.2 for report writing in each year of the project.
$3.4 for attending professinal conferences in each year of the project.
$46.4 of the budget is for community involvement (presentations to resource managers and UAA) in each year of the project.

Other Funds: A personnel contribution by AKNHP and UAA is necessary to complete the project. The AKNHP data manager will devote five months of time to development of the data-system, Keith Boggs will contribute 1.5 months time to project coordination, and Dr. Kim M. Peterson, UAA Biology Department head, will contribute one week of time to integrate the two university courses into UAA. The contribution will be made again in FY 2001 and 2002. No conditions are tied to the funds.

The $6.1 increase in cost from FY 2000 to FY 2001 is due to a cost of living increase.

FY00

Prepared: April 10 1999

Project Number: 00511
Project Title: Synthesis of conservation biology information and transfer of the information to resource managers and university students
Name: Alaska Natural Heritage Program, ENRI, UAA

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	K. Boggs	Principal investigator	2.0	6.8		13.6
	Vacant	Marine conservation biologist	12.0	5.2		62.4
	Vacant	Terrestrial-marine conservation biologist	12.0	5.2		62.4
	Vacant	Student assistant, UAA	6.0	1.0		6.0
	Vacant	Student assistant, UAA	6.0	1.0		6.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	38.0	19.2	0.0	
					Personnel Total	$150.4

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	K. Boggs; To Conservation Biology meeting, Missoula, MT	0.6	1	5	0.1	1.1
	Marine biologist; To Conservation Biology meeting, MT	0.6	1	5	0.1	1.1
	Terrestrial-marine biologist; To Conservation Biology meeting, MT	0.6	1	5	0.1	1.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$3.3

FY00

Prepared: 10-Apr-99

Project Number:
Project Title: Synthesis of conservation biology information and transfer of the information to resource managers and university students
Name: Alaska Natural Heritage Program, ENRI, UAA

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
The construction of an Internet Web page will be contracted to an Internet Web page technical company.	10.0
Contractual Total	$10.0

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY00

Prepared: April 10 1999

Project Number:
Project Title: Synthesis of conservation biology information and transfer of the information to resource managers and university students
Name: Alaska Natural Heritage Program, ENRI, UAA

FORM 4B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
PC Computer. Cost obtained from Lewis and Lewis Computer Store	2	1.8	3.6
ERDAS Imagine computer program. Cost from ERDAS	1	6.0	6.0
Arcview image analysis computer program. Cost from ESRI.	2	2.5	5.0
			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**		$14.6

Existing Equipment Usage: Description	Number of Units
Sun Unix Ultra with ArcInfo software	2
HP series E color plotter	1
HP color LaserJet 5M	1
Pentium PC's with EXCEL, WORD, ACCESS databases	2
Macintosh with Macintosh Internet software	1

FY00

Prepared: April 10 1999

Project Number:
Project Title: Synthesis of conservation biology information and transfer of the information to resource managers and university students
Name: Alaska Natural Heritage Program, ENRI, UAA

FORM 4B
Equipment
DETAIL

Project Title: Laying the Groundwork for a Successful Long-term Monitoring and Research Program

Project Number:	00512
Restoration Category:	
Proposer:	Karen Oakley USGS-Alaska Biological Science Center 1011 E. Tudor Rd. Anchorage, AK 99503
Lead Trustee Agency:	DOI
Cooperating Agencies:	USFS
Alaska Sea Life Center:	No
Duration:	1st year, 3-year project
Cost FY 00:	$196.9
Cost FY 01:	$250.0
Cost FY 02:	$250.0
Geographic Area:	No fieldwork, but project concerns entire spill area
Injured Resource/Service:	All

ABSTRACT

We will apply the latest understanding of long-term program design to plan for the monitoring and research portion of the Restoration Reserve program. The characteristics and unique considerations that attend long-term programs will be presented via briefings, public meetings, and the Annual Restoration Workshop in January 2000. We will also catalog existing and planned monitoring and research efforts in the spill area. We will then propose a planning process, leading to a conceptual design document to guide the FY 2003 Invitation. This relatively small investment in planning will help ensure a successful long-term program that avoids common planning problems, and the specific problems that can be foreseen in the *Exxon Valdez* oil spill context.

INTRODUCTION

The *Exxon Valdez* Oil Spill (EVOS) Trustee Council recently established the Restoration Reserve to provide funds for restoration beyond the last annual payment of the Exxon Corporation. In creating the reserve, the Trustee Council found that recovery from the oil spill remains incomplete. They recognized the need for a continuing long-term, comprehensive and balanced restoration program. In the resolution establishing the Restoration Reserve, the Trustee Council indicated their intention to allocate a major portion of reserve funds for additional habitat protection actions. The earnings on the balance of the reserve would be used to fund annual work plans for a combination of research, monitoring, and general restoration, including community-based restoration efforts. The Restoration Office and Chief Scientist, under the leadership of the Executive Director, were directed to begin the process of developing a long-term research and monitoring program for the spill region. The purpose of this new program is to inform and promote the full recovery and restoration, conservation and prudent management of spill-area resources.

This proposal responds to the request in the "Invitation to Submit Restoration Proposals for Federal Fiscal Year 2000" for new proposals related to "Possible Transition to Long-term Monitoring and Research Program" (see page 37 of the invitation). This proposal specifically targets the planning process for the long-term monitoring and research portion of the continuing restoration program to be funded by the Restoration Reserve. Funds from the Restoration Reserve will first be available to fund work in FY 2003 (October 1, 2002), providing a 3 year window for this planning effort. Our purpose will be to lay the groundwork for a successful long-term monitoring and research program by incorporating the latest understanding of long-term program design (how they work, why they often fail) into the planning process.

We propose the following 5 steps in this facilitation process. In the first step, we will foster understanding of all involved parties of what long-term monitoring and research are and how long-term programs differ from short-term programs. This education process will bring all parties to the planning table with a common language and understanding. The second step will be to catalog the existing and planned monitoring and research efforts in the spill region to clarify the network of data collection systems in which any oil spill-related effort will be embedded. The third step will be to define and present to the Trustee Council a planning process to be used in developing the long-term monitoring and research program. The fourth step will be to assist in implementation of that process by the Executive Director and Restoration Office. The final step, or ultimate product, will be a document describing the conceptual design of the long-term monitoring and research program. This document will be the guiding document for implementation of the program.

NEED FOR THE PROJECT

A. Statement of the Problem

At its most basic level, the "problem" is to define the problem: What do "long-term monitoring and research" mean? How does one maintain monitoring over a long enough period that the public, administrators, and researchers will appreciate the value of monitoring data? Over the next three years, the goal of this project will be to further refine the Trustee Council's objectives for long-term monitoring and research. To frame this discussion, we first provide general

observations of the nature of long-term data collection endeavors. We then describe what we see as specific challenges in the context of the *Exxon Valdez* oil spill program.

General Nature and Types of Long-term Data Collection Programs

We define "monitoring" as *repeated measurements over time for a purpose*. The general purpose of monitoring is to detect changes and trends. Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring efforts will differ in terms of their spatial and temporal scales, depending upon their purposes. Long-term programs, which are now of interest to the Trustee Council, are inherently different from short-term programs, because they include the dimension of **time**. Long-term programs have their own statistical issues, which need to be accounted for in the design, and additional care must be taken in areas such as data management and quality assurance/quality control to ensure that the data can be used for intended purposes. Long-term programs also have the truly difficult challenge of surviving changes in management and funding priorities over many budget cycles.

We classify long-term programs into three general types: (1) *Long-term Studies*, (2) *Adaptive Management Monitoring*, and (3) *Long-term Ecological Monitoring*. Each of these types of long-term program has its own literature, and examples of programs that have succeeded and failed can be found. We can readily envision possible roles for all three types of long-term monitoring and research within the continuing restoration program; the trick will be to decide which type(s) is(are) the most appropriate. These types are described below to illustrate the variety of directions the Trustee Council could choose as they flesh out this aspect of the continuing restoration program. Understanding these types will also provide a framework for classifying the various existing and planned monitoring and research efforts within the spill area.

Long-term Studies.--*Long-term studies* in ecology are needed to elucidate such phenomena as (1) slow processes, (2) rare or episodic events (like a major oil spill!), (3) processes with high variability, and (4) subtle and/or complex processes (Likens et al. 1989). The earliest *long-term studies* involved individual researchers able to piece together funding to continue work over their lifetimes, and the transfer of the work to a student or colleague when they retired. *Long-term studies* are typically site-specific (e.g., localized), and involve detailed investigations of ecological processes, with no attempt made to draw statistically valid inferences to a broader landscape. The National Science Foundation has recognized the importance of *long-term studies* in their funding of the Long-term Ecological Research (LTER) network (**http://lternet.edu**). The LTER program has 21 sites, including two sites in Alaska—Bonanza Creek Experimental Forest near Fairbanks and Toolik Lake in the Brooks Range.

Long-term studies involve monitoring--repeated measurements over time for a purpose—the purpose being to understand ecological phenomena that can only be studied over decades or centuries. One of the most important lessons from *long-term studies* as a class of scientific inquiry is that conclusions from a typical research project (2-5 years) are often proved wrong when a longer time series of data is examined.

Adaptive Management Monitoring.--At the other end of the spectrum from *long-term studies*, is what we will call *adaptive management monitoring*. In this type of monitoring, monitoring is an integral part of a management program. A cause-effect relationship is (usually) known, and when the chosen indicator variable reaches some pre-determined threshold, a

management action is taken. Examples of this type of monitoring include regulatory monitoring for pollutants (e.g., water and air quality monitoring) and salmon escapement monitoring (harvest levels are set based on the number of fish making it to spawning grounds). These types of monitoring efforts are not inherently long-term (usually the data are used in a real-time mode). However, these types of monitoring efforts may indeed last over very long time-periods because of their importance for public values (i.e., maintenance of healthy air and water, sustained production of a valuable resource like salmon). Data sets generated by these types of monitoring efforts have the potential to serve two purposes: (1) they determine management actions in an immediate time-frame and (2) they may generate data sets useful for understanding cause-effect relationships and changes over longer periods.

Long-term Ecological Monitoring.--Somewhere in between *long-term studies* and *adaptive management monitoring*, we find a relatively new class of endeavor that falls into the general category of *long-term ecological monitoring*. These endeavors typically involve large spatial scales and may attempt to employ unbiased study designs that allow valid inferences to be made about what is changing over the landscape. While links to specific management actions are often desired in *long-term ecological monitoring* programs, the links may be unclear. The primary goal is to detect changes and trends, including changes and trends that are unexpected. (This is in distinct contrast with *adaptive management monitoring* where the exact change you want to detect is known.)

One example of *long-term ecological monitoring* is the combination of landbird monitoring efforts across North America that detected changes in populations of neotropical migrants such as the Blackpoll Warbler and Olive-sided Flycatcher. The detection of these changes has triggered additional inquiries into the causes of the phenomenon. Another example is NOAA's Mussel Watch program, involving examination of mussels throughout our Nation's coastal waters for common pollutants. The Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is one of the most important examples of this type of monitoring program. Although EMAP (as originally envisioned) failed as an enduring program, EMAP has generated many good lessons about undertaking this type of effort. Various components of EMAP have survived (e.g., the Forest Health Monitoring program of the U.S. Forest Service), and these EMAP "survivors" will help our nation's effort to "take the pulse" of its environmental quality. Important lessons for development of a long-term monitoring and research program in Prince William Sound and the Gulf of Alaska exist in study of the successes and failures of EMAP.

Understanding the usefulness and limitations of these three basic types of long-term programs will make discussions of the proposed long-term program for oil spill restoration much more fruitful. The resultant program is therefore more likely to meet the goals established by the Trustee Council. Not recognizing the distinctions between these types can result in a mismatch between expectations and outcomes. For example, a possibility is that the managers describe their monitoring needs in a way that suggests they want *adaptive management monitoring* (e.g., thresholds, action plans), the scientists deliver an elegant *long-term study* (which has nothing to do with management issues), and what the managers actually need (once they do some harder thinking about their objectives) is *long-term ecological monitoring*. Meanwhile, a great deal of time and money is expended before anyone realizes there is a problem. The lessons are that having a common language for talking about "monitoring" and "research," and having clear communications about expectations beforehand, are vital.

Two other topics about the general nature of long-term programs should be touched upon briefly before we go on to the specific challenges we see for the oil spill restoration program. These relate to the importance of data management and quality assurance/quality control.

In short-term studies, one can "get away" with a certain amount of sloppiness in management of data and in methods. The study is published, and the data (likely stored in a spreadsheet on a floppy disk) get thrown in a file drawer and are forgotten while the investigator moves on to other studies. However, to have any chance of reliably detecting changes or trends over a period of time that includes decades, the data must be available (not lost) and trusted. The data collection methods must be documented (providing metadata is one of the roles of data management), and the data must be of known quality (one of the roles of quality assurance/quality control[1]). These activities add cost to the long-term data collection program, but without them, one may well end up with data that are of such questionable quality that they are of little use. Data management and quality assurance/quality control are not trivial issues in long-term programs and must be explicitly planned for.

Specific Challenges of a Long-term Program Related to *Exxon Valdez* Oil Spill Restoration

We can readily see five specific challenges to planning a long-term monitoring and research program for the *Exxon Valdez* oil spill restoration effort. These are: (1) recognizing and dealing with the inertia of the existing research program, (2) integrating a new long-term monitoring and research program with other monitoring and research efforts in the spill area, (3) an apparent lack of public support for a continuing data collection effort, (4) balancing multiple objectives, and (5) handling administrative issues.

Inertia.--The first challenge is to recognize the fundamental difference between what has been going on (a major, well-funded research program concentrating on effects and ecosystem relationships) and what is planned (or possible) in the new program (an as yet undefined mix of monitoring and research). The stage has been set for a paradigm shift in the restoration program. However, the former program has a great deal of inertia in it, and it will be a challenge to change. The planning process we propose will hopefully facilitate this paradigm shift.

Integration with Other Efforts.--Another challenge will be to recognize and build upon in some logical way the existing and planned monitoring and research efforts of resource management agencies within and surrounding the spill area. We envision that it will be a relatively simple matter to catalog these existing and planned efforts (something we propose to do). However, it will be a much more difficult matter to reconcile the differing objectives and temporal and spatial scales that these efforts can be expected to encompass. We expect to find a mix of national-level, regional and site-specific programs, each with study designs and expected results matching their specific objectives. Whether outputs from these efforts will be at all helpful to meeting the objectives of the Trustee Council is unknown. Mechanisms for achieving

[1] Most of us tend to associate quality assurance/quality control (QA/QC) with such things as how the data are collected (e.g., field and laboratory methods) and data entry. However, QA/QC has much broader significance, applying not only to how the work is done, but why. The principles of QA/QC should to be applied to all aspects of an endeavor, not just the data collection portion.

a multi-agency, integrated approach to monitoring and research are largely untested and would require a new level of partnership among the involved agencies.

Apparent Lack of Public Support.--Another specific challenge to the successful establishment of a long-term monitoring and research program for the oil spill area is the apparent lack of public support for such a program. In public comments on uses of the Restoration Reserve, habitat protection received much stronger support. Lack of a perceived benefit is a critical problem for long-term data collection programs. The success of long-term data collection programs will depend upon the ability of the long-term work to win in repeated battles over, which is more important: short-term or long-term goals. Even though the Trustee Council has the "luxury" of a dedicated source of revenue on which to base this long-term program, there will likely always be pressure to devote more resources to habitat acquisition and study of immediate problems. Thus, in crafting its long-term monitoring and research program, the Trustee Council must consider ways to generate true (valid) and continuing public support.

Balancing Multiple Objectives.—As the Trustee Council works to clarify its objectives for monitoring and research, they will likely find more things that could justifiably be done than there is money to fund. Up until now, prioritizing what gets done has been based on what might be called a "best professional judgment" approach using criteria established in the 1994 Restoration Plan. One can easily predict that as the amount of money available for research and monitoring declines, the setting and balancing of priorities will become more difficult. Tools to assist decision making where managers have multiple objectives are available and may be of use to the Trustee Council in planning its long-term program. These tools are found within a class of techniques called "decision analysis" which are widely used in business situations and have a great but largely unexplored potential in resource management situations.

Administrative Issues.—Because the work funded by the Trustee Council must be conducted via the six lead agencies, the restoration research program has heretofore proceeded in a de-centralized and distributed fashion. The nature of long-term data collection programs demands a more centralized effort to foster security of the data and to standardize the processes of reporting and synthesis. Another administrative issue concerns the currently used annual budgeting and reporting cycle. Long-term studies need long-term approval with appropriate schedules for reporting and review processes built in. A longer cycle of project approval and funding should probably be explored (for example, the National Science Foundation runs the LTER network on a 6-year basis).

In conclusion, the problem is to add the dimension of **time** to the scientific activities that have been and will continue to be an integral component of the oil spill restoration program. Adding the time dimension poses a number of challenges, and a solid planning effort is required to ensure that those challenges do not become obstacles.

B. Rationale/Link to Restoration

The Trustee Council adopted an adaptive management approach early in the restoration process. Monitoring to determine whether management actions achieve desired goals is an essential part of this process. Regardless of the particular form they take, monitoring and research clearly need to be a part of the continuing restoration program. This project will promote establishment of a successful program.

C. Location

No field work is proposed. Initial work on this project will be centered in Anchorage. In subsequent years, community input will be sought which will involve travel to communities within and near the spill area.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

As discussed above, success of long-term data collection programs requires and is enhanced by solid public support. Communities must be involved in the planning process. Through the restoration process, communities in the spill region have become involved in significant and real ways. In the process we will propose for planning the long-term monitoring program, communities will continue to be involved via the existing channels set up by the restoration office. Planning to involve communities in the economical collection of long-term data is also something that needs to be considered and built into the program, where possible (for example, see Mattson et al. 1994).

Traditional ecological knowledge will likely play a role in the monitoring program design process we intend to propose to the Trustee Council. Coming up with that design process is a part of this proposal, so we are not prepared to give all the details here. However, we did want to indicate that we see a role for traditional ecological knowledge in the design process and in the implementation of an economical long-term monitoring and research program.

A snapshot of our current thinking on this topic is this: Conceptual models can be very helpful in defining objectives for monitoring and research, and many of the design processes for long-term monitoring we are reviewing include a "conceptual model" phase. Essentially, you describe your model of how things work, then the data collection system is set up to find out if the system acts as expected. Traditional ecological knowledge represents a model of how one set of observers think the system works, based on their experiences. We think traditional ecological knowledge could provide extremely useful conceptual models for use in the objective-setting phase of the long-term program.

PROJECT DESIGN

A. Objectives

The ultimate goal of this proposal is to develop a conceptual design for a long-term monitoring and research program that meets the objectives of the Trustee Council and sets the program up to be successful over the long-term. We have five specific objectives to meet this goal.

1. Foster understanding of the general issues and components of long-term monitoring and research by the Trustee Council, Restoration Work Force, and the public to help build reasonable expectations for the program and make the planning process more productive.

2. Catalog and report on the existing and planned monitoring and research efforts in the general spill area of Trustee Council and other organizations, focusing on a comparison of their objectives, their spatial and temporal scales of interest, and measured attributes.

3. Propose a planning process for development of the long-term monitoring and research program that incorporates the latest understanding of long-term program design and input and review by all involved parties.

4. Facilitate the planning process.

5. Produce the conceptual design document for the long-term monitoring and research program based on outcomes of the planning process.

B. Methods

The work we propose is sequential--later steps depend on earlier steps. In the first year of this effort, we will focus on meeting the first three objectives (foster understanding, catalog other efforts, and propose a planning process). The work in subsequent years (facilitate the planning process and conceptual design document) will necessarily depend upon outcomes of the work in year one.

1. Foster understanding.

Our experiences elsewhere have demonstrated to us that the difficulties of establishing successful long-term monitoring and research programs are often underestimated. For the planning process to work, the involved parties must develop a common language for talking about such things as "monitoring," "research" and "long-term." To meet this objective, we propose an educational effort starting with briefings for the Trustee Council and the Public Advisory Group. These briefings would cover the distinctions between the various types of long-term programs (along the lines of what we presented under "Statement of the Problem"). We would cover the basic elements that are important to the success of long-term monitoring programs and the typical reasons for failure of long-term programs. We would also introduce the process proposed for development of a program related to oil spill restoration (see description below under objective 3).

To involve a broader segment of the Restoration Workforce and some portions of the public, we propose to hold a mini-symposium on long-term monitoring and research as part the Annual Restoration Workshop in January 2000. A variety of speakers would be invited to provide some case histories of long-term monitoring and research programs (some successful, some not so), and to address specific components of successful long-term programs.

We would work with the existing public involvement program of the Restoration Office to ensure that the public is included in this education phase, likely via public meetings, the Trustee Council newsletter, and additions to the oil spill web site.

2. Catalog existing and planned monitoring and research programs in the spill area.

An essential component of this planning process is an understanding of the milieu of existing efforts in which any work sponsored by the Trustee Council will be embedded. Much of what needs to be cataloged is already available and can likely be updated relatively quickly. In this cataloging effort, we would identify the specific objectives of each program, their spatial and temporal scales, and the attributes measured. We would also try to identify existing (but perhaps unrecognized) long-term data sets within the spill area that might have some value for continuance in the oil spill restoration context. Our search for potentially relevant endeavors would include projects involving the terrestrial and atmospheric environment as well as the marine environment. In the context of understanding long-term changes in the marine environment, land-sea-atmosphere interactions will need to be considered (e.g., global warming melts glaciers raising sea level). Thus, in the cataloging process, we would cast our net widely to ensure that we encounter all programs that could be helpful.

In this cataloging process, we will also attempt to identify the planned programs likely to come on line in the spill area in the near future. We note burgeoning interest, especially amongst federal agencies, in establishment of long-term monitoring and research programs. For example, a major new resource management initiative within the National Park Service is likely to result in new monitoring efforts in Alaska's parks, including the parks with substantial coastlines within the spill area. As part of its management plan update, Chugach National Forest is currently considering the establishment of additional Natural Research Areas (which can serve as sites for *long-term studies*). Being aware of planned efforts such as these will provide the opportunity for coordination to mutual benefit.

The catalog will be prepared in a relational database (Microsoft Access). An ArcView application would be linked to the database to allow the spatial distribution of the monitoring and research efforts to be easily visualized. The database would be made available as well as a hard copy catalog, probably using a format similar to the Current Research Profiles prepared for the Prince William Sound-Copper River region by the National Biological Survey (Thomas 1997). In addition, a report analyzing the existing and planned efforts would be prepared. The analysis would highlight the existing efforts that appear to hold the most promise for furthering the restoration goals of the Trustee Council. The report will also analyze where differing objectives and scales of interest would reduce the value of an existing effort for the goals of the Trustee Council. This analysis will provide a framework for considering how the Trustee Council can best use the funds it chooses to apply to long-term monitoring and research.

A progress report on the catalog effort will be given at the January 2000 Annual Restoration Workshop. The final report and database will be targeted for completion by the end of FY 2000 to allow the information to be used in the implementation of the planning process.

3. Propose a planning process.

We will propose a process for planning the long-term monitoring and research program that is founded in the latest understanding of long-term program design and which includes opportunities for input by all involved parties. We will develop the process during the first part of FY 2000 for a formal presentation to the Trustee Council in March 2000.

The planning process for a long-term monitoring and research program for oil spill restoration should ensure that:

- measurable objectives which are clearly related to the broad goals of the restoration program are established,
- intended data uses are clearly envisioned,
- the study design is statistically sound,
- there is a clear match between the objectives, design and intended data uses,
- critical components of successful long-term programs such as data management and quality assurance/quality control have been included and adequately funded, and
- the program answers policy-relevant questions such that true public support will be generated and maintained over time.

As part of ongoing work of the Principal Investigators (unrelated to the *Exxon Valdez* oil spill), we are currently revisiting methods for designing long-term monitoring and research programs. Specifically, we are evaluating modifications to existing methods, such as those outlined by Silsbee and Peterson (1993), Peterson et al. (1994), Elzinga, et al. (1998) and others, to incorporate recent advances in such areas as pragmatic modeling (Starfield 1997), quality assurance/quality control (ANSI/ASQC 1994, Clark and Whitfield 1993, Edwards 1998, Lawrence and Aspila 1995, Geoghegan 1996, Shampine 1993, Stottlemyer 1987, Young et al. 1992, Wagner 1995, Costanza et al. 1992), statistical analysis for detection of change and trend (Thomas 1996), and data management (Michener et al. 1997, Michener et al. 1998, Stafford 1993, Strand et al. 1983).

We are also adding and providing additional guidance in the critical steps for setting objectives (Ward et al. 1986, Whitfield 1988). Most design processes start with the seemingly innocuous step: Set Objectives. As it turns out, this step is probably the most difficult one. If this step is not done correctly, the program is likely to fail. Common problems include not being specific enough about the objectives, not clearly envisioning the consequences of picking one set of objectives over another, and expecting too much from the program (e.g., expecting the program to not only detect changes but explain them). One must be very clear about the temporal and spatial scales of interest, and whether it is more important to detect changes or trends because the design will depend upon the objectives (Overton and Stehman 1995, Rose and Smith 1992, Soballe 1998).

In addition, most design processes do not include explicit steps for involving the public--they focus on the steps that come after the objectives have been set. The presumption is that public concerns have already been taken into account. Thus, we are also considering how best to ensure that in fact the objectives are policy-relevant and meet public needs.

One method that has been widely used in business settings to assist the process of making decisions (including such things as defining objectives) is the Analytical Hierarchy Process (AHP) developed by Saaty (1980). The AHP has been used in resource management settings (DiNardo et al. 1989, Anselin et al. 1989), and has been especially useful in setting research priorities (Peterson et al. 1994, Schmoldt et al. 1994, Schmoldt and Peterson, in press). A detailed description of the AHP is beyond the scope of this proposal, but the AHP assists decision making by allowing decision makers to evaluate the importance of criteria, objectives, scenarios, actors, and alternative solutions in a decision.[2] The AHP can be applied in a group/workshop setting to facilitate involvement of the people whose input is being sought. This type of analytical planning may provide the Trustee Council with a way to balance multiple objectives, obtain public support and efficiently gather the input of the currently involved scientists. The planning process we intend to propose will likely include the use of AHP to assist in the setting of objectives.

To reiterate, we will pull together the latest information on long-term program design and incorporate it into a planning process that fits the specific needs of the *Exxon Valdez* oil spill Trustee Council.

4. Facilitate the planning process (future years).

If the Trustee Council approves the planning process we expect to propose in March 2000, we would like to remain involved to facilitate its implementation. We envision that the Executive Director would take the lead in implementing the planning process, and our exact role would depend upon what steps are included and where our assistance would be desired. For example, if the Trustee Council endorses the use of our analytical planning approach as a method for getting public and scientific input into objectives, we could provide the expertise needed to organize and run the AHP workshops.

5. Draft the conceptual design document (future years).

At the end of the planning process, there needs to be a guiding document produced to direct implementation of the long-term monitoring and research program. This guiding document should set forth the broad goals and measurable objectives for the program and address the management structure of the program.

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[2] An example: You want to buy a car. You have a certain amount of money to spend and the criteria that are important to you (and on which you plan to make your decision) are annual maintenance cost, looks and safety. Using AHP, you compare 10 brands of cars within your price range using these criteria. AHP can tell you which brand of car best meets your criteria. You can experiment with how you weight the criteria to see if a different brand becomes the better choice, as you change the weights. So, when AHP tells you that the "best" choice is a Saturn, and you still want the Porsche, you will need to reconsider how you weighted the criteria (or maybe you need to add "prestige" or "speed" as a criterion). AHP is a cheap way to explore your options. Our brains can only handle 7 or 8 "things" at a time, and AHP (and other decision tools) help us "remember" and keep order as we sort through the process of making a decision.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

1. Cooperating Agencies

Because of our specific experience and knowledge related to long-term program design, the primary cooperating agencies for this project are the DOI-BRD and the USFS. However, the participation of all 6 Trustee agencies will be required. The principal contacts for each agency will need to be directly involved to focus and facilitate our efforts to obtain information about each agencies' existing and planned monitoring and research efforts in the spill region. In addition, contacts will need to be made with individuals in each Trustee agency who are not directly involved in the oil spill, but who are involved in related efforts. Contacts will need to be made with agencies that are not part of the Trustee Council but which are involved in research and monitoring in the spill area.

2. Contracts

This project will involve two contracts with private sector consultants. The involvement of Co-Principal Investigator Dr. Lyman McDonald, of Western EcoSystems Technology, Inc., and of Dr. Anthony M. Starfield will be secured through personal services contracts with the DOI-BRD. The contracts will cover Dr. McDonald's and Dr. Starfield's involvement in preparing for and providing briefings on long-term monitoring and research programs. The contracts will also cover their involvement in further development of the planning process and all travel related to work on this project.

A contract will also be required to cover printing costs of the report we propose to prepare on the existing and planned research and monitoring efforts in the spill area. Per federal requirements, the contract will be let through the Government Printing Office.

If needed, small contracts will be used to provide honoraria to the speakers invited to address the mini-symposium portion of the Annual Restoration Workshop.

SCHEDULE

A. Measurable Project Tasks for FY 00 (October 1, 1999 to September 30, 2000)

Oct. 1999:	Team planning meeting.
Nov. 1999:	Brief the Trustee Council and Public Advisory Group, answer initial questions, discuss guidelines and sideboards for the objectives of the monitoring and research program.
Jan. 2000:	Mini-symposium on long-term monitoring and research within the Annual Restoration Workshop; progress report on catalog effort.

Mar. 2000: Propose a planning process for development of the long-term monitoring and research program to the Trustee Council.

April 15, 2000: Submit proposal for specific work in FY 00 and FY 01, based on approval and requested modifications of the planning process.

Sept. 30, 2000 Complete catalog and report on existing and planned monitoring and research efforts in the spill region.

B. Project Milestones and Endpoints

Objectives 1 (foster understanding), 2 (catalog existing efforts), and 3 (propose a planning process) will be met during FY 2000 according to the schedule listed above. The remaining objectives will be met as follows:

Oct. 1, 2000 Implement planning process (to be determined, but likely to include workshops with the public and involved scientists).

July 1, 2001 Produce draft of conceptual design document for review and comment.

Jan. 1, 2002 Produce final version of the conceptual design document to be used in time for preparing the "Invitation to Bid for FY 2003."

C. Completion Date

We intend this project to be completed when the conceptual design document is finalized on or about January 1, 2002.

PUBLICATIONS AND REPORTS

No publications are proposed at this time. However, the work we propose should result in publishable contributions to the literature of long-term program design in 2001 or 2002.

PROFESSIONAL CONFERENCES

None proposed.

NORMAL AGENCY MANAGEMENT

This project does not involve normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will require side-by-side involvement and direction from the Executive Director. The project will also require close coordination with the Chief Scientist and Restoration Office staff, particularly the Public Involvement Specialist and the Traditional Ecological Knowledge Specialist. Close coordination with Trustee and other agencies in gathering information about

existing and planned programs will also be required. We fully expect that there are proposed projects concerning the transition to long-term monitoring and research of which we are not yet aware and where coordination and reorganization of work effort will be advantageous.

PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATORS

Karen Oakley is a Fish and Wildlife Biologist with the USGS-Alaska Biological Science Center. She is currently leading development of a long-term ecological monitoring program at Denali National Park and Preserve as a prototype for subarctic parks. She provides general advice to parks and others planning long-term monitoring and research programs. She previously led the Prince William Sound-Copper River Ecosystem Initiative project, which developed an ecosystem partnership and produced indexes to published research, current research and spatial data sets for the region. In response to great interest on the part of ecosystem partners in the Copper River Basin, she put together a mini-symposium on how forests are affected by spruce beetles. She has prior experience with the *Exxon Valdez* oil spill, having served as the Principal Investigator for Bird Study 9 (Pigeon Guillemots) during the Damage Assessment phase. She later worked in the U.S. Fish and Wildlife Service Oil Spill Office where her prime achievement was arranging the disposal of the 5 van-loads of oiled bird and mammal carcasses recovered after the spill, while allowing access to museum personnel for recovery of usable specimens. She also authored guidelines for USFWS final reports that provided the basis for the guidelines currently used by the Trustee Council.

Ms. Oakley will be responsible for leading and coordinating all work on this project. She will lead the development of the planning process and will supervise production of the catalog of existing and planned monitoring and research efforts in the spill areas. She will take the lead on preparing appropriate briefings and briefing materials for the Trustee Council and Public Advisory Group, and in developing the list of speakers to be invited to the mini-symposium. As Principal Investigator with the lead agency, she will manage the involvement of the outside contractors whose expertise is needed to work on this project.

Dr. Lyman McDonald is a principal with Western EcoSystems Technology, Inc. He is a senior statistician/biometrician with many years experience in the design and management of both large and small-scale monitoring programs, involving terrestrial, aquatic and marine environments. His experience has led to appointments on regional and national technical advisory and review committees for monitoring programs, including the Statistical Design and Analysis Team for the U.S. Environmental Protection Agency, Environmental Monitoring and Assessment Program (EMAP). Because of his depth of experience and knowledge in this field of statistics, he was invited to participate in a conference at the University of Washington entitled "Environmental Monitoring Surveys Over Time," sponsored by the Natural Resources Inventory and Analysis Institute of the USDA Natural Resources Conservation Service, the Inventory and Monitoring Institute of the USDA Forest Service, the U.S. Environmental Protection Agency, and the National Research Center for Statistics and the Environment, University of Washington. Dr. McDonald provides statistical advice from someone that understands the specific issues associated with long-term monitoring and who is working with those issues at the cutting edge of this field. Dr. McDonald has had significant involvement in the EVOS Natural Resource Damage Assessment, the Nearshore Vertebrate Predator project, and the Alaska Predator Ecosystem Experiment.

Dr. McDonald will act as lead statistician and will be responsible for ensuring that the planning process includes appropriate steps to ensure a good match between objectives and intended data uses, and the design. He will play a significant role in the briefings and in the mini-symposium.

OTHER KEY PERSONNEL

In addition to Ms. Oakley and Dr. McDonald, the team for this project will include major contributions from four others: Dr. David Peterson (USGS-BRD), Dr. Daniel Schmoldt (USFS), Dr. Anthony Starfield and Charla Sterne (USGS-BRD). The team brings together important areas of expertise and experience that will be crucial to planning of a successful long-term monitoring and research program. Various subsets of our team have extensive experience working together (Peterson and Schmoldt; Oakley and Starfield; Oakley and McDonald) on past projects, and we are excited about the opportunity to combine our talents for this challenging project.

Dr. David L. Peterson is a Research Biologist with the USGS-Forest and Rangeland Ecosystem Science Center, University of Washington Field Station, Seattle. He is also Professor, College of Forest Resources, at the University of Washington. His research focuses primarily on the effects of environmental stress on ecosystems, including the potential impacts of climatic change, pollution, and fire. He has developed monitoring programs and planning systems for three different federal agencies, and is a leader in the application of analytical tools in resource management. His recent book, Ecological Scale, emphasizes the need to quantify spatial and temporal objectives in scientific studies, monitoring, and resource management. An earlier book, Human Ecology and Climate Change, focuses on natural and cultural resources of Alaska. In cooperation with the USGS-Alaska Biological Science Center, he facilitated implementation of the Department of Interior Prince William Sound Ecosystem Initiative. He has authored over 120 publications on a wide range of topics in ecology and natural resources.

Dr. Peterson will be involved in development of the planning process. He and Dr. Daniel Schmoldt have worked as a team in several situations where multi-objective decision analysis has been used, and they will continue their fruitful collaboration in this project. They will take the lead on how decision analysis should be applied within the planning process, and for implementation, if approved. Dr. Peterson will be specifically responsible for how resource management issues are folded into the decision process. The scale issues for this project are considerable, and Dr. Peterson will also ensure that proper considerations of spatial and temporal scale are included.

Dr. Daniel L. Schmoldt is currently a Research Forest Products Technologist with the Southern Research Station, USDA Forest Service, Thomas M. Brooks Forest Products Center, Virginia Tech, Blacksburg VA.. He is also adjunct assistant professor in the Dept. of Wood Science and Forest Products at Virginia Tech and an Honorary Fellow with the Dept. of Forest Ecology and Management and Biological Systems Engineering Dept. at the University of Wisconsin-Madison. Dr. Schmoldt received degrees in mathematics, computer science, and forest biometry from the University of Wisconsin-Madison. Prior to his present position with the Research Unit "Integrated Lifecycle of Wood: Tree Quality, Wood Processing, and Recycling," he worked as a Research Forester for the Fire Management Planning and Economics research unit and also the Atmospheric Deposition research unit of the Pacific Southwest Research Station, USDA Forest Service. Current research activities include (1) tree quality assessment—using imaging methods and nondestructive evaluation techniques—and (2) wood processing automation for the hardwood industry—applying ultrasonic, computed tomography, and optical scanning coupled with machine vision systems. He also works on various projects dealing with

forest management planning and multi-criteria decision making. In addition to authoring more than 110 articles across a wide range of natural resource disciplines, he has co-authored a reference text, Building Knowledge Based Systems for Natural Resource Management and is editing a reference text with several colleagues, The Analytic Hierarchy Process in Natural Resource and Environmental Decision Making. Other professional activities include Working Party Leader for IUFRO 4.11.03, "Information Management" and Joint Editor-in-Chief for *Computers and Electronics in Agriculture*.

Dr. Schmoldt will be involved in the development of the planning process. He and Dr. David Peterson have worked as a team in several situations where multi-objective decision analysis has been used, and they will continue their fruitful collaboration in this project. They will take the lead on how decision analysis should be applied within the planning process, and for implementation, if approved. Dr. Schmoldt will be specifically responsible for applying the latest version of his Analytical Hierarchy Process program in this effort. He is currently developing a Java version of the AHP that will run on any computer; it will incorporate a graphical interface, and the program will be freely available. In addition, the new version will include better sensitivity analysis tools than are available in commercially-available AHP packages (e.g., Expert Choice).

Dr. Anthony M. Starfield is an applied mathematician. He has two main interests: using computers to solve practical problems (from mining engineering to conservation biology) and teaching others to do the same. He has offered course and workshops on modeling in many parts of the world, with a particular emphasis on modeling and decision analysis in conservation. He is currently a professor in the Department of Ecology, Evolution and Behavior at the University of Minnesota. He has authored over 25 modeling papers in the areas of geomechanics and heat flow through rock (between 1964 and 1988) and over 40 papers related to ecological modeling, conservation biology, operations research, expert systems and education. He is the primary author of How to Model It—Problem Solving for the Computer Age and Building Models for Conservation and Wildlife. His recent invited paper in the Journal of Wildlife Management (61:261-270) describes his philosophy for incorporating a pragmatic approach to modeling into resource management, which he contrasts with the model-as-representation-of-reality approach. Dr. Starfield argues for the creation of a modeling culture within our resource management and research agencies where simple, easily-built models are used as problem-solving tools and effective communication devices and where what you learn in the process of building the model is more important than the model itself. Dr. Starfield has applied his approach to problem solving in a wide variety of resource management issues around the world, including Alaska. His Alaska work includes collaboration with Dr. F. Stuart (Terry) Chapin and others at the University of Alaska Fairbanks on pathways and outcomes of global warming and on sustainable use of caribou by Alaska native communities as affected by climate change and oil development. He has taught his modeling course twice for resource management agencies in Alaska (USFS, NPS and USGS-BRD) and will be returning in October 1999 to teach a course for the U.S. Fish and Wildlife Service.

On this project, Dr. Starfield will be involved in the development of the planning process. The purpose of his involvement is to ensure that the process incorporates the pragmatic modeling approach (see the JWM paper, pages 266-267, "Modeling to Improve Data Collection and Monitoring"). Dr. Starfield will also be one of the invited speakers at the mini-symposium.

Charla Sterne is a Wildlife Biologist with the USGS-Alaska Biological Science Center. She will be responsible for preparing the catalog of existing and planned monitoring and research programs in the spill area. Ms. Sterne has extensive experience in Access database development from her work on the Pacific Seabird Monitoring Database (internet distribution anticipated by fall 1999). The Pacific Seabird Monitoring Database is a relational database which stores yearly observations on any of six population parameters for 56 species that breed in the Pacific north of 20 degrees N. The system utilizes a run-time version of Microsoft Access and is integrated with ArcView 3.0 to allow mapping and spatial analysis of data. As the point of contact for the 19 researchers (from four Pacific states, British Columbia, the Russian Far East, and Mexico) currently contributing their data to this effort, Ms. Sterne maintains and updates the database, reviews data submissions, provides technical assistance to data contributors, and recruits new project participants. Previously, as the district wildlife biologist for the Glacier Ranger District, Chugach National Forest, Ms. Sterne participated in a variety of projects in the spill area and conducted a preliminary investigation into a long-term monitoring framework for Prince William Sound.

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2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
						$46.8	$150.1	
Personnel	$0.0	$87.9						
Travel	$0.0	$28.4						
Contractual	$0.0	$60.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$2.8	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$179.5			Estimated FY 2001	Estimated FY 2002		
General Administration	$0.0	$17.4						
Project Total	$0.0	$196.9			$250.0	$250.0		
Full-time Equivalents (FTE)	0.0	1.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$43.5			$50.0	$50.0		

Comments:
Two permanent staff of the DOI-BRD (Oakley and Peterson) are involved in this project, and their salary costs for work on this project will be covered by base money ; these funds are shown in the "Other Resources" category.
Two consultants will be brought on by contract (through DOI-BRD): Dr. Lyman McDonald and Dr. Anthony Starfield. Both have agreed to provide their services without an indirect cost.
Part of this project includes bringing several invited speakers (we estimate 6) to the Annual Restoration Workshop to address long-term monitoring and research topics. Estimated costs for this "mini-symposium" (shown in the DOI-BRD budget) are roughly $16.0, including travel and honoraria for the speakers.
Costs for the four project participants that reside outside Anchorage to attend the Annual Restoration Workshop are roughly $6.1, or 3% of the total project cost. We do not anticipate costs for NEPA compliance, technical review session attendance, annual report writing, publications, conferences, or community involvement for this fiscal year.
An important caveat: Except for the work on the catalog which we have budgeted for the whole year, project costs apply primarily for work through March 2000, when the planning process will be proposed to the Trustee Council. We could not project costs related to implementation of the planning process after March 2000 because we not know what, if anything, the Trustee Council will approve.

FY00

Prepared: 4/15/99

Project Number: 00512
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Lead Agency: DOI-BRD

FORM 2A
MULTI-TRUSTEE AGENCY SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$54.0
Travel		$20.6
Contractual		$60.4
Commodities		$0.0
Equipment		$2.8
Subtotal	$0.0	$137.8
General Administration		$12.3
Project Total	$0.0	$150.1
Full-time Equivalents (FTE)		1.0
Other Resources		$43.5

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$200.0	$200.0		

Dollar amounts are shown in thousands of dollars.

Comments

FY00

Prepared: 4/15/99

Project Number:
Project Title:Laying the groundwork for a successful long-term monitoring and research program
Agency: DOI-BRD

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Charla Sterne	Wildlife Biologist	GS 11/1	12.0	4.5		54.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		12.0	4.5	0.0	
					Personnel Total	$54.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
C. Sterne to Kodiak/gather data on ongoing projects	0.5	1	2	0.2	0.9
C. Sterne to Cordova/Valdez/gather data on ongoing projects	0.5	1	2	0.2	0.9
C. Sterne to Seattle for planning meeting	0.8	1	3	0.2	1.4
K. Oakley to Seattle for planning meeting	0.8	1	3	0.2	1.4
D. Peterson to Anchorage for Trustee Council briefings (2) and planning	0.8	2	10	0.2	3.6
D. Peterson to Anchorage for Annual Restoration Workshop	0.8	1	3	0.2	1.4
Invited speakers for mini-symposium, assuming 6 speakers, coming from the lower 48	1.0	6	18	0.2	9.6
					0.0
Rental cars for all travel (12 person-trips)					1.4
					0.0
					0.0
					0.0
				Travel Total	$20.6

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: DOI-BRD

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:		Proposed FY 2000
Description		
Dr. Lyman McDonald, Western Ecosystems Technology, Inc.	Form 4A attached	27.0
Dr. Anthony M. Starfield	Form 4A attached	26.4
Government Printing Office, for printing of report on existing and planned monitoring and research efforts in the spill area, no Form 4A attached.		1.0
Honoraria for 6 invited speakers, at $1.0K each, no Form 4A attached		6.0
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$60.4

Commodities Costs:	Proposed FY 2000
Description	
Commodities Total	$0.0

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: DOI-BRD

FORM 3B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
Computer for C. Sterne	1	2.0	2.0
ArcView	1	0.8	0.8
			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**	$2.8

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: DOI-BRD

FORM 3B
Equipment
DETAIL

Prepared: 4/15/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$33.9
Travel		$7.8
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$41.7
General Administration		$5.1
Project Total	$0.0	$46.8
Full-time Equivalents (FTE)		0.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$50.0	$50.0		

Dollar amounts are shown in thousands of dollars.

Comments:
Costs for Dr. Schmoldt to attend the Annual Restoration Workshop are approximately $1.7K, or 4% of the USFS portion of the total project cost.

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: USFS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Daniel Schmoldt	Research Forester	GS 14/6	3.0	8.1		24.3
To be named	Computer Specialist	GS 9/1	3.0	3.2		9.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		6.0	11.3	0.0	
					Personnel Total	$33.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
D. Schmoldt to Seattle for planning meeting	0.8	1	3	0.2	1.4
D. Schmoldt to Anchorage for Trustee Council briefings (2), and planning	1.1	2	10	0.2	4.2
D. Schmoldt to Anchorage for Annual Restoration Workshop	1.1	1	3	0.2	1.7
Rental cars					0.5
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$7.8

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 2000
Description	
Commodities Total	$0.0

FY00

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: USFS

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/15/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			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

FY00

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Agency: USFS

FORM 3B
Equipment
DETAIL

Prepared: 4/15/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$20.6
Travel		$6.4
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$27.0
Indirect		$0.0
Project Total	$0.0	$27.0
Full-time Equivalents (FTE)		0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$30.0	$30.0		

Dollar amounts are shown in thousands of dollars.

Comments:

For this project, Dr. McDonald charges $90/hour for his time, and $ 60/hour for a Biometrician I. The indirect rate for this project is 0%.

Costs for Dr. McDonald to attend the Annual Restoration Workshop are approximately $1.5K, or 5% of the total contract cost.

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Lyman McDonald - Western EcoSystems Technology, Inc.

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	Lyman McDonald	Principal Investigator	1.0	15.8		15.8
	To be named	Biometrician I	0.5	9.6		4.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	1.5	25.4	0.0	
					Personnel Total	$20.6

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	L. McDonald to Seattle for planning meeting	0.5	1	3	0.2	1.1
	L. McDonald to Anchorage for Trustee Council briefings (2), and planning	0.9	2	10	0.2	3.8
	L. McDonald to Anchorage for Annual Restoration Workshop	0.9	1	3	0.2	1.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$6.4

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Lyman McDonald - Western EcoSystems Technology, Inc.

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2000
Description	
Commodities Total	$0.0

FY00

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Lyman McDonald - Western EcoSystems Technology, Inc.

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/15/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			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	

FY00

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Lyman McDonald - Western EcoSystems Technology, Inc.

FORM 4B
Equipment
DETAIL

Prepared: 4/15/99

2000 EXXON VALDEZ TRUS. .. COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$20.0
Travel		$6.4
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$26.4
Indirect		$0.0
Project Total	$0.0	$26.4
Full-time Equivalents (FTE)		0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$30.0	$30.0		

Dollar amounts are shown in thousands of dollars.

Comments:
For this project, Dr. Starfield charges $125/hour and no indirect costs.

Costs for Dr. Starfield to attend the Annual Restoration Workshop are approximately $1.5, or 6% of the total contract cost.

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Dr. Anthony M. Starfield

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRUS . _ _ COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	Anthony Starfield	Modeler	1.0	20.0		20.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	1.0	20.0	0.0	
					Personnel Total	$20.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	A. Starfield to Seattle for planning meeting	0.5	1	3	0.2	1.1
	A. Starfield to Anchorage for Trustee Council briefings (2), and planning	0.9	2	10	0.2	3.8
	A. Starfield to Anchorage for Annual Restoration Workshop	0.9	1	3	0.2	1.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$6.4

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Dr. Anthony M. Starfield

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUS . __ COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FY 2000
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2000
Description	
Commodities Total	$0.0

FY00

Prepared: 4/15/99

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Dr. Anthony M. Starfield

FORM 4B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			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

FY00

Project Number:
Project Title: Laying the groundwork for a successful long-term monitoring and research program
Name: Dr. Anthony M. Starfield

FORM 4B
Equipment
DETAIL

Prepared: 4/15/99

Lower Cook Inlet Waste Management Plan

Project Number:	00514
Restoration Category:	General Restoration
Proposer:	Alaska Department of Environmental Conservation
Lead Trustee Agency:	ADEC
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Continued
Duration:	2nd year of 3-year project
Cost FY 00:	600.0
Cost FY 01:	200.0
Cost FY 02:	0.0
Geographic Area:	Lower Cook Inlet
Injured Resource/Service:	All Injured Resources

ABSTRACT

This project will address pollutants reaching the marine environment in proximity to the communities of Seldovia, Nanwalek, and Port Graham through implementation of recommendations developed in the Lower Cook Inlet Waste Management Plan, currently in preparation. Following the model of the Sound Waste Management Plan and the Kodiak Waste Management Plan, this project is designed to address marine pollution from land based sources and identify methods to help restore vital injured resources in these coastal communities.

INTRODUCTION

In varying amounts, a wide range of waste streams are generated from the communities of Seldovia, Port Graham, and Nanwalek that may be entering, degrading, and preventing recovery of the Exxon Valdez spill area. This includes oil generated from vehicles and vessels, hazardous wastes generated by households, and solid wastes. This pollution constitutes a major and chronic source of marine pollution.

Port Graham, Seldovia, and Nanwalek currently face varied problems with managing these wastes, including inadequate facilities to properly manage used oil, landfills located in areas of potential groundwater and surface water contamination, lead, acid batteries, and hazardous household wastes disposed of in community landfills where they may leach into surrounding land and water. As a result of these problems, pollution from these sources is entering Kachemak Bay and the Gulf of Alaska on an on-going basis.

The oil spill region is undergoing an effective effort by the Trustee Council to reduce marine pollution, especially in Prince William Sound and on Kodiak Island. The lower Cook Inlet region has experienced chronic marine pollution problems as well, threatening recovering species injured by the Exxon Valdez oil spill. As a result, wastes generated within the communities represent a chronic source of pollution that not only hinders full recovery of the marine environment, but also has a negative impact on services and general quality of life.

The current process to develop the Lower Cook Inlet Waste Management Plan is providing a forum for communities to identify, rank, and propose action to address region-wide pollutant problems. Regional approaches are being considered as well as ways to share resources where appropriate to improve protection of the marine environment.

This project will implement the specific recommendations, which are forthcoming from the planning process funded by EVOS for this current year (project #99514).

NEED FOR THE PROJECT

A. Statement of Problem

This project addresses pollution entering the Kachemak Bay from a wide variety of sources, including households, businesses, boats, and automobiles. These sources generate used oil, oily bilge water, hazardous wastes, and solid wastes on an on-going basis. These communities are struggling to contain the pollution problem, but do not have adequate equipment, facilities, and training necessary to ensure prevention of spills, illegal dumping/discharges of solid and oily wastes, and of on-going contamination of ground and surface water from current disposal practices. As a result, pollution is entering the waters around the villages that may be entering, degrading, and preventing the recovery of the Exxon Valdez oil spill.

Marine pollution in this region affects the following injured resources: intertidal and subtidal organisms, harlequin ducks, black oystercatchers, sea otters, harbor seals, herring, and other sea birds, shore birds, and marine mammals. The Lower Cook Inlet Waste Management plan is documenting heavy dependence on these resources for subsistence in these communities, as well as potential for economic development associated with recreation and tourism. The economic

and cultural strength of the communities depends on the assurance of long term viability of the ecosystem.

B. Rationale/Link to Restoration

The wastes entering the waters generated from the communities on an ongoing basis are affecting fish, wildlife, and human uses injured by the oil spill. A decrease of land-based pollution would have the effect of decreasing the stress on injured fish and wildlife that rely on clean water, particularly those that feed in the intertidal or nearshore waters in the vicinity of community waterfronts. Subsistence will be the major beneficiary, along with recreational uses.

Chronic pollution from community sources is believed to have significant adverse effects on the marine environment:

- refined petroleum products tend to be even more toxic to fish and wildlife than crude oil,
- the cumulative effects of chronic marine pollution can substantially increase the stress on fish and wildlife, and
- with regard to seabirds, chronic marine pollution is believed to be at least as important as large-scale spills.

C. Location

This project will take place in Seldovia, Port Graham, and Nanwalek.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

The communities of Port Graham, Nanwalek, and Seldovia fully support this project. The governing body of each community is participating in the ongoing planning effort. The planning team includes representatives of the communities, ADEC, Trustee Council members, and has gained support and input from the Kenai Peninsula Borough and the Nunagpet/Chugachmiut Environmental Consortium. The Chugach Regional Resources Commission is helping facilitate the planning process.

Implementation of the waste management plan will ensure participation from all of these parties, and will provide key opportunities to incorporate local and traditional knowledge into the phases of this project. In addition, the project will include extensive community outreach with continuing education through tribal councils and schools, as well as training and skill development for specific waste management technologies.

PROJECT DESIGN

A. Objectives

1. To reduce pollution that is entering Kachemak Bay from solid waste sites and sewage outfalls, mishandling of wastes, and illegal dumping of solid, hazardous, and oily wastes.

2. To reduce the flow of used oil into Kachemak Bay from vessels, boats, vehicles, and other land based sources due to lack of sufficient pollution management equipment.

B. Methods

This project will use the Waste Management Plan being developed in project #99514 as the basis for proposed work in each community. With the close direction of the involved communities, the environmental engineering contractor is currently completing the assessment and identification of cost effective solutions for pollution problems. The findings of the assessment and recommendations for specific actions for achievement of the above objectives will be compiled and published in a forthcoming document entitled the Lower Cook Inlet Waste Management Plan. All identifiable problems and feasible solutions and their costs will be addressed in this manuscript and it will be presented to the Trustee Council in accordance with "Procedures for the Preparation of Final Reports." Any recommendations to construct environmental facilities will take into consideration proper siting and planning of operation and maintenance. Intrusive work involving construction of facilities may require NEPA compliance documentation and will be so noted.

For the next phase of implementing the plan, represented by this proposal, the ADEC will be the lead Trustee Council agency. Specific roles will be outlined for each local tribal association and IRA traditional councils, village corporations, and schools, as well as the City of Seldovia, the Kenai Peninsula Borough, and Nunagpet/Chugachmiut Environmental Consortium. Based upon experience with Prince William Sound and Kodiak Island communities, representative activities that may be recommended by the plan include:

Improved systems for safe transport and handling of hydrocarbon fuels
Selection and development of landfill sites
Closure of existing dumpsites
Improved equipment and processes for handling wastes
Improved equipment for maintenance of existing waste facilities
Improved wastewater collection and treatment systems
Community education on waste management practices, including pollution prevention
Long term monitoring of resources subject to effects of community waste management

The detailed plan recommendations will be the basis for this project, including conceptual designs, costs, and designation of responsibilities for implementation in FY 2000 and FY 2001. A memorandum of cooperation will be developed and circulated to each affected party for whom roles are identified. The memorandum will identify commitments of resources and responsibilities of each party for implementation of the plan. As the lead agency, ADEC will be will obtain contractual project management assistance to coordinate equipment procurement, engineering design, construction of facilities and site improvements, and associated training.

Until the specific plan recommendations are completed for project #99514, the project budget is an estimate based upon experience with the waste management projects previously funded by the Trustee Council for communities in Prince William Sound and Kodiak Island. Thus, the target figure of 800.0 is derived from a hypothetical composite of likely waste management needs, and their associated costs, for the three communities in Lower Cook Inlet. The estimate is approximately proportional to those for communities in prior EVOS projects. Although reliable

costs have been estimated on a preliminary basis for individual waste improvement measures, the actual selection of priorities and their costs will be provided in the report to be submitted in June 1999. That information will in turn provide the basis for the detailed budget and required budget forms for this project. The total budget amount estimated for this project includes all anticipated cost elements and associated general management costs. As background information, the current plan development phase (#99514) was funded by EVOS for 54.5.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Alaska Department of Environmental Conservation is the lead agency and will oversee a contractor's management of the project phases to build, install and develop improved waste management capabilities in these communities.

SCHEDULE

A. Measurable Project Tasks

June 30,1999:	Waste Management Plan final project report (#99514) submitted to Trustee Council Chief Scientist. Detailed budget for this project also submitted.
June 30, 1999:	Circulate draft memorandum of cooperation among local communities to implement the plan.
August 1999:	Initiate contract for implementation assistance
September – March 2000:	Implement engineering site selection process (including NEPA documentation, as appropriate)
September – March 2000:	Develop long-term resource monitoring plan
January - May 2000:	Develop facility designs and start equipment procurement
April 2000 - January 2001:	Develop training schedule and community education materials
June 2000:	Procure equipment
February – May 2000:	Implement community education and training program
May 2000:	Spring Clean-up activities
July 2000 – August 2001:	Construct facilities, implement training

B. Project Milestones and Endpoints

June 11, 1999:	Lower Cook Inlet Waste Management Plan (99514)
June 30, 1999:	Final report (99514) to Trustee Council Chief Scientist
September 1, 1999:	Notice to Proceed for implementation contractor
January 31, 2000:	Draft facility site selection report(s)
March 31, 2000:	Final facility site selection
April 30, 2000:	Draft site engineering plans
March 30, 2000:	Draft equipment procurement specifications
May 31, 2000:	Final equipment specifications and engineering drawings
July 1, 2000:	Break ground for new facilities
September 30, 2000:	Report on FY 2000 implementation efforts
August 31, 2001:	Final inspection of new facilities
September 30, 2001:	Final project report

C. Completion Date

September 30, 2001

PUBLICATIONS AND REPORTS

Reports will be prepared and submitted as required by EVOS procedures.

PROFESSIONAL CONFERENCES

Results will be presented at the annual EVOS symposium.

NORMAL AGENCY MANAGEMENT

As in the previous waste management projects funded by the Trustee Council for communities within the area affected by the spill, these initiatives are not funded under agency responsibilities, and would not occur if not for the oil spill.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As in the preceding waste management projects for Prince William Sound and Kodiak, the resulting community improvements in preventing harmful spills and releases will help promote recovery of resources damaged by the oil spill.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This proposal builds upon the previous project that was approved by the Trustee Council to develop a plan for improving waste management in these communities. This proposal will carry out the recommendations identified in the plan. The approved DPD for #99514 specifies that the final plan be submitted in advance of the proposal represented by this current submittal. Due to unanticipated delays in finalizing the contract, the submittal date for the plan is revised to June 1999. This will allow sufficient budget detail to be identified and provided prior to a final decision on this proposal.

PROPOSED PRINCIPAL INVESTIGATOR

Marianne See, EVOS Liaison
Office of the Commissioner
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska 99501
(907) 269-7635 phone, (907) 269-7508 fax

A summary of credentials is attached.

OTHER KEY PERSONNEL

When the waste management plan is developed, additional technical specialists or managers will be identified to assist with aspects of this project.