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19.12.03

FY 2003

Draft Work Plan

June 2003

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, Alaska 99501-2340 • 907/278-8012 • fax 907/276-7178

MEMORANDUM

TO: Core Peer Reviewers
Stephen Braund, Pete Peterson, Jim Reynolds, Alan Springer, George Rose

FROM: Phil Mundy, Science Coordinator S. Schubert for
phil_mundy@oilspill.state.ak.us

RE: Conventions for peer review of FY 03 proposals

DATE: April 16, 2002

The procedures for reviewing the FY 03 Detailed Project Descriptions (DPD) will be similar to last year. As in past years Bob Spies will assign projects to reviewers and send electronic review sheets for each project to each reviewer, and also send a memo documenting standard procedure under separate cover.

1. Primary reviewers are asked to e-mail the electronic review form for their projects to me with a copy to Stephanie Davis, davis@amarine.com no later than the end of business on **Thursday, May 9**. Please pay close attention to the section entitled "Overall assessment of this project and its relationship to the cluster and overall program." Secondary and tertiary reviewers are encouraged to do the same.

2. The subject line of the e-mail to me should read, **FY 03 DPD 03nnn** where nnn is the project number. Please attach the review form as a word processor file, and put the form inside the e-mail as text as a back up.

The explanation of how the electronic reviews will be used is as follows. At the peer reviewer's meeting the text of the primary reviewers' recommendation, and secondary and tertiary reviews, if available, will be projected on a screen during the discussion. The text will be edited as the discussion of the DPD proceeds. At the end of the discussion, the text should reflect as much as possible the sense of the group. The Chief Scientist will refer to this text when he prepares his recommendation for the Trustee Council. In this way, all participants can review the text as it evolves, and also have access to at least the text of the primary review.

Please note that you need to be generally familiar with the full suite of DPD's because you are asked to evaluate the proposals on which you are the primary reviewer in relation

to the cluster (i.e., Oil Spill: Lingering Injury) and overall restoration program. In addition to the questions on the electronic review form, consider the following questions in relation to the clusters and the overall program:

Are some projects especially important because they help achieve a balanced, integrated, ecologically-oriented whole? See the Invitation to Submit Restoration Proposals for Federal Fiscal Year 2003 (February 2002) and the GEM Program document at http://www.oilspill.state.ak.us/.

Are some projects worthwhile and technically appropriate but less important than others?

Are some projects most appropriately considered to be within the normal management responsibilities of the Trustee agencies?

Are some new projects more important that some ongoing projects?

Are there important gaps?

For continuing projects, take special note of the "Explanation of Changes in Continuing Projects" section of the DPD. This section is included with ongoing projects to simplify your work.

Also please bear in mind that this suite of DPDs is Phase I only for FY 03. All proposals should be either (1) continuation of currently ongoing projects or (2) new work on lingering oil effects or GEM-related synthesis. The two phases are described in more detail on pages 1 and 4 of the Invitation.

As always, your continued cooperation is vital to success. Looking forward to working with you. If you have any questions, please contact me, Bob, Sandra, or Molly.

Cc: Bob Spies
Andy Gunther
Sandra Schubert

Exxon Valdez Oil Spill Trustee Council

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MEMORANDUM

TO: Restoration Work Force
PAG Representatives (Chuck Meacham, Chris Blackburn)

FROM: Sandra Schubert, Program Coordinator

RE: Restoration Proposals: FY 03 Phase I

DATE: April 17, 2002

This set of binders contains the Detailed Project Descriptions and detailed budgets submitted in response to the Trustee Council's FY 03 *Invitation to Submit Restoration Proposals: Phase I*. In all, 33 proposals totaling $4.35 million were received; this includes roughly $1.2 million for Project 03100/Public Information & Administration. The Council's funding cap for FY 03--including Project 03100--is $6.0 million. A portion of this amount (roughly $2.5-3.0 million, including Project 03100) is expected to be awarded under Phase I.

The front pocket of the first binder contains two spreadsheets:

1. A list of all proposals in numeric order. This list contains the project's assigned number and title, the name of the individual who submitted the proposal, and the project's assigned cluster.

2. A list of all proposals by cluster. In addition to project number, title, and proposer, this list contains an abstract of the project, the project's assigned lead agency, the amount of funding requested for FY 03, and the project's duration (the number of years for which funding is being requested from the Trustee Council). For continuing projects, the spreadsheet also contains the FY 02 projection of the amount of funding needed in FY 03 (this column is labeled "FY 03 Expected"). Funding requests from non-Trustee agencies have been adjusted by Restoration Office staff to include agency "GA" (general administration).

Both of the spreadsheets are marked DRAFT. Please give me a call if you find any errors or omissions. Lead agencies and research clusters were assigned by Restoration Office staff, and are open to discussion.

A teleconference meeting of the Executive Director, Restoration Work Force, and two PAG members to develop the Draft Work Plan: Phase I will be held at the Restoration Office (441 West 5th Avenue, 5th floor) at 10:00 am Wednesday, June 5, 2002.

FY 03 WORK PLAN: PHASE I - INDEX OF PROPOSALS

Proj.No.	Project Title	Proposer	Cluster
12-BAA	Photographic Monitoring of Resident Killer Whales	C. Matkin/North Gulf Oceanic Society	Oil Spill: Recovery Monitoring
03052	Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in GEM	P. Brown- Schwalenberg/CRRC	Community Involvement/Public Outreach/Other
03100	Public Information and Administration	All Trustee Council Agencies	Community Involvement/Public Outreach/Other
03190	Construction of a Linkage Map for the Pink Salmon Genome	F. Allendorf/Univ. Montana	Oil Spill: Lingering Injury
03210	Youth Area Watch	R. DeLorenzo/Chugach School District	GEM Transition: Monitoring
03250	Project Management	All Trustee Council Agencies	Community Involvement/Public Outreach/Other
03290	Hydrocarbon Database and Interpretation Service	J. Short, B. Nelson/NOAA	Data Management & Information Transfer
03340	Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem	T. Weingartner/ UAF	GEM Transition: Monitoring
03350	Alaska SeaLife Center Bench Fees		Oil Spill: Ecosystem Recovery & Function
3	Patterns and Processes of Population Change in Selected Nearshore Vertebrate Predators	J. Bodkin, B. Ballachey/USGS-BRD, D. Esler/Simon Fraser Univ.	Oil Spill: Ecosystem Recovery & Function
03455	GEM Data System	Restoration Office	Data Management & Information Transfer
03462	Effect of Disease on Pacific Herring Population Recovery in Prince William Sound	G. Marty/Univ. of California, Davis	Oil Spill: Recovery Monitoring
03476	Effects of Oiled Incubation Substrate on Pink Salmon Reproduction	R. Heintz/NOAA	Oil Spill: Lingering Injury
03550	Alaska Resources Library and Information Services (ARLIS)	All Trustee Council Agencies	Community Involvement/Public Outreach/Other
03558	Harbor Seal Recovery: Application of New Technologies for Monitoring Health	S. Atkinson/UAF	Oil Spill: Recovery Monitoring
03561	Evaluating the Feasibility of Developing a Community-Based Forage Fish Sampling Project for GEM	D. Roseneau/USFWS	GEM Transition: Monitoring
03574-BAA	Assessment of Bivalve Recovery on Treated Mixed-Soft Beaches in Prince William Sound	D. Lees/Littoral Eco.& Environ. Services	Oil Spill: Recovery Monitoring
03575-BAA	Designing a Community Involvement/Community-Based Monitoring Plan for GEM	M. Sigman/Center for Alaskan Coastal Studies, et al	GEM Transition: Monitoring
4	Evaluation of Airborne Remote Sensing Tools for GEM Monitoring	E. Brown/UAF, J. Churnside/NOAA	GEM Transition: Tools to Improve Monitoring

NOTE: DPDs and budgets have not yet been developed for 03100, 03250, 03350, 03455, and 03630.

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FY 03 WORK PLAN: PHASE I - INDEX OF PROPOSALS

Proj.No.	Project Title	Proposer	Cluster
03585	Lingering Oil: Bioavailability and Effects to Prey and Predators	J. Rice, J. Short/NOAA; J. Bodkin, B. Ballachey/USGS; D. Esler/Simon Fraser Univ.	Oil Spill: Lingering Injury
03587-BAA	Understanding the Cellular Processes of Recovery and Its Utility in Oil-Spill Restoration Efforts	C. Downs/EnVirtue Biotechnologies, Inc.	Oil Spill: Ecosystem Recovery & Function
03594	Development of an Alaska Standard Species for Marine Toxicity Testing - The Alaska Green Urchin	R. Perkins/UAF	Oil Spill: Lingering Injury
03596-BAA	Securing Flow Data for a Lower Kenai Peninsula Salmon Stream	J. Cooper/Cook Inlet Keeper	GEM Transition: Monitoring
03600	Synthesis of the Ecological Findings from the EVOS Damage Assessment and Restoration Programs, 1989-2001	R. Spies/EVOS Chief Scientist, et al	GEM Transition: Synthesis & Retrospective Analysis
03607-BAA	Geographic Information Systems (GIS) Map of Water Quality Monitoring Sites Across the Gulf of Alaska	M. Gracz/Cook Inlet Keeper	GEM Transition: Synthesis & Retrospective Analysis
03610	Kodiak Archipelago Youth Area Watch	T. Schneider/Kodiak Island Borough School District	GEM Transition: Monitoring
03614	Monitoring Program for Near-Surface Temperature, Salinity, and Fluorescence in the Northern Pacific Ocean	S. Okkonen/UAF	GEM Transition: Tools to Improve Monitoring
03620	Lingering Oil and Predators: Pathways of Exposure and Population Status	S. Rice, J. Short, M. Lindeberg/NOAA; J. Bodkin, B. Ballachey/DOI	Oil Spill: Lingering Injury
03625-BAA	Prince William Sound Isotope Ecology Ecology Synthesis	T. Kline/PWSSC	GEM Transition: Synthesis & Retrospective Analysis
03630	Scientific Management under GEM	Restoration Office	Data Management & Information Transfer
03631-BAA	Top-Down Process Synthesis	T. Kline/PWSSC	GEM Transition: Synthesis & Retrospective Analysis
03636-BAA	Management Applications: Commercial Fishing	K. Adams, R. Mullins/Cordova	GEM Transition: Synthesis & Retrospective Analysis
03649	Reconstructing Sockeye Populations in the Gulf of Alaska over the Last Several Thousand Years	B. Finney/UAF	GEM Transition: Synthesis & Retrospective Analysis
03656	Retrospective Analysis of Nearshore Marine Communities Based on Analysis of Archaeological Material and Isotopes	G. Irvine/USGS, J. Schaaf/NPS, D. Mann/UAF, J. Southon/Univ. Calif.	GEM Transition: Synthesis & Retrospective Analysis

NOTE: DPDs and budgets have not yet been developed for 03100, 03250, 03350, 03455, and 03630.

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INDEX OF PROPOSALS BY CLUSTER -- FY 03 WORK PLAN: PHASE I

Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
Oil Spill: Lingering Injury					$146.0	$643.9	$30.0
03190	Construction of a Linkage Map for the Pink Salmon Genome	F. Allendorf/Univ. Montana	ADFG	Cont'd 8th yr. 8 yr. project	$80.0	$80.3	$0.0

This is the final year of a project based upon experiments conducted at the Alaska SeaLife Center that use the linkage map constructed to test for effects of regions of the genome on traits that are important to recovery of pink salmon (e.g., growth and survival). In summer 2001, 259 sexually mature adults were collected in Resurrection Bay from the 1999 cohort produced from wild pink salmon collected from Likes Creek. In FY 03, the analysis of the genotypes in the returning adults will be completed to test for genetic differences in marine survival and other life history traits (e.g., body, size, egg number, and egg size).

03476	Effects of Oiled Incubation Substrate on Pink Salmon Reproduction	R. Heintz/NOAA	NOAA	Cont'd 5th yr. 5 yr. project	$36.0	$37.4	$0.0

Populations are maintained through successful reproduction; this study is designed to determine if exposure to oil impairs pink salmon reproduction. This experiment began in the fall of 1998 when pink salmon eggs were incubated in oil contaminated water. Fish that survived exposure were marked and released in the spring of 1999. They reached maturity at sea and returned to spawn in the fall of 2000. Return rates confirmed previous observations of reduced marine survival among exposed fish, but evaluations of offspring (F1) survival rates did not indicate any reproductive impact. The F1 were incubated in clean water until spring 2001 when they were marked and released. They will mature and return to the hatchery in the fall of 2002 and their reproductive ability will be evaluated by generating an F2 generation. A diminished ability to produce the F2 generation represents a genetic effect of oil transmitted to unexposed generations. Such an effect was demonstrated for similarly treated pink salmon in 1997, but corroborating data do not exist. This project is designed to retest that experiment; if diminished reproductive ability is corroborated, it would demonstrate a significant and unanticipated effect of oil pollution.

03585	Lingering Oil: Bioavailability and Effects to Prey and Predators	J. Rice, J. Short/NOAA; J. Bodkin, B. Ballachey/USGS; D. Esler/Simon Fraser Univ.	NOAA & DOI	Cont'd 2nd yr. 2 yr. project	$30.0	$52.1	$0.0

About 20 acres of contaminated beach were found in 2001 surveys of western Prince William Sound conducted under Project 01543. In these areas, sea otters and harlequin ducks have not recovered, raising concerns that continued oil exposure may be affecting their survival. Biochemical assays and mortality patterns are consistent with continuing oil exposures, but prior to this study, linkages between oil persistence and impacts at higher trophic levels had not been attempted. In this study, shoreline contamination, exposure and effects were examined simultaneously by choosing a common set of sites at which to assess oil persistence and biological impacts on sea otters and harlequin ducks. Fieldwork was conducted in FY 02, and closeout activities, including data analyses and writing of reports and publications, will be done in FY 03. During field operations, prey living in oil patches were encountered in larger numbers than anticipated. These have been sampled (primarily clams) and archived. Additional closeout funds have been requested to analyze these samples. The National Oceanic and Atmospheric Administration's Auke Bay Lab has been leading the studies of oil bioavailability and impacts to prey species; Department of Interior-U.S. Geological Survey has been directing the studies on sea otters and harlequin ducks.

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Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
03594	Development of an Alaska Standard Species for Marine Toxicity Testing - The Alaska Green Urchin	R. Perkins/UAF	ADFG	New 1st yr. 1yr. project		$134.1	$0.0

This project will develop a standard marine toxicity testing procedure using cold water and an Alaska species. None of the standard test procedures required or recommended by the Environmental Protection Agency and other environmental regulators use cold-water test animals. Use of typical warm-water species to make decisions about Alaska conditions and species is unsatisfactory from a scientific standpoint, and this practice also interferes with public acceptance of the results. Decisions requiring toxicity testing include crude oil components and cleanup chemicals, such as dispersants and beach cleaners. This project proposes developing the Alaska green urchin as a test species. Tests of urchin fertilization and embryo development are sensitive indicators of toxicity.

03620	Lingering Oil and Predators: Pathways of Exposure and Population Status	S. Rice, J. Short, M. Lindeberg/NOAA; J. Bodkin, B. Ballachey/DOI	NOAA	New 1st yr. 2 yr. project		$340.0	$30.0

Lingering oil and continued effects to sea otters and sea ducks are the most surprising and best documented long term impacts of the oil spill. Strong evidence is accumulating which implicates lingering oil as a factor constraining recovery of the nearshore ecosystem in western Prince William Sound. Acute and chronic contamination of sediments and prey species were well documented during the years following the spill. Twelve years later, elevated biomarker levels in sea otters and sea ducks have indicated continued exposures to hydrocarbons. Evidence implicating a route of exposure to date has been largely circumstantial. However, in 2001 and 2002, extensive sampling was undertaken to document the distribution, abundance, and bioavailability of lingering oil along those shorelines most heavily impacted by the spill. This has paved the way for identifying specific areas where sea otters and sea ducks could be currently foraging and exposed to lingering oil. This project is an outgrowth of the earlier studies and will focus on the direct pathways of lingering oil to sea otter and sea duck populations in two heavily impacted bays in the western sound.

Oil Spill: Recovery Monitoring					$120.3	$248.6	$0.0
03012-BAA	Photographic Monitoring of Resident Killer Whales	C. Matkin/North Gulf Oceanic Society	NOAA	Cont'd 11th yr.	$0.0	$17.8	$0.0

This project will transition monitoring of the damaged resident AB pod and other resident pods and the potentially endangered AT1 transient population into a cooperative program with the Alaska SeaLife Center and various foundations. Monitoring has occurred on a yearly basis since 1984 and was crucial in evaluating the serious oil spill effects on killer whales. This project seeks funds to augment current research directed at transient killer whales and provide for annual monitoring of AB pod and other resident pods and analysis and reporting of results.

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Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
03462	Effect of Disease on Pacific Herring Population Recovery in Prince William Sound	G. Marty/Univ. of California, Davis	ADFG	Cont'd 5th yr. 4 yr. project	$0.0	$78.5	$0.0

In spring 2001, prevalence of *Ichthyophonus hoferi* (38 percent) in the Pacific herring population of Prince William Sound was more than 50 percent greater than in any year studied (1989-2000). *I. hoferi* causes severe, disseminated, chronic disease in Pacific herring that is best diagnosed using histopathology. Before 2001, *I. hoferi* was not associated with unexpected declines in population biomass, but during the last century increases in *I. hoferi* prevalence in Atlantic herring have been associated with several disease outbreaks. To understand the significance of the 2001 *I. hoferi* outbreak, this project will analyze samples already collected in fall 2001 and spring 2002 as part of Project 02462.

03558	Harbor Seal Recovery: Application of New Technologies for Monitoring Health	S. Atkinson/UAF	ADFG	Cont'd 3rd yr. 3 yr. project	$85.0	$117.0	$0.0

This study is a continuation of the study to assess the potential for new technologies to monitor the endocrine and immune systems for the health of harbor seals. During year one, baseline samples were collected from both permanently captive and rehabilitation seals at the Alaska SeaLife Center. Analysis of thyroxine (T4), triiodothyronine (T3), and cortisol (metabolic and gluconeogenic hormones), and measurement of immunoglobulins (IgG, IgM, and IgA) and organochlorine contaminants are currently being assessed. Cell lines to quantify immunoglobulins have been initiated, and baseline hormones have been established. FY03will compare the profiles of free-ranging seals and those failing to thrive in their environment in an effort to restore this species.

03574-BAA	Assessment of Bivalve Recovery on Treated Mixed-Soft Beaches in Prince William Sound	D. Lees/Littoral Eco.& Environ. Services	NOAA	Cont'd 2nd yr. 2 yr. project	$35.3	$35.3	$0.0

Studies from 1989 through 1997 suggest that bivalve assemblages on beaches in Prince William Sound with high-pressure hot-water washing remain severely damaged in terms of species composition and function. This project will assess the generality of this apparent injury to these assemblages. A finding that our conclusions are accurate will indicate that a considerable proportion of mixed-soft beaches in treated areas of the sound remains extremely disturbed and that these beaches are functionally impaired in terms of their ability to support foraging by damaged nearshore vertebrate predators such as sea otters and harlequin ducks. The study will also provide insight into the need for remediation of beaches to restore biodiversity and function on these assemblages.

Oil Spill: Ecosystem Recovery & Function					$339.0	$549.2	$0.0
03350	Alaska SeaLife Center Bench Fees		ADFG	Cont'd	$150.0	$150.0	

NOTE: Bench fees will be calculated by the Alaska SeaLife Center by July 1. The cost amount shown above is a placeholder.
This project will pay for the use of labs and office space, as well as other direct expenses, at the Alaska SeaLife Center for those projects funded by the Trustee Council that have a SeaLife Center component. Two FY 03 projects, both of which are continuing projects, include a SeaLife Center component: 03423/Patterns and Processes of Population Change in Selected Nearshore Vertebrate Predators and 03558/Harbor Seal Recovery: Application of New Technologies for Monitoring Health.

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Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
03423	Patterns and Processes of Population Change in Selected Nearshore Vertebrate Predators	J. Bodkin, B. Ballachey/USGS-BRD, D. Esler/Simon Fraser Univ.	DOI	Cont'd 5th yr 5 yr. project	$189.0	$216.2	$0.0

Sea otters and harlequin ducks have not fully recovered from the oil spill, based on population-level demographic differences between oiled and unoiled areas. Further, in oiled areas, both species show elevated cytochrome P4501A, almost certainly reflecting continued exposure to oil. This project is exploring links between oil exposure and the lack of population recovery, with the intent of understanding constraints to full recovery of these species and the nearshore environment generally. The results also serve to monitor the progress of recovery of the species and the system. To date, the work has consisted of field components for both species, and a captive component for harlequin ducks. Proposed activities for FY 03 include (a) the third and final year of harlequin duck field studies quantifying oil exposure and survival of females during winter and (b) closeout of all project components and preparation of the final report.

03587-BAA	Understanding the Cellular Processes of Recovery and Its Utility in Oil-Spill Restoration Efforts	C. Downs/EnVirtue Biotechnologies, Inc.	NOAA	New 1st yr. 1 yr. project		$183.0	$0.0

This project will elucidate the cellular and genomic mechanisms that affect the rate of recovery in bivalve species impacted by the oil spill. The project will (a) determine the adverse affects of a long-term oil-spill exposure on specific processes of cellular physiology and genomic integrity that could potentially impede or slow the rates of recovery in populations of *Protothaca staminea* and (b) determine the link between cellular-physiological condition with PAH-body burden in these two species of bivalves by characterizing these parameters in populations from sites that exhibit different levels of oil contamination. Completion of this work may provide a foundation to address questions critical to the issue of variable rates of recovery in both invertebrate and vertebrate species in oil-impacted areas. It will provide new and powerful tools to improve monitoring methodologies, as well as potentially providing valuable information for restoration efforts.

GEM Transition: Tools to Improve Monitoring					$57.1	$64.9	$0.0
03584	Evaluation of Airborne Remote Sensing Tools for GEM Monitoring	E. Brown/UAF, J. Churnside/NOAA	ADFG	Cont'd 2nd yr. 2 yr. project	$40.0	$44.0	$0.0

This is the year-two completion of a project initiated in FY 02. The main objective is an evaluation of airborne remote sensing tools for GEM ecological interpretation of the data collected. The instrument package consists of (a) a pulsed lidar to map subsurface features to a maximum of 50 m, (b) an infrared radiometer to map Sea Surface Temperature (SST) day, (c) two three-chip digital video systems to map ocean color (chlorophyll), birds, mammals, surface fish schools, and ocean frontal structure, and (d) an infrared digital video to map birds and mammals at night. Shipboard and buoy data will be used for validation and interpretation of remotely sensed data.

03614	Monitoring Program for Near-Surface Temperature, Salinity, and Fluorescence in the Northern Pacific Ocean	S. Okkonen/UAF	ADFG	Cont'd 2nd yr. 2 yr. project	$17.1	$20.9	$0.0

This project will use a thermosalinograph and fluorometer, to be installed on a crude oil tanker, to acquire continuous, long-term measurements of the near-surface temperature, salinity, and fluorescence fields along the tanker route between Valdez, Alaska and Long Beach, California.

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Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
GEM Transition: Synthesis & Retrospective Analysis					$308.2	$508.8	$261.3
03600	Synthesis of the Ecological Findings from the EVOS Damage Assessment and Restoration Programs, 1989-2001	R. Spies/EVOS Chief Scientist, et al	ADNR	Cont'd 2st yr. 3 yr. project	$212.0	$212.0	$184.8

This project is synthesizing the results from 12 years of post-spill study in the EVOS damage assessment and restoration programs in the context of anthropogenic and natural factors causing change in the northern Gulf of Alaska ecosystem. The result of the work will be an integrated synthesis book. The book will consist of three major sections: (a) the basic structure and function of the ecosystem, (b) how does it change over time and respond in disturbances? and (c) the effect of the spill: how our understanding of the ecosystem has matured and what future path will help us better understand this valuable marine ecosystem. The book will be a major product of the EVOS restoration program and help set the foundation for the Gulf Ecosystem Monitoring and Research Program.

03607-BAA	Geographic Information Systems (GIS) Map of Water Quality Monitoring Sites Across the Gulf of Alaska	M. Gracz/Cook Inlet Keeper	NOAA	New 1st yr. 1 yr. project	$12.8	$0.0

This project will synthesize existing data to create a comprehensive Geographic Information Systems (GIS) map and database of monitoring sites across the Gulf of Alaska. This map will be published in hardcopy and will be linked to CIMMS (Cook Inlet Information Management and Monitoring System, Project 01391) and STORET, through which the map and data can be easily updated and made available to monitoring entities as well as policy makers, scientists, and the general public. This map and the accompanying data will serve as a lasting tool for the restoration and protection of the Gulf of Alaska's resources by coordinating diverse monitoring efforts and establishing a framework into which information about current and future monitoring programs can be entered.

03625-BAA	Prince William Sound Isotope Ecology Ecology Synthesis	T. Kline/PWSSC	NOAA	New 1st yr. 3 yr project	$32.6	$20.4

This project will provide a 'big picture' synthesis of the present structure of the pelagic ecosystem of Prince William Sount through preparation of a scientific paper with tentative title: "A stable isotope based trophic structure of the pelagic community of Prince William Sound, Alaska". The documentation of a 'before picture' will be of extremely high value because the recently documentated regional change in species composition is likely to alter pelagic trophic structure during GEM. [Note: This project also requested $23,200 for FY 05.]

03631-BAA	Top-Down Process Synthesis	T. Kline/PWSSC	NOAA	New 1st yr. 2 yr. project	$55.6	$29.5

This project will synthesize information that suggests ontogenetic increases of the trophic position of the walleye Pollock such that they contribute to top-down processes when >600mm in length, using stable isotope analysis of archived samples and data. Pollock feed at multiple trophic levels depending on their size, with larger pollock cannibalizing smaller pollock, especially those that are age-0. Preliminary analysis suggested that pollock of this size range has a high potential for cannibalism. Pollock of this size range are presently being removed from Prince William Sound since the discovery of a mostly undisturbed population during the SEA project (Sound Ecosystem Assessment, Project /320.) The proposed documentation of a 'before picture' will be of extremely high value for GEM, because fising pressure may effectively remove the larger size class pollock from the sound as has happened in the Bering Sea.

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Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
03636-BAA	Management Applications: Commercial Fishing	K. Adams, R. Mullins/Cordova	NOAA	Cont'd 2nd yr.	$50.0	$50.0	

This project is intended to build a bridge between the scientific commuinty, which is describing and attempting to predict variation in biological production, and the commercial fishing community, which is attempting to find management applications for this new information. In addition, the project seeks to provide community presence to participate in development of GEM.

03649	Reconstructing Sockeye Populations in the Gulf of Alaska over the Last Several Thousand Years	B. Finney/UAF	ADFG	Cont'd 2nd yr. 3 yr. project	$28.2	$90.8	$26.6

This project is reconstructing changes in sockeye salmon abundance over the last 5000 years using the ^{15}N record left by salmon carcasses in the sediments of spawning lakes in Prince William Sound, the Kenai Fjords, the Kenai River watershed, and on Kodiak Island. The research question is: What is the normal variability in sockeye salmon populations in the Gulf of Alaska and how does it relate to climatic changes in the Gulf of Alaska region? The results will provide a valuable background for future monitoring studies within GEM and for fisheries managers working to preserve and restore natural salmon runs. [Note: This project was originally scheduled to close out in FY 03; an additional year of funding is now being requested.]

03656	Retrospective Analysis of Nearshore Marine Communities Based on Analysis of Archaeological Material and Isotopes	G. Irvine/USGS, J. Schaaf/NPS, D. Mann/UAF, J. Southon/Univ. Calif.	DOI	Cont'd 2nd yr. 2 yr. project	$18.0	$55.0	$0.0

This project will investigate long-term (6,300 year) patterns of productivity and relative species abundances in nearshore, intertidal communities via retrospective analyses. These analyses will focus on excavated midden remains of very rich, well-dated archaeological sites along the Katmai National Park and Preserve coast. Changes in nearshore marine communities will be assessed through examination of relative species abundances, size-frequency analysis, and other indicators of habitat changes. Isotopic analysis of shells will provide an assessment of long-term productivity patterns in the nearshore marine environment as related to major periods of climate change.

GEM Transition: Monitoring					$202.9	$341.1	$93.9
03210	Youth Area Watch	R. DeLorenzo/Chugach School District	ADFG	Cont'd 8th yr.	$96.4	$96.8	

This project links students in the oil spill impacted area with research and monitoring projects funded by the Trustee Council. The project involves students in the restoration process and provides these individuals the skills to participate in restoration now and in the future. Youth conduct research identified and delegated by principal investigators who have indicated interest in working with students. Youth Area Watch fosters long-term commitment to the goals set out in the restoration plan and is a positive community investment in that process. Participating communities in FY 03 will be Tatitlek, Chenega Bay, Cordova, Nanwalek, Port Graham, Seldovia, Seward, Valdez, and Whittier.

Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
03340	Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem	T. Weingartner/ UAF	ADFG	Cont'd 6th yr.	$33.1	$50.6	$32.1

Interannual variations in temperature and salinity on the northern Gulf of Alaska shelf reflect environmental changes that affect this marine ecosystem. Quantifying and understanding this variability require long time series such as the 32-year record at hydrographic station GAK 1 near Seward. This project continues this time series, quantifies the synoptic, seasonal, and interannual variability, and seeks to understand the reasons for this variability. It will also begin to examine interannual variations in near-surface stratification and the timing of the spring bloom on the inner Gulf of Alaska shelf. The data will be used to predict the baroclinic component of the mass and freshwater transport variability in the Alaska Coastal Current in the northern gulf.

03561	Evaluating the Feasibility of Developing a Community-Based Forage Fish Sampling Project for GEM	D. Roseneau/USFWS	DOI	Cont'd 2nd yr. 2 yr. project	$11.6	$17.8	$0.0

This project will close out Project 02561, which is evaluating the feasibility of developing a community-based forage fish sampling project for GEM. The work in FY 03 will consist of compiling and analyzing information collected during FY 02, and writing a final report.

03575-BAA	Designing a Community Involvement/Community-Based Monitoring Plan for GEM	M. Sigman/Center for Alaskan Coastal Studies, et al	NOAA	New 1st yr. 1 yr. project		$98.6	$0.0

This project will design and produce a draft GEM community involvement and community-based monitoring plan to address the needs of diverse communities in the region. This initiative will be informed by (a) a case history review of working models of community-based monitoring efforts relevant to the GEM conceptual foundation, (b) a regional capacity assessment to identify potential partnerships, (c) issues and indicators as identified by Chugach Regional Resource Commission's Tribal Natural Resource Management Planning Process and other community planning processes. Recommendations will include identifying new approaches to melding Western science and local and traditional knowledge and pilot community-based monitoring projects. [Note: This proposal is being presented in two phases. Phase I ($41,900) would take place October-December 2002. Phase II (approximately $56,700) would be developed and submitted following the completion of Phase I.]

03596-BAA	Securing Flow Data for a Lower Kenai Peninsula Salmon Stream	J. Cooper/Cook Inlet Keeper	ADFG	New 1st yr. 1 yr. project		$15.5	$0.0

Since August 1998, Cook Inlet Keeper and the Homer Soil and Water Conservation District have been collecting discharge and water quality data from four important salmon streams on the lower Kenai Peninsula: Ninilchik River, Anchor River, Deep Creek, and Stariski Creek. With the loss of funding, the U.S. Geological Survey (USGS) no longer can maintain the Ninilchik River gauge. Keeper, Homer Soil and Water Conservation District, Ninilchik Traditional Council and others depend on this gauge for the flow data needed to achieve a complete picture of water quality in these watersheds. This project will provide funds for Keeper to contract with USGS to maintain the gauge for one year, during which time long-term funding will be secured.

Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
03610	Kodiak Archipelago Youth Area Watch	T. Schneider/Kodiak Island Borough School District	ADFG	Cont'd 4th yr.	$61.8	$61.8	$61.8

This project will engage students in projects with goals aligned with the general restoration efforts of the Trustee Council. Students and site coordinators will conduct interviews with local experts and document traditional ecological knowledge, publishing it in a Kodiak School District oral history magazine. Participation of Youth Area Watch adults and students in the annual Academy of Elders/Science Camp will be strongly encouraged. Such participation will serve as another avenue for more tribal members to learn about restoration efforts, scientific monitoring techniques, and occupations related to such work. The value and implications of traditional ecological knowledge will be strongly emphasized throughout the implementation of the project.

Data Management & Information Transfer					$435.0	$422.7	$22.7
03290	Hydrocarbon Database and Interpretation Service	J. Short, B. Nelson/NOAA	NOAA	Cont'd 12th yr.	$35.0	$22.7	$22.7

This ongoing project provides data and sample archiving services for all samples collected for hydrocarbon analysis in support of Trustee Council projects. These data represent samples collected since the oil spill in 1989 to the present and include environmental and laboratory National Resource Damage Assessment and restoration data. Additionally, this project provides interpretive services for hydrocarbon analysis, public releases of the hydrocarbon and pristane databases, and storage and maintenance of the hydrocarbon sample archives.

03455	GEM Data System	Restoration Office	ALL	Cont'd 2nd yr.	$150.0	$150.0	

NOTE: A Detailed Project Description and budget will be developed by June 3. The cost amount shown above is a placeholder.
This project will continue work on the data system for GEM. It will support a Data Manager to provide the leadership and ongoing maintenance necessary for this essential part of the GEM program.

03630	Scientific Management under GEM	Restoration Office	ALL	Cont'd Ongoing	$250.0	$250.0	

NOTE: A Detailed Project Description and budget will be developed by June 3. The cost amount shown above is a placeholder.
This project will fund the Science and Technical Advisory Committee (STAC), its subcommittees, and related support activities including the Trustee Council's Annual Workshop. The purpose of the STAC, which consists of seven members appointed by the Trustee Council, provides the primary scientific advice to the Council's Executive Director on GEM and how proposed and funded monitoring and research projects meet the mission and goals of the GEM program and address key questions and hypotheses. In addition, the STAC may at times participate in and/or lead the peer review process for proposals and project results. Subcommittees, with expertise on each of four habitat types--watersheds, nearshore, Alaska Coastal Current, and offshore--will recommend to the STAC testable hypotheses, items for invitation, and potential peer reviewers as well as possibly conduct peer review on proposals and project results.

INDEX OF PROPOSALS BY CLUSTER -- FY 03 WORK PLAN: PHASE I

Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request
Community Involvement/Public Outreach/Other					$1,580.3	$1,577.6	$192.6
03052	Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in GEM	P. Brown- Schwalenberg/CRRC	ADFG	Cont'd 9th yr.	$180.0	$177.3	$192.6

In FY 03, this project will focus on four objectives: (a) establishing Core Action Plans for the Tribal Natural Resource Management Plans being developed in FY 02, (b) identifying priority regional and community-specific research and monitoring issues and concerns and fitting them to community-based research and monitoring activities, especially those related to GEM, (c) conducting a "Wisdomkeeper Series" for discussing and sharing research and monitoring issues with selected biologists, scientists, elders, and traditional knowledge experts, and (d) developing pilot community-based research and monitoring projects for potential implementation in FY 04. Communities involved in the project are Tatitlek, Chenega Bay, Port Graham, Nanwalek, Cordova/Eyak, Seward/Qutekcak, Seldovia, Valdez, Kodiak Island Region/Ouzinkie, and the Alaska Peninsula Region/Chignik Lake.

03100	Public Information and Administration	All Trustee Council Agencies	ALL	Cont'd	$1,200.0	$1,200.0	

NOTE: A Detailed Project Description and budget will be developed for this project by June 3. The cost amount shown above is a placeholder.
This project provides overall support for public involvement, and administration of the restoration program, including GEM. It includes funding for the Trustee Council staff working at the direction of the Executive Director, public involvement efforts including the active participation of the Public Advisory Group (PAG), and management of the EVOS Investment Fund.

03250	Project Management	All Trustee Council Agencies	ALL	Cont'd	$100.0	$100.0	

NOTE: A Detailed Project Description and budget will be developed by June 3. The cost amount shown above is a placeholder.
Project management supports the Trustee agencies in fulfilling their responsibility to ensure that individual projects are managed consistent with the Memorandum of Agreement and Consent Decree, the Restoration Plan, and Trustee Council authorization. Tasks performed by project managers include coordinating activities between principal investigators and the Restoration Office, reviewing project expenditure activity, assisting in the development of project proposals, and tracking project reports.

03550	Alaska Resources Library and Information Services (ARLIS)	All Trustee Council Agencies	ALL	Cont'd ongoing	$100.3	$100.3	

This project represents the Trustee Council's contribution to the Alaska Resources Library and Information Services (ARLIS). ARLIS serves as a central access point for information generated through the Trustee Council restoration process and the GEM program. In addition, ARLIS acts as the public repository for reports and other materials generated from and related to the cleanup, damage assessment and restoration efforts following the oil spill. ARLIS supports the research efforts and information needs of the Restoration Office, principal investigators, natural resources professionals, and the general public.

INDEX OF PROPOSALS BY CLUSTER -- FY 03 WORK PLAN: PHASE I

Proj.No.	Project Title	Proposer	Lead Agency	New or Cont'd	FY 03 Expected	FY 03 Request	FY 04 Request

	All Proposals*	Work Plan Only**
Total Continuing Projects FY 03 Expected:	$3,188.8	$1,988.8
Total Continuing Projects FY 03 Requested:	$3,484.6	$2,284.6
Total New Projects FY 03 Requested:	$872.2	$872.2
Total New & Continuing Projects FY 03 Requested:	$4,356.8	$3,156.8

** 33 projects were received (25 continuing and 8 new). The costs included for the following projects are placeholders, as budgets have not yet been prepared: 03100/Public Information & Administration ($1,200.0), 03250/Project Management ($100.0), 03350/ASLC Bench Fees ($150.0), 03455/GEM Data Management ($150.0), and 03630/GEM Science Management ($250.0).*

*** The Work Plan Only column includes all projects except 03100/Public Information & Administration ($1,200.0).*

NOTE: The FY 03 funding cap set by the Council is $6.0 million (for Phases I and II), including 03100/Public Information & Administration.

PHOTOGRAPHIC MONITORING OF RESIDENT KILLER WHALES IN PRINCE WILLIAM SOUND AND KENAI FJORDS, ALASKA
-A Cooperative Program-
(Submitted under BAA #52ABNF200037)

Project Number: ~~03312~~ 03012

Restoration Category: Monitoring, Research

Proposer: North Gulf Oceanic Society

Lead Trustee Agency: NOAA

Duration: 1 year

Cost : $16,566

FY 2003

Geographic Area: Prince William Sound/Kenai Fjords, Alaska

Injured Resource/Service: Killer Whales

ABSTRACT

This project transitions monitoring of the damaged resident AB pod and other resident pods and the potentially endangered AT1 transient population into a cooperative program with Alaska Sea Life Center and various foundations. Monitoring has occurred on a yearly basis since 1984 and was crucial in evaluating the serious oil spill effects on killer whales. This proposal seeks funds to augment current research directed at transient killer whales and provide for annual monitoring of AB pod and other resident pods and analysis and reporting of results.

INTRODUCTION

On March 31, 1989 AB pod was observed in oil sheens and six of the 36 pod members were missing. A total of 14 whales were lost from resident AB pod in the two years following the *Exxon Valdez* oil spill and there was no recruitment into the pod during those years. Since that time the social structure within AB pod has shown signs of deterioration. Maternal groups have traveled independently or with other pods, and pod members have not consistently traveled with closest relatives. Although 4 calves were recruited during the period 1992-1994, there were 5 additional mortalities in 1994. There has been a net increase of four individuals since 1995. In 2001 there were two recruited calves and one newmortality, the pod currently contains 26 individuals. The rate of mortality observed in this pod after the oil spill far exceeds that recorded for 10 other resident pods observed in southern Alaska over the past 18 years or for 19 pods in British Columbia over the past 23 years. Although it appears this pod is now slowly recovering, population modeling indicates recovery will not be complete until 2015 due to the loss of females and juveniles and their reproductive potential at the time of the spill.

Nine whales from the transient AT1 group have not been observed since 1989. Two additional AT1 whales have not been sighted for seven years. Another member of this group stranded and died on a beach near Cordova, Alaska in July 2000 and another stranded and died in 2001.. From genetic and photographic data from beached whales, four of these thirteen missing AT1 group whales are known to be dead. Although transient killer whale social structure is not fully understood, we are confident that the other missing AT1 whales also are dead. Statistical analysis backs up this supposition and strongly suggests that they have either died or permanently emigrated from the area. Since there is no record of these whales in adjacent regions and they appear to have a limited range, it is almost certain that the missing AT1 whales are dead.

Eighteen years of systematic data collected under public and private funding have been placed in a specially designed GIS database currently housed at the U.S. Fish and Wildlife Service, Marine Mammals Management Division, Anchorage, Alaska and at Alaska Pacific University, Anchorage, Alaska under the management of collaborator, Dr. David Scheel. The database contains 914 records of encounters with killer whales in and near Prince William Sound and Kenai Fjords, Alaska. Analyses have determined large-scale differences in spatial distribution patterns between resident and transient whales over time (Sheel et al. 2001). Changes in transient whale distributions have been examined in relation to changes harbor seal populations.

There is worldwide concern that specific PCB and dioxin congeners may have negative effects on reproduction in mammals. The recovery of killer whales in Prince William Sound and the long-term health of the population is dependent on unimpeded reproductive processes. Recently there is concern over contaminant levels and their relationship to the recent decline of southern resident killer whales in Puget Sound. During this study we have measured contaminant levels in both resident and transient killer whales, and found much higher levels in the transient population. Contaminants apparently passed from mother to offspring via lactation and levels follow consistent patterns within genealogies (Ylitalo et al 2001). Samples were obtained from individually identified living whales that can be re-identified and re-sampled to assess future changes in levels. The ability to sample and potentially resample specific known

individuals and their known kin is a unique aspect of this project. Results of contaminant analysis (Ylitalo et al 2001) raise concern that contaminants in transient whales could negatively impact reproduction and/or reduce immune response leading to mortalities. There has been no successful reproduction in the AT1 group since 1984. All chemical analysis of tissue and assistance in the interpretation of results is provided by the NMFS/NOAA Environmental Contaminant Laboratory, Seattle, Washington under a cooperative agreement with N.G.O.S. that is continuing

In FY97 we initiated a remote hydrophone and acoustic monitoring as a long-term assessment tool. Initial analysis and separation of pods has been completed and results are in publication. (Yurk et al. in press). Currently we are operating a hydrophone in Resurrection Bay and another at Chiswell Island, both powered by solar and wind power and using microwave transmission technology. Both of these hydrophones are fully supported by the Alaska Sea Life Center, (funds are not requested here) but will aid in our overall monitoring efforts of resident pods.

NEED FOR THE PROJECT

A. Statement of Problem

The AB pod of killer whales was injured by the EVOS. Although it initially had shown signs of recovery from 1991 to 1993, mortalities in 1994/95 reduced the number of surviving AB pod whales to a low of 22. Since 1995 there has been a net gain of four individuals; however, recovery to prespill numbers is not expected until 2015, provided there are no additional atypical mortalities. At least 12 of the original 22 members of AT1 group of transient killer whales have apparently died since 1989 and there has been no recruitment within the group. Recovery for this group seems doubtful at this time and a petition to list them as an endangered population is in preparation. This project will continue to monitor the status of AB pod and the AT1 group.

Sightability of killer whales in Prince William Sound has changed since the spill; particularly resident whales have been more frequently encountered in the Kenai Fjords region. Transient whales are seen less frequently in all areas than prior to the spill.

Initial mortalities within AB pod following the spill have apparently led to additional mortalities due to loss of key individuals. Deterioration of AB pod social structure has led to a situation where one subpod now travels separately most of the time (the AB25 subpod travels with AJ pod). The project will provide long-term insight into effects of changes in killer whale social structure due to unnatural mortalities. A detailed population model for resident killer whales is under construction.

Despite considerable effort, re-sightings of the AT1 group have declined and fewer individuals are seen when members of this transient group are located. We are confident that 12 of the original 22 members of this group are dead, or have emigrated to other regions; although the later possibility is very unlikely. None of the AT1 whales have been sighted or identified in southeastern Alaska despite healthy pinniped populations and frequent transient sightings in that region.

Although the rate of encounter with members of the AT1 transient group has declined, there has been no detectable increase in the sightings of other transient groups, suggesting that other transients are not increasing their use of the Sound as use of the region as AT1 group declines. Whether this overall decline in the encounters with

transient (marine mammal eating) killer whales is related to oil spill effects or ecosystem changes is not clear, but we suspect a combination of the two factors. It is likely that the severe decline in harbor seals and Steller sea lions are important factors in the decline of transients in the region.

MtDNA and nuclear DNA analysis has demonstrated the genetic uniqueness of the AT1 group from residents as well as from other transients. If the AT1 population does not have other components in western Alaska, the loss of the AT1 group could represent a serious overall loss of genetic diversity.

Some environmental contaminants such as PCBs and DDTs have been linked to reproductive dysfunction in mammals and immune system dysfunction. We have discovered very high levels of these contaminants in the transient (marine mammal eating) killer whales, including the non-reproducing AT1 group. When compared to other cetacean populations, these levels appear to be in a range that could result in reproductive dysfunction and reduced immune response or other effects that might impede recovery of this group.

B. Rationale/Link to Restoration

The final report from previous monitoring (FY2002) will detail the status of AB pod and the AT1 transient group. However, the status of AB pod is considered not recovered at this time, the group numbers 26 whales and one subpod (AB25) continues to travel primarily with AJ pod. AB pod numbered 36 whales before the spill and was a unified pod. The recent growth in the pod suggests a recovery is under way.

An annual killer whale behavioral database of spanning 18 years now exists in a GIS format. This will be continued as part of the proposed monitoring. It is accompanied by a photographic database that includes identifications of all individuals from each frame of film for every encounter logged in the GIS system. This will facilitate development of potential critical habitats for killer whales, particular in the Kenai Fjords region where data of this type has been collected in recent years and where GIS analysis/publication is currently in process.

Continued development of acoustic monitoring and a dialect directory has provided a cost-effective year- round extension of the monitoring program. We will continue to work cooperatively with the Alaska Sea Life Center, Kenai Fjords National Park, and See More Wildlife Systems in this endeavor, although no funds for this aspect of the project are requested here. The signal is broadcast 24 hours a day on local FM in Seward. Our program directly involves residents and visitors in the process of monitoring and restoration through connection with Alaska Sea Life Center and Kenai Fjords tour and charter boat industry.

C. Location

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

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

There is great public concern and interest for killer whales in Prince William Sound and in Kenai Fjords. The expanding tourboat industry depends on a healthy killer whale population to attract and satisfy visitors and residents and the research and its results enrich the experience of visitors and residents. We have been closely involved with tourboat and recreational operators and residents by exchanging sighting information on a daily basis and providing a catalogue of individual whales to enhance enjoyment of whale observation. We have provided and continue to provide workshops detailing whale biology. We are involved in the Youth Area Watch program, taking young students out to participate in our research. Recent publication of an updated identification catalogue that includes details of our research results and viewing guidelines has further sparked interest in these whales. Killer whales now draw thousands of visitors to the region each year.

We continue to collect observations and stories from native residents and others that will provide background for interpretation of our findings and place the work in a historical and cultural perspective. Some of these legends and stories are used to place our research in a broader context in our publication: "Killer Whales of Southern Alaska" (Matkin et al 1999).

PROJECT DESIGN

A. Objectives

1. To extend field time and allow monitoring of resident killer whale pods, including the non-recovered AB pod.

2. Continue population, feeding habits, acoustics, genetics and contaminant studies that will be funded as part of cooperative agreements.

3. To provide for analysis and development and GIS input of data and to provide a report on the status of AB pod and resident killer whales in the region as well as the AT1 transient group.

B. Methods

The portion of study funded by the EVOS Trustee Council will rely on the photoidentification of each individual in each pod/group, that regularly uses the Sound, particularly AB pod. It is important that researchers maximize the time actually spent with resident killer whales (particularly AB pod and other resident whales) to insure thorough identification of all individuals. We will use the field time provided under the Trustee Council portion of the study to work with AB pod and other resident pods when they are present. Methods proposed to obtain photographic data necessary to meet monitoring objectives will be similar to those used by the NGOS in Prince William Sound/Kenai Fjords for the past eighteen consecutive years. Searches for whales will not be made on random transects, but based on current and historical sighting information. In

addition whales will be located by listening for killer whale calls with a directional hydrophone (calls can be heard up to 10 miles away), or by responding to VHF radio calls from other vessels reporting sightings of whales. We have developed network of cooperating vessel owners and tour boat operators that regularly report whale sightings. In addition, requests for recent killer whale sightings will be made routinely on hailing Channel 16 VHF and working channel 77.

A vessel log and chart of the vessel track will kept for each day the research vessels operate. Nobletech software and a laptop computer configured with GPS will automatically record the research vessel track in real time. The elapsed time and distance traveled will be recorded and vessel track plotted. Record will be made of the time and location of all whale sightings and the weather and sea state noted at regular intervals.

The Nobletech system will also be used to record specifics of each encounter with killer whales including the trackline during these encounters. This data system will be used in 2002 to log all encounters and summarize effort. Additional attention will be made to relate behavior to location using a Nobletech data recording system which relates precise geographic location to behavioral events. The new data collection system will be based killer whale encounter data sheets developed in 1995 and specifically tailored to GIS data entry. Data recorded will include date, time, duration, and location of the encounter. Rolls of film exposed and the estimated number of whales photographed will also be recorded. A chart of the whales' trackline during the encounter will be completed and the distance traveled by the vessel with the whales will be calculated by the Nobletech system on a daily basis. The new system will make it much simpler to link general behavior of the whales (i.e. feeding, resting, traveling, socializing, milling) to location and time.

Photographs for individual identification will be taken of the port side of each whale showing details of the dorsal fin and gray saddle patch. Photographs will be taken at no less than 1/1000 sec using Fuji Neopan 1600, a high speed black and white film,. A Nikon 8008 or Nikon N70 autofocus camera with internal motor drive and a 300 mm f4.5 autofocus lens will be used. When whales are encountered, researchers will systematically move from one subgroup (or individual) to the next keeping track of the whales photographed. If possible, individual whales will be photographed several times during each encounter to insure an adequate identification photograph. Whales will be followed until all whales are photographed or until weather and/or darkness makes photography impractical.

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

The primary vessel used to secure identification photographs will be a 34' diesel inboard powered vessel capable of 20 knots, that can sleep 3-4 individuals (R.V. *Natoa).* With sleeping accommodations and large fuel capacity, the R.V. *Natoa* can remain in the field for extended periods photographing whales.. This vessel will operate a total of 10 days under funding from this project, with days selected to maximize encounters with resident whales (AB pod) during the late July through early September period. From

historical data these dates are judged to be to be the most likely time to encounter AB pod as well as many of the other resident pods that use the Prince William Sound and Kenai Fjords.

The report for the monitoring segment will include a summary of all field effort including that funded outside of this DPD, and will include a summary of the pods and individuals encountered and a status report on AB pod and the AT1 group. Changes within AB pod will be examined with consideration for the age and sex structure of the pod and maternal groups within the pod and related to the population model now under development. Trends in transient killer whale sighting rates and demographics will also be presented. Frame by frame input of identification data from exposed film into VAX and IBM PC computer systems will occur and identifications tabulated by pod and by individual. Copies of killer whale encounter data and vessel logs will be made available to the EVOS Trustee Council and/or lead agency and this data will be archived in the GIS database for potential future analysis. Frame by frame identification data will also be made available on disk. Copies of the GIS program and data base will be available by request to NGOS.

PC (Windows) compatible computers owned by NGOS will be used to analyze field data. The GIS system at Alaska Pacific University (Dr. David Scheel) and U.F.W.S, Marine Mammal Management Division in Anchorage (Doug Burn) and VAX data system at the Pacific Biological Station, Nanaimo also will be used for data storage and analysis.

C. Contracts and Other Agency Assistance

The *Exxon Valdez* Trustee Council is asked to supply only a portion of the overall killer whale research project in Prince William Sound/Kenai Fjords, with primary funding coming from the Alaska Sea Life Center. EVOS Trustee Council funding will allow the continuation of field work and analyses focused on resident killer whales. The entire project will be completed under the auspices of the North Gulf Oceanic Society (NGOS) under federal research permits held by NGOS and issued under the Marine Mammal Protection Act. NGOS will provide for data entry into the GIS database housed at Alaska Pacific University and U.S.Fish and Wildlife Service, Marine Mammal Research in Anchorage using the a pre-existing menu interface and for input of frame by frame identification data into the VAX system.

SCHEDULE

A. Measurable Project Tasks for FY2002

July-September 2003: Field work focusing on AB pod and other resident pods.

Nov 2003 - Jan. 31, 2004: Analysis of photographs from 2003 fieldwork. Input data into GIS system.

January-March 2004: Prepare report summarizing field activities and interpreting data

January 2004: Attend EVOS Trustee Council/GEM annual workshop

B. Project Milestones and Endpoints

The FY2003 killer whale project will transition monitoring of resident killer whales (AB pod) and AT1 transients into the GEM program. The secondary funding requested from the Trustee Council combined with other funding sources provide for continuing long term killer whale monitoring program.

C. Completion Date

Annual report will be submitted by April 30, 2004

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The monitoring of killer whales and analysis of current data is part of a long-term program to investigate killer whale recovery, monitor populations and the examine the interactions of killer whales with other species. It will be integrated with harbor seal and sea otter studies as well as with other GEM projects as appropriate. In FY2003 this project will rely on approximately $72,000 in funds from other sources and cooperative agreements to complete the program. As a non-profit research institution familiar with private funding sources and cooperative programs, NGOS can work with the Trustee Council cooperation to maximize potential for funding in the future.

PROPOSED PRINCIPAL INVESTIGATOR:

Craig O. Matkin
North Gulf Oceanic Society
60920 Mary Allen Ave, Homer, Alaska 99603
Phone/Fax (907) 235-6590
comatkin@xyz.net

KEY PERSONNEL

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

Matkin has studied killer whales in Prince William Sound since 1977. He initiated systematic killer whale photoidentification in Prince William Sound, and is a founding

member of NGOS. In 1994 he completed the "The Biology and Management of Killer Whales in Alaska" for the U.S. Marine Mammal Commission. Other pertinent publications include EVOS killer damage assessment results ("The Status of Killer Whales in Prince William Sound 1984-1992", Craig O. Matkin, G. M. Ellis, M.E. Dahlheim, and J. Zeh in T.R. Loughlin. ed. Marine Mammals and the *Exxon Valdez* and Matkin and C.O., Matkin, D.R., Ellis, G.M. , Saulitis, E. and McSweeney, D. 1997. Movements of resident killer whales in Southeastern Alaska and Prince William Sound, Alaska. Marine Mammal Science, 13(3):469-475. Mr. Matkin also teaches at the University of Alaska, Lower Kenai Penninsula Campus.

Eva L. Saulitis (M.S. University of Alaska) , a director of NGOS, has conducted fieldwork on killer whales in Prince William Sound each season since 1987. She is a principal field biologist for the monitoring segment of this project (photoidentification) and will co-operate the research vessel *Natoa*. She will make ready and maintain all necessary equipment, complete photoidentification work and all logs and data sheets as required. She will provide entry of field data into the GIS system.

Saulitis completed her MS thesis "The Behavior and Vocalizations of the AT Group of Killer Whales in Prince William Sound, Alaska." in 1993. She coauthored the "Biology and Management of Killer Whales in Alaska" for the U.S. Marine Mammal Commission and "Killer Whales" for the EVOS Restoration notebook series and authored Saulitis, E.L., C.O. Matkin, K. Heise, L. Barrett Lennard, and G.M. Ellis. 2000. Foraging strategies of sympatric killer whale (*Orcinus orca*) populations in Prince William Sound, Alaska. Marine Mammal Science16 (1):94-109. She has done extensive analysis of killer whale calls and has operated research vessels in Prince William Sound since 1988.

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FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 02	Proposed FY 03	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$8,420.0						
Travel		$540.0						
Contractual		$4,600.0						
Commodities		$1,500.0						
Equipment		$0.0						
Subtotal	$0.0	$15,060.0	Estimated FY 04					
Indirect		$1,506.0						
Project Total	$30,000.0	$16,566.0	$17,000.0					
Full-time Equivalents (FTE)		0.2						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments: This budget is part of a cooperative program with the Alaska Sea Life Center.

FY03

Prepared:

Project Number: ~~00312~~ 03012
Project Title: Photographic Monitoring of Resident Killer Whales In Prince William Sound and Kenai Fjords, Alaska
Name: North Gulf Oceanic Society

FORM 4A
Non-Trustee
SUMMARY

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Contractual Costs:	Proposed FY 03
Description	
Vessel Contract (34' Natoa, deisel inboard) 10 days @ 460/day	4,600.0
Contractual Total	$4,600.0

Commodities Costs:	Proposed FY 03
Description	
Communications	150.0
Field Food (30/day for 10 days)	300.0
Fuel	650.0
Film Processing/Printing	400.0
Commodities Total	$1,500.0

FY03

Prepared:

Project Number: 00312
Project Title: Photographic Monitoring of Resident Killer Whales In Prince William Sound and Kenai Fjords, Alaska
Name: North Gulf Oceanic Society

FORM 4B
Contractual & Commodities DETAIL

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 03
	Craig Matkin	PI, Field Biologist, Boat Operator	1.4	4800.0		6,720.0
	Eva Saultis	Field Biolgist, Data	0.5	3400.0		1,700.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	1.9	8200.0	0.0	
					Personnel Total	$8,420.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 03
						0.0
	1 RT Homer/Anchorage	180.0	1	3	120.0	540.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$540.0

FY03

Prepared:

Project Number: 00312
Project Title: Photographic Monitoring of Resident Killer Whales In Prince William Sound and Kenai Fjords, Alaska
Name: North Gulf Oceanic Society

FORM 4B
Personnel
& Travel
DETAIL

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 03
			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

FY03

Prepared:

Project Number: 00312
Project Title: Photographic Monitoring of Resident Killer Whales In Prince William Sound and Kenai Fjords, Alaska
Name: North Gulf Oceanic Society

FORM 4B
Equipment
DETAIL

Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program

Project Number:	03052
Restoration Category:	General Restoration
Proposer:	P. Brown-Schwalenberg/CRRC
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	Indefinite
Cost FY 03:	$165,700
Geographic Area:	All
Injured Resource/Service:	Subsistence

ABSTRACT

In FY 03, this project will transition into following up on the development the Tribal Natural Resource Management Plans (TNRMP) completed under EVOS TC project # 02052 with the development of core Action Plans for each TNRM plan. The core action plans are the principle instrument documents that will be developed and used to accomplish the goals and issues identified and specified in the TNRM plans and planning processes. CRRC will also develop an Action Plan for it's regional Integrated Tribal Natural Resource Management Plan as well as a Fisheries Management Plan to include as a major more focused segment of. CRRC will also work with each of the five Tribes whose Tribal Natural Resource Management Plans were developed in FY 01 and FY 02 to develop core TNRM Action Plans for each of the five TNRM's. These Action Plans will become the heart of the overall regional and Tribal TNRMP's. They will become the primary vehicle for accomplishing the goals identified and set forth in the planning process. The priority issues and action items identified in the workshops, gatherings and meetings, will provide the focus and tone of the core Action Plans. The Action Plans will be species and habitat specific and utilized

for identifying specific actions, timelines, responsible parties, agreements, needed policies or ordinances, laws and or decision or task oriented processes for accomplishing or otherwise addressing each of the priority issues, project and action items identified in the TNRMP's and or associated TNRM planning activities. In addition, the project will work in coordination with the regional and Tribal TNRM programs to explore and develop linkages between the priority TNRM issues and concerns, the Action Plans and management, research and education agencies/organizations to address the priority issues of each community. This project will strive for establishing, maintaining and optimizing community involvement with regard to the Gulf Ecosystem Monitoring (GEM) Program. In FY 03, this project will focus on four objectives: (a) Establishing core Action Plans for the regional and Tribal TNRMP's; (b) continuing the process, with a higher degree of specificity and focus, of identifying priority regional and community specific research and monitoring issues and concerns and fitting them to community-based research and monitoring program activities, especially those within and related to the GEM program, (c) establishing and conducting a "Wisdomkeeper Series" (see Appendix 1) for community and sub regional gatherings for discussing and sharing TNRM and research and monitoring issues with selected biologists, scientists, elders and traditional knowledge experts (d) developing and refining pilot community-based research and monitoring projects for potential implementation in FY 04.

INTRODUCTION

This proposal is designed to develop core Action Plans for the regional and each of the five pilot communities' Tribal Natural Resource Management Plans (TNRMP). A core Action Plan and a Fisheries Management Plan will be developed and implemented into CRRC's regional Integrated Tribal Natural Resource Management Plan. CRRC will also work with each of the five pilot community Tribe's Tribal Natural Resource Management Plans that were developed in FY 01 and FY 02 to develop core Action Plans. These core Action Plans will become the primary vehicles for accomplishing the goals identified and set forth in the TNRM planning process.

Priority issues and action items identified in the TNRM planning process and TNRMP's will be focused on, delineated, added to and developed into potential project concepts and action oriented tasks through Action Planning workshops, gatherings and meetings. These Action Plans will be utilized for identifying specific actions, timelines, responsible parties, agreements, needed policies or ordinances, laws and or decision or task oriented processes for accomplishing or otherwise addressing each of the priority action items identified in the TNRMP's and or associated TNRM planning activities.

The project will work in coordination with the regional and Tribal TNRM programs and the GEM program. Linkages will be developed and expanded upon between the priority TNRM issues and concerns, the Action Plans and management, GEM research, monitoring and community involvement planning, research and education agencies/organizations to address the priority issues of each community. This project will strive for establishing, maintaining and optimizing community involvement with regard to the Gulf Ecosystem Monitoring (GEM) Program.

This Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program project will focus on four objectives in FY 03 including:

(a) Establishing core Action Plans for the regional and Tribal TNRMP's;
(b) continuing the process, with a higher degree of specificity and focus, of identifying priority regional and community specific research and monitoring issues and concerns and fitting them to community-based research and monitoring program activities, especially those within and related to the GEM program;
(c) establishing and conducting a community and sub regional gatherings/seminar process for discussing and sharing TNRM and nearshore research and monitoring issues with selected biologists, scientists, elders and traditional knowledge experts

(d) developing and refining pilot community-based research and monitoring projects for potential implementation in FY 04.

This year's project will enable CRRC and the pilot community Tribes to continue to develop and expand upon the stewardship capacity of these coastal Native communities. This proposed project will examine the communities' interests, priorities and activities through their Tribal Natural Resource Management Programs and how these will relate to the future GEM Program. Candidate community-based pilot and demonstration projects emerging from our planning effort will exhibit a blend of modern measurement science and traditional observation, which will be beneficial to both the GEM Program and the Tribal Natural Resource Management Programs.

Efforts have been underway primarily in FY 01 and FY 02 to assist five pilot communities (Cordova, Nanwalek, Ouzinkie, Port Graham, and Tatitlek) in the development of their Tribal Natural Resource Management Plans. Draft TNRM plans were developed for each Tribal Community. These TNRM plans and their inherent planning process, are designed to assist these coastal pilot communities in identifying and addressing priority natural resource issues together will linking these priority issues with the appropriate and preferably community-based research and monitoring activities best suited to addressing each priority issue.

The corporations and Tribes in Prince William Sound have been working extensively with the United States Forest Service to ensure their involvement in the Chugach National Forest Management Plan Revision currently underway. Cooperative and collaborative management of lands and resources have been actively discussed and strategies for further developing a formal relationship are underway.

In FY 01, the CRRC Board of Directors held a strategic Planning Session. During this meeting they identified Natural Resource Management Plan development along with the EVOS $20 million Tribal Community Fund as top priorities of CRRC. The Board of Directors also prioritized the communities' involvement in GEM and community involvement/Traditional Ecological Knowledge, indicating their interest in remaining involved in the EVOS process. In October of 2000 the Community Facilitators, Natural Resource Specialists, Science Advisor, Principal Investigator, TEK Specialist, and Spill Area Wide Community Involvement Coordinator (currently the Community Development Director) all participated in the GEM Workshop, advocating for meaningful community involvement and TEK being incorporated into the GEM Plan/Program. In March 2001 the Principal Investigator and Community Development Director in cooperation with the Chugach Alaska Corporation, Chugachmiut, and the North Pacific Rim Housing Authority organized the Chugach Regional Summit on Natural Resources for participation by the Board of Directors of the Chugach Region Native corporations, Tribal Councils, and regional organizations. The Community Facilitators and Natural Resource Specialists also participated. During this Summit the communities identified barriers, and developed solutions, for the Tribal Natural Resource Management Programs and discussed ways to assist in creating cooperative relationships

between the Tribes and Native corporations in the area of jurisdiction, enforcement and management of natural resources. Furthermore, community meetings were held in the villages of Port Graham, Nanwalek, Ouzinkie and Cordova in 2001 and 2002 to discuss their Tribal Natural Resource Management Plans and identify common objectives between their Management Plans and the GEM Plan.

In FY 03, specific tasks will be to accomplish the four primary objectives described briefly above and in more detail in the Project Design section below. CRRC will also participate in GEM planning and implementation. Additionally, the five pilot communities will work with project staff to identify common areas of interest between the Tribal Natural Resource Programs research and monitoring efforts and GEM Program's efforts. Once these common areas of interest are identified, the scientific staff and communities will develop methods by which communities can take on specific research and monitoring activities of GEM, while leveraging other funds to implement other aspects of their Management Plans.

In addition to the three primary objectives, CRRC will continue to coordinate and accomplish the following general goals and tasks:

1. Continue the involvement of community members and local Tribal Natural Resource Programs throughout the spill region in the GEM planning and implementation process, especially for nearshore and watershed/marine linkages.

2. Serve as contact point for the Tribes and Their Natural Resource Specialist in each of ten participating communities (Alaska Peninsula Region/Chignik Lake, Chenega Bay, Cordova, Kodiak Island Region/Ouzinkie Nanwalek, Port Graham, Seldovia, Seward, Tatitlek, and Valdez).

3. Additionally, the five pilot community TNRM programs and associated staff as well as the Tribal Environmental staff will work together with project staff to develop common areas of interest between the Tribal Natural Resource Management Programs, their Management and associated Action Plans, and the GEM Program.

The specific tasks for the Traditional Ecological Knowledge (TEK) Specialist will be to:

1. Assist the Tribe(s) in preparing for and launching CRRC's Wisdomkeeper Series first gathering (see Appendix 1).

2. Help facilitate community meetings and coordinate tribal member interviews to stimulate discussion and solicit input prior to the Wisdomkeeper Gatherings and to develop background material for the gatherings.

3. Assist scientists participating in the Wisdomkeeper Gathering by consulting on the preparation of background material and on the scope, style, and content of presentations to be given at the gathering.

4. Help facilitate the planning and implementation of the Wisdomkeeper Gathering.

5. Help the Tribe and CRRC develop plans to implement the recommendations of the Wisdomkeeper Gathering regarding training, monitoring, research, and communication."

The specific tasks for the Scientific Advisor will be to:

1. Work with the communities to identify GEM related research and monitoring Projects within their Tribal Natural Resource Management Plans and Associated Action Plans.

2. Assist in the development of a community involvement and community-based research and monitoring framework plan for GEM by participating in the project being proposed to the EVOS TC project by the Center for Alaska Coastal Studies in collaboration with CRRC.

3. Help coordinate the community-based research and monitoring with other research and monitoring activities planned under GEM and coordinate community input in the GEM program.

4. Help develop additional research and monitoring ideas for soliciting funding from sources other than GEM.

5. Serve as the liaison between the five Tribal pilot communities and biologists, scientists and managers to help insure effective and meaningful dialogue is being maintained.

NEED FOR THE PROJECT

A. Statement of Problem

Tribal and other coastal people living in the Chugach Region and EVOS impacted area, have an innate sense of the marine, nearshore and shore interface areas that they depend on for their subsistence lifestyles as well as their cultural, spiritual and economic needs. There are vast amounts of all kinds of important natural resource information available within the traditional Tribal users, elders, commercial fishers and other resource experts that live and reside in these coastal communities. However, getting this information identified, documented,

communicated and, when appropriate, shared with other Tribes, state and federal research and management agencies is quite a challenge in these remote and semi remote coastal areas.

By developing and maintaining Tribal Natural Resource Management Programs and associated management Plans and Action Plans, provides a means by which Tribes and coastal communities can systematically identify and address many of their priority natural resource issues and concerns. The development of the core Action Plans for CRRC's regional and each of the pilot communities' TNRMP's, will help provide a useful and efficient mechanism for collecting and assembling priority Tribal and coastal community natural resource interests. These priorities, once assembled, compiled and documented, can then help assist Regional and Tribal Natural Resource Programs as well as State, Federal and non government research and management agencies and organizations in understanding what the most important research and monitoring needs are based on the Tribal and coastal communities interests and concerns.

There is also a major need for developing and nurturing stronger alliances and networking between Tribal Natural Resource research, monitoring and management interests and personnel with those of scientists, educators, and non Tribal natural resource management or environmental professionals. Increasing meaningful Tribal Involvement in nearshore and shore based research and monitoring planning and activities will help facilitate ownership and support for building a better understanding of the natural resources and their associated marine ecosystems.

Marine bird, fish and mammal stocks are profoundly influenced by their hosting marine environment and the associated food-webs that support their production. Variations in annual production and species composition associated with cycles and shifts in ocean climate have been documented for many years now. To meet the mission of GEM, the physical condition of the northern Gulf of Alaska and selected target populations must be carefully tracked through time. The emerging "historical records" provide important insight about how the ecosystem responds to environmental fluctuations on scales from weeks and months to decades and ideally centuries. GEM monitoring will be strengthened significantly by the addition of coastal observations in the many sub-environments stretching from Prince William Sound to the Alaska Peninsula. There is a critical need to establish strong community-based research and monitoring programs that will help address many Tribal and community derived research questions and hypotheses. The community-based research and monitoring that will continue to be promoted and developed through this and other projects, will also help to support long-term observational and monitoring programs in coastal waters that can become the fingers and even sophisticated meters monitoring the pulse of the marine life blood they depend on.

It is important to reiterate what may seem obvious to some, yet completely overlooked by others. This is that the *Exxon Valdez* oil spill caused much more direct and severe disruption to the lives of the Tribal and other coastal citizens in these spill impacted coastal communities and surrounding areas than most other populations.

While scientific studies aimed at restoring the resources and services damaged by the oil spill have occurred throughout the spill area, most of the researchers work for agencies or institutions based in Anchorage, Fairbanks, or outside Alaska. Residents have voiced concern over a lack of involvement by spill area communities in the restoration efforts, and incomplete communication to spill area inhabitants of study proposals and results.

This project, over the past several years, has helped bring about an increasing amount of communication between the scientists and the communities. Yet there still exists a void for meaningful involvement in the GEM nearshore and watershed marine interface research and monitoring process by the Tribes at the grass roots level. At the same time, researchers have recognized that Native people have traditional knowledge that could help them answer questions they have not been able to answer through conventional scientific means. In addition, communities in the spill area are very concerned about the long-term stewardship and management of lands and resources important to their subsistence way of life.

These communities have been developing their Tribal Natural Resource Management Programs at the local level to ensure long-term health of injured oil spill species, important subsistence resources, and responsible management of lands in proximity to their villages and traditional use area. The Gulf Ecosystem Monitoring Plan is also very concerned with the ecosystem and coordination between the communities and the Trustee Council regarding community-based monitoring and will be necessary to effectively monitor and document change in the Gulf of Alaska ecosystem. Furthermore, the EVOS Trustee Council has recognized the need to increase communication and community involvement in the restoration process.

The need for developing and maintaining meaningful community involvement in the GEM program was stressed throughout the GEM Workshop, held in Anchorage in October 2000 (Exxon Valdez Oil Spill Trustee Council, 2001) as well as the GEM nearshore workshop in Anchorage held by the EVOS TC in January of 2002. The National Research Council also sited the need for meaningful community involvement in their Interim Report (National Research Council, 2001). During the Public Advisory Group's April 4, 2001 meeting, the integration of community involvement into the GEM Program was identified as a top priority (Exxon Valdez Oil Spill Trustee Council, 2001). Therefore, it is evident that the integration of Tribes, their Natural Resource Programs, community research and monitoring, and GEM must take place in order to ensure meaningful community involvement in the GEM Program. The specifics of how this will occur have yet to be determined, but it is evident that meaningful community involvement must be defined by the communities.

According to the NRC review comments of the GEM Draft Programmatic document, "The challenge then is not whether community involvement is warranted but how to build such involvement in a meaningful way." The NRC review comments go on to say "Community involvement needs a foundation (simple, robust, and adaptable) that permits the local issues to be addressed in a meaningful way from the very beginning of the program. . . . Communities must have a role in helping define what will be done and where it will be done. They must also be involved in actively conducting the research, analyzing data, and disseminating the results to members of the community."

The Community Involvement Project (052) is one of the EVOS TC's best efforts in striving for the development of meaningful community involvement in the GEM program. This proposed project will be a useful tool and process to help develop and actualize meaningful community involvement for these Tribes and take it to the next level.

B. Rationale/Link to Restoration

This project furthers the Trustee Council's goals of facilitating the involvement of spill area residents and resource users in the post restoration and GEM process. It also reaffirms the Trustee Council's dedication to the involvement of people living in the oil spill affected areas in the restoration process.

People living in the spill area have a lot of extensive general and detailed knowledge about the condition and status of resources. This information can significantly add to other data collected as part of scientific studies. Local people have expressed a desire to be involved in all aspects of restoration, research and monitoring projects. The Tribes in the Chugach Region and the Ouzinkie Tribe have developed their Tribal Natural Resource Management Plans. These plans are leading the way for the creation of methods and projects that will ensure the continued abundance of subsistence resources important to their communities. Five of those TNRM draft plans were completed in FY 01 and FY02. These Plans form the basis for development of Tribal Natural Resource Management Programs. The Tribal Natural Resource Management Plans outline overall interests of the communities, including economic development, traditional use area management, and various other aspects of their Natural Resource Management Programs. The Chugach Tribes are also currently working with the Chugach Regional Resources Commission's region wide Integrated Tribal Natural Resource Management Plan. This project will also develop core Action Plans that will become the action mechanisms of the TNRMP's to address species and habitat specific issues and concerns. CRRC's regional ITNRMP plan and associated Action Plan will coordinate all the Tribal Action Plans to provide a format for the Tribes to work cooperatively to address issues related to management, monitoring and research of their traditional use areas. Both the Tribal and regional Integrated Natural Resource Management and associated Action Plans will be instrumental in planning for participation in the GEM community-based research and monitoring programs. GEM must integrate local Resource Management Plans and

Programs into the overall GEM Program to effectively monitor environmental conditions and indicator species. This project will continue to open communication lines and help facilitate the interaction between the different entities.

At present, the only systematic and year-round monitoring program of ocean conditions in the northern Gulf of Alaska is maintained in outer Resurrection Bay by the Institute of Marine Science, University of Alaska Fairbanks (GAK-1 station) and the Barren Islands (National Data Buoy Center's Buoy # 46079) and in Cook Inlet at the Drift River Terminal, AK (National Data Buoy Center's Buoy # DRFA2) and AUGA2 - Augustine Island, AK and by Cook Inlet Keeper and the Kachemak Bay Research Reserve in Kachemak Bay. Also, some seasonal records of temperature and plankton volumes have been made over the years by aquaculture corporations in Prince William Sound, lower Cook Inlet, and at Kodiak. These observations, coupled with those undertaken by several private organizations in the region provide evidence that citizen monitors can be important contributors to long-term programs, but also demonstrate that to be effective, these efforts must be standardized and coordinated over time, which can be accomplished through the GEM Program. Furthermore, resource managers will benefit greatly from any new information arising from GEM and other coastal monitoring programs, such as information and data generated by the Tribes.

C. Location

This project will be spill area wide. The five pilot project communities from FY01 and FY02 will continue with this Action Plan/research and monitoring issues identification phase of the project. The pilot project communities include Eyak, Nanwalek, Ouzinkie, Port Graham, and Tatitlek. Chenega Bay, Chignik Lake, Qutekcak, Seldovia, and Valdez will continue to be involved in the GEM process through EVOS TC sponsored workshops and meetings as resources and interest allow. The pilot communities will continue the process of developing their core Action Plans which will be used to identify areas of interest, priority issues and concerns. These core Action Plans and the associated planning will help build a stronger linkage between the Tribal Natural Resource Management Programs and the GEM Program. Once these TNRMP and associated Action Plans are in place, the other communities will be integrated into the process. Other regional, Native, and community organizations will be encouraged to participate and mold the parameters for the monitoring programs.

The project's benefits will be realized both in meaningful involvement by the communities and through proactive action facilitated by the core Action Plans and their associated Tribal Natural Resource Management Programs.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

The core of this project is the incorporation of community involvement and traditional knowledge into the EVOS TC GEM Program. Communities will be informed of EVOS TC projects, more recent and new GEM related projects and programs, research findings,

and provide input into the Trustee Council process through a network of Tribes and their Tribal Natural Resource Management Programs, TNRM program planners and specialists, TEK Specialists, the projects Principal Investigator, and Science Advisor.

PROJECT DESIGN

A. Objectives

The objectives of the project will be to:

1. Develop CRRC's ITNRMP Action Plan and Regional Tribal Fisheries Management Plan.

2. Work with the five pilot project communities in establishing their Tribal Natural Resource Committees or similar and developing associated core Action Plans to address their priority issues.

3. Implement the CRRC Wisdomkeeper Series (see Appendix 1). This special Series of gatherings will provide a major resource for discussing and exploring potential means of addressing priority community issues.

4. Increase the meaningful community involvement of spill area communities in the research and monitoring efforts of the Trustee Council through community-based monitoring.

5. Improve the communication of research and monitoring findings and results of restoration efforts to spill area Village Councils, inhabitants and the appropriate regional organizations. It is expected that by doing so, this project will increase the effectiveness of the overall GEM efforts.

6. Provide community input into the plans for GEM, including review of drafts and suggestions for community-based activities such as research and monitoring, education, data sharing, and outreach. The Tribes will also work with the Trustee Council to help define and explain their view of meaningful community involvement. The communities' priority issues and the research and monitoring projects and programs needed to address them, can be developed in conjunction with their Tribal Natural Resource Management Action Plans. This activity will help promote close cooperation in the development of research and monitoring ideas under GEM and associated projects and programs, so that they benefit each other as much as possible.

7. Use the above in coordination and cooperation with the Center for Alaska Coastal Studies proposed community involvement and community-based monitoring framework plan for GEM to help further the design of a useful community involvement and community-based monitoring plan and program for GEM. A

community-based or citizen monitoring program requires mechanisms for (a) identifying and selecting monitoring activities, (b) developing appropriate methods for the various parameters to be monitored, (c) training monitors and ensuring the quality of data collected, (d) submitting, managing, archiving, and accessing the data generated, (e) providing results and other feedback to EVOS, and (f) jointly evaluating the approach and results of the monitoring effort on a regular basis with EVOS.

8. Compare the research parameters of the GEM Program to the Tribal Natural Resource Management Plans, to help identify where their interests in research and monitoring overlap. This information will then be used to identify ways that the EVOS Trustee Council and the Tribes can work together in order to meet their common objectives.

9. Select possible monitoring activities for pilot projects in FY 03 and FY 04. After designing the program and identifying what can be monitored, we will select certain monitoring activities to carry out in FY 04 (i.e., to include in our proposal for FY 04) to test the system. These pilot projects will help us evaluate and refine our overall community-based program approach and aid in the selection of potential long-term monitoring activities under GEM as well as under other funding programs.

B. Methods

The objectives will be achieved using the following methods:

1. A Tribal Natural Resource Program Planner will be hired by the Chugach Regional Resources Commission. This position will work closely and in coordination with the Tribal Natural Resource Programs and their associated NR Specialists, other NR staff and Each Tribe's Natural Resource Committees and/or Tribal Council in developing and implementing TNRM Action Plans, developing linkages and communications between Tribal TNRM priority issues and concerns with the scientific and management community as well as addressing this projects other overall goals and objectives.

2. Working with the Tribes and their Tribal Natural Resource Management Program staff the Tribal Natural Resource Program Planner will strive to continue furthering the goal of community outreach. The goal of community outreach will be to continue the partnership, which began under 95052 between the people residing in the oil spill affected region and scientific researchers. Outreach will include communication of traditional knowledge and local interests, as well as communication of research proposals and study results.

3. Finalize and implement CRRC's Community WisdomKeeper Series. This annual rotating community gathering series which is described in detail in Appendix 1, will be used to promote the concept of Tribal communities getting together on top

priority issues identified through their TNRM programs and planning activities and other formats. The concept will include a Tribe hosting a WisdomKeeper Gathering on a special research topic or concern that will then have invited experts from both the Tribal/traditional users and scientific realms. These gatherings will be held in the manner in which the hosting Tribe is most comfortable with and their culture and wisdom will be especially honored and respected during each particular WisdomKeeper Gathering.

4. Assist in collaborative efforts as a project partner with the Center for Alaska Coastal Studies proposed EVOS TC project to help produce a community involvement and community-based monitoring plan for GEM. CRRC will work closely with this project together with the other project partners and help coordinate interactions and input into this project to assemble a plan for community involvement in GEM from the Tribal natural resource and environmental staff in the region. CRRC will continue working with the native villages of Port Graham and Nanwalek that are partners with Ms. Solomon and the University of Washington in this community-based project it helped start up in FY 02. This Tribal Replicate Modeling program and pilot project was initiated in FY 02 working with the University of Washington's PhD graduate candidate Anne Solomon.

5. Further work in FY 03. Once we have accomplished the above tasks, we will continue its work after submitting a proposal for FY 03. Depending on the outcome of the above activities, we may do one or more of the following: (a) identify other sources of funding for monitoring activities, (b) continue to refine the ideas presented in the monitoring program design and the specific monitoring activities, (c) explore closer ties with monitoring plans by scientists involved with GEM and others, and (d) explore closer ties with community-based research and monitoring programs, Tribal Natural Resource Management Programs, and citizen monitoring projects currently being developed.

6. A contract will be renewed by ADF&G Subsistence Division to CRRC for overall coordination of the Tribal Natural Resource Program and associated TNRM programs. The contractor will develop subcontracts with each of the 5 pilot communities for involvement in the TNRM program.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

A contract will be let to CRRC for overall coordination of this project. The contractor will be expected to arrange for the coordination of any TNRM staff in the communities of Chenega Bay, Cordova, Nanwalek, Port Graham, Seward, Seldovia, Tatitlek, Valdez and communities in the Alaska Peninsula and Kodiak Island regions. Additionally, CRRC will contract with Dr. Henry Huntington to serve as the TEK specialist and will develop separate contracts with local scientists to serve as science advisors as the needs arise.

SCHEDULE

A. Measurable Project Tasks for FY 03 (October 1, 2002 - September 30, 2003)

October 1-31, 2002:	Contract with CRRC and ADF&G Renewed.
October 1-31, 2002:	CRRC's Tribal Natural Resource Program Planner begins and will be coordinating with each pilot community in the development of the Action plans and associated TNRM program planning and implementation.
October 1-31, 2002:	Contract with TEK Specialist renewed.
10/1 – 9/30, 2002:	Contract with Science Advisors developed as needed.
October 1-31, 2002:	MOU renewed between ADF&G & CRRC.
October – Jan. 2003:	CRRC Wisdomkeeper Series planning committee meetings held.
October – Jan. 2003:	CRRC and Tribal TNRM and environmental personnel prepare for the EVOS GEM Workshop by developing draft Action Plans based on priority community issues to be potentially addressed in the GEM program and associated projects.
November to Jan. 2003:	Project Staff to work with each pilot community and or Tribe to develop Action Plans to help identify and address priority issues.
November to Jan. 2003:	Review Pilot project season plans, help assemble project teams and finalize project work schedules.
November to Jan. 2003:	Review, model, identify activities, and provide further input to latest GEM draft with communities.
January 2003:	Meeting held with Project Staff and others to review GEM draft and provide input, refine list of community interests and objectives, prepare for EVOS GEM Workshop.
January 2003:	Participate in EVOS GEM Workshop, assisting in the development of community-based research and monitoring project ideas and needs potentially addressed by the GEM program.
Winter 2003:	List of activities compiled, organized, and evaluated.
February 2003:	Attend EPA Region 10 regional conference on the Env.
March 2003:	Attend Alaska Forum on the Environment Conference
March-April 2003:	Pilot project season work begins.
May 2003:	Attend the Native American Fish & Wildlife Society Conference.
Spring-Summer 2003:	Pilot projects being worked on with community project teams.
Spring-Summer 2003:	Finalize TNRM core Action Plans for each pilot community's TNRMP and for CRRC's region wide ITNRMP.

August 2003:	Model and list activities completed and refined, other resources and funding sought, links to community programs developed and scientific activities explored.

B. Project Milestone and Endpoints

October 2002:	Contracts in place. First CRRC Wisdomkeeper Gathering planning committee meeting held (see Appendix 1).
January 2003:	Project Staff and others refine community involvement/monitoring parameters and attend the GEM Workshop.
March 2003:	Pilot projects plans finalized and initiated.
August 2003:	Pilot project case history draft reports submitted.
September 2003:	Each pilot community and CRRC's regional TNRM Plan and associated Action Plans finalized and submitted
April 2004:	Final report submitted to EVOS.

C. Completion Date

September 30, 2003.

PUBLICATIONS AND REPORTS

Each of the five pilot community TNRMP's and their associated Action Plans will be submitted as well as CRRC's region wide ITNRMP and core Action Plan. A final report will be compiled in coordination with the ADF&G and provided by CRRC, describing and summarizing the progress and accomplishments of the Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program project. In addition, CRRC will provide a full report of the first CRRC Wisdomkeeper Series Gathering.

PROFESSIONAL CONFERENCES

The Tribal Natural Resource Program Planner, TEK Specialist, Science Advisor, and Principal Investigator will be attending the Native American Fish & Wildlife Society Conference in May of 2003. This Conference will provide an excellent opportunity to examine other Tribal Natural Resource Management Programs and talk with people who are recognized as community involvement and community monitoring experts. Project personnel will also attend the Alaska Forum on the Environment, EPA's Region 10 conference and any EVOS TC GEM and nearshore workshops.

NORMAL AGENCY MANAGEMENT

Not Applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This community outreach effort is in fact a novel effort to coordinate the Restoration Program with the Tribal Natural Resource Management Programs and builds on the established relationship between CRRC and the communities in Prince William Sound, lower Cook Inlet, Kodiak and the Alaska Peninsula. Other organizations may be included, such as the Cook Inlet Keepers, Regional Citizen Advisory Councils, Kachemak Bay Research Reserve, Alaska Wilderness Recreation and Tourism Association, and various other organizations.

CRRC is contributing a considerable amount of in-kind services to the project as well as the community involvement and community-based monitoring plan for GEM project being proposed by the Center for Alaska Coastal studies in which CRRC is a project partner. CRRC's Tribal Natural Resource Management Program development project has been operating for the past four years in four of the villages in the Chugach Region, and Ouzinkie. CRRC, through a BIA contract, is providing technical assistance to the villages in developing their natural resource management programs. The Native American Fish & Wildlife Society will be providing training and technical assistance through their Regional Conference and technical workshops. Part of the normal duties of the Natural Resource Specialists will be to collect traditional harvest and other baseline data (such as population assessments) on the resources in their traditional use areas.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This Project is a new project which will follow up on previous TNRM and community involvement work funded by the EVOS TC.

PROPOSED PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg, Executive Director
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PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg: Ms. Brown is the Executive Director of the Chugach Regional Resources Commission (CRRC) since 1994. She assists the Chugach Region Tribes in developing their Tribal natural resource programs, developing projects that stimulate the local community economy, and addressing issues and concerns directly related to subsistence and natural resources. She has worked for the past 19 years in such positions as Tribal Administrator for her Tribe, the Lac du Flambeau Band of Lake Superior Chippewa Indians, Society Administrator for the Native American Fish & Wildlife Society, Office Manager of the Bering Sea Fisheries Development Fund, and as a private consultant, assisting Alaska Native Tribes in obtaining funding for natural resource management programs, and setting up their natural resource program administrative systems. CRRC and the previous organizations that Ms. Brown has operated have consistently met all standards of proper management, including annual program and financial audits.

OTHER KEY PERSONNEL

Tribal Natural Resource Program Planner: This position will be hired through this project and will be the principle position responsible for coordinating this project and assisting the Tribes and CRRC with the development of their Action Plans and associated TNRM programs and projects.

Dr. Henry Huntington: CRRC has contracted with Dr. Huntington to serve as the TEK Specialist. Dr. Huntington received his Ph.D. at the University of Cambridge (U.K.), Scott Polar Research Institute in Polar Studies. He has served as the Environmental Coordinator for the Inuit Circumpolar Conference (ICC), coordinating ICC policy regarding the Arctic Environmental Protection Strategy (AEPS), in cooperation with indigenous organizations in Russia and Scandinavia. He was also responsible for traditional ecological knowledge and other research projects under the auspices of the AEPS.

Paul McCollum: Mr. McCollum is CRRC's Fisheries and Natural Resource Biologist and will be providing in kind project support and assistance at all levels of this project. Mr. McCollum has been working in the Chugach Region for the past 22 years and has over 28 years of experience with Alaskan fisheries and natural resources research, enhancement and management programs and projects. He is very familiar with the villages and natural resource projects in the region. He holds a degree in marine biology and has assisted in the development and implementation of fisheries curriculum at the high school and college level both in the Chugach Region as well as the Yukon and Kuskokwim Region. He also works with the Port Graham Village Council on fisheries, natural resources and environmental issues and projects as well as the Nanwalek IRA Council including their salmon enhancement program. He has provided valuable work throughout the region, assisting the Tribes in the development of their Tribal natural resource management plans and associated projects and programs.

LITERATURE CITED

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Appendix I.

CRRC's Community WisdomKeeper Series:
An approach to exchanging information

Introduction

This Community WisdomKeeper Gathering format has been developed by Dr. Henry Huntington for CRRC to utilize in this EVOS Project # 03052 to gain and share valuable information across cultural boundaries and jurisdictions. The name WisdomKeeper is borrowed from the Bering Sea Coalition which held a conference in 1999 entitled Wisdomkeepers of the North. We prefer this type of Tribal description to Symposia which could be considered the logical western alternative. While this CRRC's Community WisdomKeeper Series has been developed solely by Dr. Huntington for CRRC and specifically as a tool for this EVOS project #03052, the title WisdomKeeper has been borrowed with permission from the Bering Sea Coalition, out of respect for the type of Tribal and community process they used for the above mentioned conference. CRRC's Community WisdomKeeper series will be finalized before implementation and event planning take place and the Bering Sea Coalition will be consulted with in order to learn more about their very successful "Wisdomkeepers of the North; Vision, Healing and Stewardship for the New Millennia" conference held in Anchorage.

Background

The EVOS Restoration Program gave considerable attention to the question of involving spill-area communities in the effort to assess the recovery of the region from the oil spill. The effort focused on the previous CRRC/EVOS TC Community Involvement Project and associated TEK Project(s), with additional community outreach work in several other projects throughout the duration of the Restoration Program. Despite this attention, however, meaningful community involvement remained elusive. In part, perhaps, this was because "meaningful involvement" was difficult to define and harder still to measure. "Community involvement" came to stand for many things, from involvement in specific research projects, to having a political voice at the level of the Trustee Council, to finding a way to acknowledge the human cost of the spill despite the Justice Department's stance that humans were not among the injured resources. Satisfying the many aims and motives captured by "community involvement" may not have been realistic, and the absence of more specific targets meant that evaluating the success of the overall effort was impossible.

Despite the difficulties experienced in the Restoration Program, the EVOS Trustee Council and others have emphasized the importance of community involvement in the Gulf Ecosystem Monitoring Program (GEM). Certainly, the

long-term success of GEM, both in its own monitoring and in its broader goal of establishing a healthy Gulf of Alaska, depends on public support and the shared commitment of those who live and work in the region. Building that support and establishing cooperative ties with the region's residents will best be done through a variety of approaches, each of which is likely to require considerable effort. This paper describes one such approach, with the goal of promoting substantive exchanges of information between the region's Tribes and those involved in GEM.

The Need

Sound stewardship of natural resources requires having and having timely access to good information. This is especially true as our understanding of a natural system evolves, for example through the anticipated findings of GEM over the coming decades. In a system such as the Gulf of Alaska, where the many residents and users have considerable experience and expertise with the system, promoting effective exchanges between scientists, managers, and users is vital to the development of a shared commitment to both the principles and the practices of sound stewardship. If the various groups do not have the opportunity to develop a common understanding of the system, it is highly unlikely that they will agree on the steps needed to protect the health of the system. This common understanding cannot happen by accident. Instead, the mechanism for promoting its development should be an integral part of GEM.

The Approach

There are several examples of effective information exchanges between and resource users and scientists and managers. These include the Barrow Symposium on Sea Ice, the Marine Mammal Commission's workshop on the Impacts of Changes in Sea Ice and Other Environmental Parameters in the Arctic, and co-management groups such as the Alaska Beluga Whale Committee. These examples have several things in common:

- *A clear focus.* Each meeting had clear objectives and a well-defined topic. While the topic may have been broad, it was coherent (e.g., "sea ice," or "beluga whales") and provided a useful means of engaging a diverse group of participants.
- *Extensive preparation.* The participants were given time to think over the topics to be discussed, and in some cases were able to do additional research prior to the meeting.
- *Diverse and knowledgeable participation.* Participation in the meetings was well distributed among the different groups taking part (e.g., users, scientists, etc.), and the individual participants were selected for their expertise and their commitment to the objectives of the meeting.

- *Adequate support.* The meetings were well planned, well organized, and allowed for follow-up work to complete the goals of the meeting.

In addition, the most successful cases are those that allow for a continued effort instead of a one-time event. The co-management groups typically meet annually to discuss research and management plans, and are able to build relationships over time that lead to greater collaboration and mutual understanding. The Alaska Beluga Whale Committee, for example, has helped Alaska Native hunters become certified as satellite taggers, while at the same time promoting acceptance of traditional ecological knowledge as a vital part of their research program.

Drawing on these examples, CRRC will establish a Community WisdomKeeper Series. Each WisdomKeeper Gathering (perhaps to be held annually) would address a topic broad enough to encompass several actual or potential research projects, but specific enough to allow discussions to remain focused and productive. Selection of topics could be done jointly by community representatives and scientists involved in GEM. The format of the workshops should promote discussions and interactions rather than lectures, and the number of participants should be limited. An example of how a WisdomKeeper Gathering might be organized is as follows:

Preparation: (3-6 months, by WisdomKeeper Organizing Committee)
Select topic and specific WisdomKeeper Gathering objectives
Identify participants, date, location
Prepare scientific reviews of the topic(s) (by contract with scientists)
Prepare community reviews of the topic(s) (by contract with tribes or researchers)

WisdomKeeper Gathering: (3-4 days)
Review the topic and the objectives
Give overview reports of the scientific reviews
Give overview reports of the community reviews
Discuss, leading to conclusions/recommendations/findings
Assign follow-up tasks

Post-WisdomKeeper Gathering: (2 months or more, by Organizing Committee & others)
Prepare written report
Other tasks as identified at the WisdomKeeper Gathering

The outcomes of the WisdomKeeper Gathering include (a) progress towards a shared understanding of current knowledge about the WisdomKeeper topic; (b) development of a research or monitoring agenda; and (c) identification of opportunities for collaboration or further exchanges between communities and scientists and managers. Realizing these outcomes may take some time, but as the WisdomKeeper Series continues, the process of collaboration and the development of cooperative activities should become increasingly common and efficient.

Rationale

The WisdomKeeper Series has no guarantee of success. Nonetheless, separating the function of information exchange from the multitude of explicit and implicit goals of the Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program project should help. Furthermore, the successful examples cited above show that this approach has worked in other settings, and that GEM can apply the lessons learned.

Under the TEK Project, several Information Workshops were held, each of which was in some ways a smaller version of the symposia proposed here. The Symposium Series, however, differs from the Information Workshops in several key ways. First, the communities would have a greater role in selecting the topic to be addressed. The Information Workshops were limited to existing projects. Second, each symposium would cover more than the one or two projects addressed in the information workshops. The broader scope would allow for wider discussion instead of just reaction to the efforts of a particular researcher. Third, more thorough preparation, especially on the community side, would give community members time to consider the topic in some detail, which again is an improvement over reacting to a researcher's presentation. Fourth, the objectives of each symposium would encompass more than the next steps of a particular project, giving greater range to the potential outcomes as well as a longer time horizon to achieve them. In sum, the symposia would be far more thorough than the Information Workshops and would have more explicit objectives.

The Symposium Series should not try to find topics of equal interest throughout the spill area, but should choose topics on their merit and suitability to the symposium format. The frequency of the symposia will be limited by funds and personnel available to prepare them. While the idea could eventually be copied by different organizations, it would be best to begin with one organization coordinating the symposia to establish the pattern and provide continuity.

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002- September 30, 2003

Budget Category:	Authorized FY 2002	Proposed FY 2003	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$60.0						
Travel		$22.1						
Contractual		$60.0						
Commodities		$2.0						
Equipment		$0.0						
Subtotal		$144.1	Estimated FY 2004					
Indirect		$21.6						
Project Total		$165.7	$180.0					
Full-time Equivalents (FTE)		1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Indirect - CRRC's indirect amount is 15%. This includes costs related to general office operation.
NEPA Compliance - Not Applicable to this Project.
Annual Restoration Attendance - Not Applicable to this Project.
Report Writing - Not Applicable to this Project.
Publications - Not Applicable to this Project.
Professional Conferences - 6% of the Project Budget will go towards the Project Personnel's attendance at the Native American Fish & Wildlife Society Conference in May 2003.
Community Involvement - 100% of the Project Budget.

FY03

Prepared: 04/09/2002

Project Number: 03052
Project Title: Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002- September 30, 2003

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2002
To Be Hired	Tribal Natural Resource Program Planner		12.0	5.0	0.0	60.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		12.0	5.0	0.0	
					Personnel Total	$60.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2002
Port Graham - Anchorage		0.2	2	8	0.1	1.2
Tatitlek - Anchorage		0.5	2	8	0.1	1.8
Chenega Bay - Anchorage		0.5	2	8	0.1	1.8
Seldovia - Anchorage		0.3	2	8	0.1	1.4
Nanwalek - Anchorage		0.2	2	8	0.1	1.2
Seward - Anchorage		0.2	2	8	0.1	1.2
Cordova - Anchorage		0.3	2	8	0.1	1.4
Valdez - Anchorage		0.2	2	8	0.1	1.2
Ouzinkie - Anchorage		0.7	2	8	0.1	2.2
Chignik Lake - Anchorage		0.7	2	8	0.1	2.2
Fisheries and Natural Resource Biologist/TEK Specialist/Science Advisor/						6.5
Principle Investigator's travel throughout spill area						0.0
					Travel Total	$22.1

FY03

Project Number:
Project Title: Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 04/09/2002

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002- September 30, 2003

Contractual Costs:	Proposed
Description	FY 2002
TEK Specialist & Science Advisor	30.0
Sub-contracts with Tribal Councils in spill Area (5 @ $2,000) to participate in GEM planning and implementation	10.0
Sub-contracts with Tribal Councils in spill Area (5 @ $4,000) for Natural Resouce Management Plan integration with GEM	20.0
Contractual Total	$60.0

Commodities Costs:	Proposed
Description	FY 2002
Incidental costs for workshops (meeting space rental, supplies, food, etc.)	2.0
Commodities Total	$2.0

FY03

Prepared: 04/09/2002

Project Number:
Project Title: Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities DETAIL

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002- September 30, 2003

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2002
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY03

Project Number:
Project Title: Tribal Natural Resource Stewardship and Meaningful Tribal Involvement in the GEM Program
Name: Chugach Regional Resources Commission

FORM 4B
Equipment
DETAIL

Prepared: 04/09/2002

Construction of a Linkage Map for the Pink Salmon Genome

Project Number:	03190
Restoration Category:	Research
Proposer:	Fred W. Allendorf University of Montana
Lead Trustee Agency:	ADFG
Alaska SeaLife Center:	No
Duration:	8th year, 8-year project
Cost FY 03:	$75,000
Geographic Area:	Prince William Sound
Injured Resource:	Pink salmon

ABSTRACT

This is the final year of our project based upon experiments conducted at the Alaska SeaLife Center (ASLC) that use the linkage map we have constructed to test for effects of regions of the genome on traits that are important to recovery of pink salmon (e.g., growth and survival). In summer 2001, we collected 259 sexually mature adults in Resurrection Bay from the 1999 cohort produced from wild pink salmon collected from Likes Creek. We will complete the analysis of the genotypes in the returning adults to test for genetic differences in marine survival and other life history traits (e.g., body size, egg number, and egg size).

INTRODUCTION

This is the final year of our research to construct a genetic linkage map for pink salmon (*Oncorhynchus gorbuscha*) and to use this map to evaluate effects of natural selection on the genome of this species. Such a map was proposed initially to provide the necessary platform to identify genetic damage in pink salmon inhabiting oiled streams following the March 1989 *Exxon Valdez* oil spill (EVOS). We have conducted a series of experiments based at the Alaska SeaLife Center (ASLC) to identify regions of the genome that affect various organismal traits and to test for the effects of natural selection on regions of the genome that include markers used to describe genetic population structure. This research will aid recovery efforts with pink salmon, including estimation of straying rates, description of stock structure, and testing whether marine survival and other organismal measures of phenotypic variation have a genetic basis. We are asking for a reduced budget to complete our research.

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

This project began in FY 96. However, we did not receive authorization to proceed until half-way through FY 96 (March 1996). We have completed our two initial objectives that included identifying several hundred genetic markers and using them to construct a linkage map. We have used the ASLC for experiments that apply the linkage map to an understanding of the fundamental population biology and genetics of pink salmon.

This work was originally designed to support work with pink salmon under the project *Oil-Related Embryo Mortalities* (Restoration Study \191A). The objective of that project was to identify germline mutations in pink salmon exposed to oil. Genetic damage induced by oil may either be small changes in nucleotide sequence (microlesions) or large-scale changes in chromosome structure (macrolesions). A detailed genetic map for pink salmon would have been invaluable for interpreting the results of Restoration Study \191A in several ways. First, it would be possible by following the inheritance of any DNA lesions to determine if they are micro- or macro-lesions. Second, these lesions could be mapped to determine if they are randomly spread throughout the genome or if they occur at mutational "hot spots" that are susceptible to oil induced damage. However, Restoration Study \191A is no longer ongoing, and thus our future work will concentrate on our original Objectives 5 and 6 as described in this proposal.

We propose to complete the analysis of our experiments at the ASLC to test for regions of the genome associated with marine survival and fitness. We collected 259 sexually mature adults that returned to Resurrection Bay and the ASLC that were produced in 1999 from wild pink salmon collected from Likes Creek. We have identified the parents of these fish based upon genotypes at nine microsatellite loci and a growth hormone locus.

NEED FOR THE PROJECT

A. Statement of Problem

Elevated embryo mortality was detected in populations of pink salmon inhabiting oiled streams following the spill. These increased rates of mortality persisted through the 1993 field season, three generations after the oil spill, suggesting that genetic damage may have occurred as a result of exposure to oil during early developmental life-stages. The consequences of the putative genetic damage include impaired physiological function of individuals and reduced reproductive capacity of pink salmon populations (Bue et al. 1998).

The aggregate of evidence from field studies and incubation experiments suggests that embryos exposed to oil in 1989 and 1990 accumulated deleterious mutations in the germline (Bue et al. 1998). However, see Cronin and Bickham (1998) for an alternative interpretation of these data. This hypothesis of genetic damage is consistent with previous field observations and laboratory experiments on the effects of crude oil on early life stages of fish. Long term intra-gravel oil exposures (7-8 months) to freshly fertilized eggs provide embryos sufficient time to accumulate polynuclear aromatic hydrocarbons (PAH's) from very low aqueous concentrations of crude oil. PAH's are abundant in crude oil and are potent clastogens (i.e. capable of breaking chromosomes). Roy et al. (1999) have recently reported evidence of molecular genetic damage to pink salmon embryos exposed to crude oil.

Mironov (1969) observed reduced survival of fish embryos and larvae exposed to very low aqueous doses (1 ul oil/L seawater) of oil. Longwell (1977) reported genetic damage in pelagic embryos affected by the ArgoMerchant oil spill. Moles et al. (1987) confirmed that pink salmon embryos take up PAH's and demonstrated that the uptake was much greater in an intertidal environment than in strictly freshwater conditions. Biggs et al. (1991) found greater numbers of chromosome aberrations in larval herring that incubated in oiled areas than in non-oiled areas. It is likely that the same type of damage may have occurred in pink salmon and other species in Prince William Sound, and this damage could have affected the germline of exposed individuals (Malkin 1994; Bue et al. 1998).

Molecular genetic techniques have been used extensively to describe population structure of Pacific salmon (Utter et al. 1993; Gharrett and Smoker 1994; Seeb et al. 1998). Genetic divergence among populations has been interpreted as largely reflecting the patterns of exchange of individuals among populations (gene flow) and random changes in frequency of selectively neutral alleles within populations (genetic drift) (Allendorf and Phelps 1981; Waples 1995). This is a useful approach that allows description of the pattern and amount of gene flow among populations.

This approach to describe population structure is based upon the assumption that the pattern and amount of divergence observed is not affected by natural selection or mutation. However, even weak natural selection may have a substantial effect on the pattern of genetic divergence among populations (Allendorf 1983). In addition, different mutation rates at marker loci may also affect the amount of genetic differentiation between populations, in particular if mutation rates at some loci are high (e.g., Jin and Chakraborty

1995). Thus, the high frequency of mutations that we have detected may also have a substantial effect on the amount and pattern of genetic divergence at some loci.

Molecular markers may be affected by natural selection even if the markers themselves are not the target of selection. Loci that are selectively neutral and have no effect on the phenotype are expected to be affected by the action of natural selection at closely linked loci (Slatkin 1995). Apparent heterozygous advantage ("associative overdominance") can result at neutral loci by linkage disequilibrium with nearby loci that are affected by natural selection (Pamilo and Pálsson 1998). Zhivotovsky et al. (1994) have recently questioned the description of genetic population structure of pink salmon and suggested that natural selection may have an important effect on allozyme frequency divergence in pink salmon.

It has been notoriously difficult to detect and measure the effects of natural selection in natural populations (Lewontin 1991). Comparing the distribution of genotypes in a single cohort followed through different life history stages is the most powerful method to detect natural selection (p. 303, Lynch and Walsh, in preparation). The facilities at the ASLC provided an exceptional opportunity to measure lifetime fitness from fertilization to sexual maturity of molecular genetic markers spread throughout the genome identified in previous years of this project.

B. Rationale/Link to Restoration

The recovery objective for pink salmon is healthy and productive populations that exist at prespill levels or levels in unoiled areas. An indication of recovery is when egg mortality in oiled areas match prespill or levels in unoiled areas. A genetic map would be essential for detecting and understanding causes of reduced egg and embryo survival in oiled areas (Bue et al. 1998). The genetic damage caused by exposure to oil may persist longer in populations of pink salmon than in other vertebrates because of the tetraploid nature of the salmonid genome. Salmonid fishes went through a tetraploid event some 25 million years ago that duplicated their entire genome (Allendorf and Thorgaard 1984). The extra genes in pink salmon may mask the effects of mutational damage caused by recessive deleterious alleles. The effects of these deleterious mutations may be uncovered in subsequent generations.

This research will provide a powerful test of the assumption of the absence of natural selection affecting molecular markers. This assumption is the foundation of interpreting patterns of genetic divergence among populations as reflecting patterns of genetic exchange. Evidence of natural selection affecting the molecular markers would cause a major change in the interpretation of genetic variation in natural populations of pink salmon and other species. This will be true whether the selection is acting on the markers themselves or chromosomal segments linked to the markers. Recent results from molecular studies of the genome suggest that natural selection may play a greater role than previously thought in determining the structure of the genome, including the organization of genes and chromosomes, as well as the patterns and amounts of genetic variation present (Hurst 1999).

C. Location

Gametes for the inheritance studies and linkage map were collected from Prince William Sound in collaboration with the project Oil-Related Embryo Mortalities (Restoration Study \191A). Embryo incubation took place at the Genetics Lab facilities of ADFG. The laboratory analyses were done at the University of Montana and the ADFG genetics lab in Anchorage.

We began in FY 1998 to use the ASLC Research Facilities at Seward for experiments designed to test for natural selection at loci throughout the genome of pink salmon. Sexually mature pink salmon used in the experimental matings in 1998 and 1999 were collected from Likes Creek in Resurrection Bay. The progeny were marked with an adipose fin clip and released into Resurrection Bay. Due to the failure of the fish pass at the ASLC to attract returning adults we adjusted our plans for recapturing returning adults from the 1999 cohort to include sampling in upper Resurrection Bay.

COMMUNITY INVOLVEMENT

This is a specialized project that will not benefit directly from the knowledge of local/traditional people. We developed two computer interactive educational games that were incorporated into displays describing our project at the ASLC ("Lost Child" and "Who's Your Father?"). In addition, we have taken opportunities to explain our research in different Alaska high schools. Kathy Knudsen gave a presentation on this project to the freshman biology class at Kenai High School, and Kate Lindner discussed this study with high school students in Kongiganak.

We involved the community of Seward in helping us collect the returning adults. A lottery was conducted during the 2000 and 2001 field seasons as an incentive to recreational fishermen to turn in any marked pink salmon they caught. This resulted in 18 recreational fishermen turning in 22 marked fish in 2001 and 38 recreational fishermen turning in 61 marked fish in 2002.

PROJECT DESIGN

A. Objectives

Our initial primary objective was to construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms. Pink salmon have 26 pairs of chromosomes (2N=52; Allendorf and Thorgaard 1984), and, therefore, should have a total of 27 linkage-groups: 25 autosomes, an X-chromosome, and a Y-chromosome. We planned to map enough variable markers so that a new marker can be assigned with high probability to one of the 27 linkage groups. It was impossible to know how many markers this would require because we did not know the total length of the pink salmon linkage map. The linkage map of the zebrafish (*Danio rerio*) has been estimated to be 2900 centimorgans (cM; Johnson et al. 1996) and that of the medaka (*Oryzias latipes*) to be 2480 cM (Wada et al. 1995). There currently are efforts to include

zebrafish among genome projects of model species sponsored by the National Institutes of Health under the Human Genome Project (Roush 1997). Such a massive effort in zebrafish would provide extremely helpful information for understanding the genome of salmonid fishes.

We expected the pink salmon map to be large because of the polyploid ancestry of salmonids and due to the fact it is female based. Young et al. (1998) recently have published a rainbow trout (*Oncorhynchus mykiss*) linkage map based upon recombination rates in males and estimated the total map to be 2628 cM. However, the linkage map in males will be shorter than in females because of the reduced recombination rate in male salmonids (Johnson et al. 1987a). We initially anticipated that it would be necessary to map over 500 markers to ensure that new markers can be assigned to an existing linkage group with high probability (Van der Beek and Van Arendonk 1993). For example, 99% of all loci in the zebrafish were estimated to be located within 20 cM of a marker on the map based upon an earlier report using 414 markers (Postlethwait et al. 1994).

This project originally had the following overall specific objectives:

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

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

3. Map putative lesions identified in Restoration Study \191A.

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

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

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

We have completed Objectives 1 and 2. We cannot pursue Objective 3 because Restoration Study /191A did not identify any putative lesions for mapping. At present, we do not intend to pursue Objective 4 because Restoration Study \191A is no longer ongoing. However, this type of experiment to detect oil-induced lesions could be pursued in the future at the ASLC. The primary focus in FY 03 will be completing Objectives 5 and 6; we propose to use the linkage map to test if there are phenotypic effects and adaptive significance of different classes of molecular markers.

B. Methods

OBJECTIVES 1 & 2

Our initial map was constructed using gynogenetic haploid and gynogenetic diploid progeny from an odd-year individual female (95-103). This is the same procedure that has been used to build the zebrafish linkage map (Postlethwait et al. 1994). Stanley (1983) reported that haploid embryos of Atlantic salmon will develop until just prior to the stage of hatching if development of the eggs is activated by sperm in which the DNA has been inactivated by UV-radiation. We have used this technique routinely with fishes of the genus *Oncorhynchus* (Forbes et al. 1994; Spruell et al. 1999). This allows us to follow the segregation and linkage relationships in haploid progeny from females. The use of haploid progeny avoids possible difficulties of dominance with some types of DNA markers because recessive alleles are not obscured by their dominant alternatives in haploids (Lie et al. 1994). Our odd-year map is primarily based on 603 segregating markers in 94 haploid progeny from a single pink salmon female (A95-103) that returned to Armin F. Koernig hatchery in Prince William Sound in August 1995. We also have placed a number of so-called "anchor" loci on this map, including 13 allozyme and 41 microsatellite loci.

In addition we have completed the construction of a linkage map based on the segregation pattern of 90 haploid individuals in an even-year female (V96-13). Odd- and even-year pink salmon are reproductively isolated due to the fixed two-year life cycle of this species (Aspinwall 1974). Beacham et al. (1988) report substantial allozyme and morphological evidence for differentiation of alternate brood years. In addition, Phillips and Kapuscinski (1988) and Phillips et al. (1999) detected chromosomal rearrangements between odd- and even-year populations that occur in the same geographical area. Furthermore, in a recent experimental study, Gharrett et al. (1999) demonstrated outbreeding depression in crosses between the two year classes. Together, these finding suggest that the alternate brood years are reproductively isolated and genetically distinct. Having linkage data from both odd- and even-year individuals made it possible for us to map more markers and allowed us to test if linkage relationships are conserved between the reproductively isolated year classes.

Differences in meiosis between male and female salmonids have been found in all species that have been examined (Allendorf and Thorgaard 1984; Johnson et al. 1987a). There generally is greater recombination in females than in males (Johnson et al. 1987a; Allendorf et al. 1994). In addition, only disomic inheritance has been reported in females. However, in males some loci show patterns of segregation that approach those expected with tetrasomic inheritance (Allendorf and Thorgaard 1984).

Construction of a full linkage map is a large task. We developed as many time and labor saving procedures as possible. Our linkage map was constructed by computer assisted analysis (MapMaker, Lander et al. 1987). We have been assisted by Mark Daly of the Whitehead Institute at MIT in using this program.

A useful genetic map contains genetic markers that are abundant, randomly distributed throughout the genome, highly polymorphic, and readily detectable in many laboratories (Jacob et al. 1995). We began using random amplified polymorphic DNA (RAPD)

markers because they fit these criteria and they have been used successfully in constructing linkage maps in zebrafish and medaka (Johnson et al. 1996; Wada et al. 1995). We have switched to two other types of genetic markers that are superior to RAPDs in this work.

PINEs: There are a variety of repetitive DNA elements that are scattered throughout the genome of salmonid fishes. Greene and Seeb (1997) have described a technique that uses the sequences from a SINE (short interspersed nuclear element) and a transposon to detect many DNA polymorphisms. They have called this technique SINE-printing. We have modified this technique using other types of repetitive elements for our mapping study to detect a class of molecular markers that we call PINEs (paired interspersed nuclear elements; Spruell et al. 1999).

Kido et al. (1991) described 3 SINEs in salmonid fishes. They documented the presence of two such elements, *Hpa*I and *Sma*I, in pink salmon. Spruell and Thorgaard (1996) subsequently reported the presence of the 5'-end of the third element, *Fok*I, in pink salmon. Goodier and Davidson (1994) confirmed that salmonids also contain the transposon *Tc*1, a member of another class of repetitive elements. Both SINEs and transposons occur in high copy number and are believed to be ubiquitously dispersed throughout the genome, making them ideal candidates for genomic mapping efforts.

We have used DNA sequences from four types of repetitive elements as polymerase chain reaction (PCR) primers to generate multiple DNA fragments from a single PCR reaction in pink salmon. The theoretical basis for this procedure is similar to the use of the human SINE *Alu*I to identify human chromosomes in somatic cell hybridization experiments (Nelson et al. 1989). Primers complementary to one end of the element are oriented such that they initiate DNA synthesis from the end of the element, progressing into the surrounding genomic DNA. A single primer or combinations of primers may be used to generate multilocus patterns. Greene and Seeb (1997) used this technique to confirm the parentage of pink salmon fry, demonstrating the potential utility of including these fragments in our mapping study. We have used 12 different pairs of PINE primers to detect 162 segregating markers in our reference family.

AFLPs: Amplification fragment length polymorphisms have been used extensively in the construction of genomic maps in plants (Maheswaran et al. 1997; Becker et al. 1995). The AFLP technique is especially advantageous for two reasons. First, many bands are produced per reaction and, therefore, more polymorphic loci are produced per unit effort. Second, the selective amplification step uses a subsample of the PCR products of the preamplification. Up to 133 selective amplifications can be completed from a single pre-amplification that originally used only 0.5 µg of genomic DNA. Much less genomic DNA is needed to produce more bands than using other methods such as RAPDs. This is an important consideration when dealing with the limited amount of tissue available from haploid embryos.

Gene-Centromere Map

We estimated recombination rates between 312 loci and their centromeres using half-tetrad analysis in a recently published manuscript (Lindner et al. 2000). We produced the half-tetrads by initiating development with irradiated sperm and blocking the maternal

second meiotic division. AFLPs were significantly more centromeric than loci identified by three other techniques (allozymes, microsatellites, and PINEs). The near absence of AFLPs in distal regions could limit their utility in constructing linkage maps. A large proportion of loci had *y* values approaching 1.0, indicating near complete crossover interference on many chromosome arms. As predicted from models of chromosomal evolution in salmonids, all duplicated microsatellite loci that shared alleles (isoloci) had *y* values of nearly 1.0. This is consistent with previous data from allozyme loci.

Odd-Year Linkage Map

We have described the segregation of 590 markers in haploid progeny from female A95-103; we have also mapped 13 allozyme loci in the same female. We assigned 546 of the 590 DNA markers and all of the allozyme loci to one of 44 linkage groups covering a distance of 4559 cM. Given the haploid number of 26 chromosomes for pink salmon, our mapping efforts produced 18 extra linkage groups. Taking into account the extra linkage groups and 44 unassigned markers as well as the distance to the telomeres we estimate the size of the pink salmon genome to be 6691 cM. The haploid pink salmon genome is approximately 2.72 million kilobase pairs (kpb; Johnson et al 1987b); thus, we estimate approximately 406 kbp/cM. These results are consistent with our expectations when comparing to maps constructed in other fishes.

Even-Year Linkage Map

We have completed construction of a linkage map for even-year pink salmon from Prince William Sound. We have analyzed the segregation pattern of 85 loci in an even-year family (V96-13) and assigned 103 of 123 loci to one of 33 linkage groups. One gene of known function, *MHCB^{a}2*, is assigned to a linkage group that consists of one microsatellite and two PINE loci.

We have not found any differences in location of loci on the maps or recombination rates between the odd- and even-year maps. We are completing the comparative analysis of the odd- and even-year maps, and will submit a manuscript for publication within three months.

Mutation Analysis

Our results have provided exciting and important information about mutation processes in microsatellites that are accepted for publication in the journal Molecular Biology and Evolution (Steinberg et al. 2002). Our experimental design depends upon being able to place returning adults into their correct family on the basis of their multiple-locus genotypes. We tested this by examining inheritance data at 11 loci (nine microsatellites and two genes of known function) for 10 progeny from each of the 50 families that were released in spring of 1999. In the process of analyzing the inheritance data, we detected several mutations at two of the microsatellite loci (*SSA408* and *OGO1c*), indicating that these loci have particularly high mutation rates. Furthermore, at *SSA408* the mutations detected were not distributed randomly among families. Rather, clusters of identical mutant alleles were found in certain families, suggesting they may have resulted from mutation events occurring very early in gametogenesis, prior to meiosis.

Our results have important significance for the use of microsatellite loci in management. Mutations are expected to have a substantial effect on the amount and pattern of genetic divergence among populations if the mutation rate approaches the rate of migration among populations (see discussion in Allendorf and Seeb 2000). Not surprisingly, the number of mutations detected was correlated with the number of alleles in the sample. We detected mutations at the two loci that have the greatest number of alleles in the parental population (*OGO1c* and *SSA408*). The mutation rate estimates at *OGO1c* and *SSA408* ($3.7x10^{-3}$ and $5.4x10^{-3}$) are at the high end of the range of 10^{-3} to 10^{-6} reported for other organisms (Dallas 1992, Weber and Wong 1993, Schug et al. 1997). The variability of these two loci makes them powerful tools for assigning parentage. We were able to unambiguously assign parentage to 35 of the 36 returning fish from the 1998 cohort based on these two loci alone. However, given the high probability of mutation at these loci, our results indicate that it is important to use a combination of low and high variability markers for parentage analysis. Our mutation analysis also suggests that *OGO1c* and *SSA408* are inappropriate as markers for analysis of stock structure in pink salmon.

OBJECTIVES 5 & 6

The completion of a genome map for pink salmon provides important information for addressing genetic issues related to two other Components of the Pink Salmon Restoration Program. The numerous genetic markers identified in the course of this study will provide greatly increased power and resolution to identify stocks of pink salmon on a very fine scale (Stock Separation and Management). In addition, understanding the process of mutation will help identify appropriate markers for use in stock identification. The genome map also provides a platform to test for the presence of genes having major effects on traits of importance for the management of pink salmon, and to test for phenotypes associated with specific combinations of multilocus genotypes (Lander and Schork 1994). These genetic markers will be of great value in identifying fish from supplementation programs (hatchery-raised stocks) and detecting their ecological and genetic interactions with wild fish (Supplementation).

This aspect of the research was being performed at the ASLC research facilities. Approximately 50,000 and 24,000 marked fish were released in spring of 1999 and 2000 respectively. We collected 36 sexually mature adults in Resurrection Bay from the 1998 cohort and 259 sexually mature adults in Resurrection Bay from the 1999 cohort produced from wild pink salmon collected from Likes Creek. A sample of 500 fry was collected at release and will be analyzed so that their genetic characteristics prior to the marine phase of the life cycle can be compared to the returning adults. We will test for genetic effects on phenotypes of special importance by comparing the genotypes of the released fish with the genotypes of the returning fish. This will allow us to test for genes with a major effect on marine survival. We will test for loci or regions of the genome that have a large effect on phenotypes of interest, so-called quantitative trait loci (QTL's). For example, Jackson et al. (1998) recently have presented evidence for QTL's that affect upper temperature tolerance in rainbow trout linked to two of 24 polymorphic loci that they examined. Mousseau et al. (1998) have used a similar approach to estimate heritabilities for weight, length, and age at sexual maturation in chinook salmon.

Karl and Avise (1992) reported concordant patterns of genetic differentiation for mitochondrial DNA and four nuclear DNA loci in the American oyster (*Crassostrea virginica*) along the east coast of North America. In contrast, previous allozyme studies had not detected these genetic differences among these same populations. Karl and Avise concluded that the pattern observed for the DNA markers reflected the historical patterns of isolation and gene flow among these populations while this pattern is obscured in the allozymes because of "balancing selection" at the allozyme loci. Similar results have been reported in the Atlantic cod (Pogson et al. 1995). These results provide an important challenge to the generally accepted utility of allozyme markers for describing historical patterns and amounts of gene flow between populations. That is, if allozymes are under strong natural selection then they may not provide accurate information about the genetic structure and amount of gene flow among populations.

Restoration Projects 95320D and 96196 have described the genetic population structure in Prince William Sound (PWS) odd- and even-year fish at allozyme loci and mitochondrial DNA (mtDNA) (Seeb et al 1996; Habicht et al. 1998). These studies reported small but statistically significant genetic allele frequency differences among streams, and concluded that pink salmon in PWS should be managed taking into account subpopulation structure rather than as a single panmictic population. As is usually done in such studies, these authors assumed that the genes they examined were selectively neutral (that is, not affected by natural selection). However, the estimates of these authors could be severe overestimates of the actual amount of gene flow if "balancing" selection is maintaining similar frequencies (Karl and Avise 1992; Pogson et al. 1995). That is, there may be much less gene flow among populations than is suggested by these studies.

Zhivotovsky et al. (1994) have reviewed population genetic data of pink salmon and concluded that the interpretations concerning amounts and patterns of gene flow are questionable because even weak natural selection could have a major effect on genetic divergence among populations of pink salmon. A series of papers by Altukhov and his colleagues has provided evidence for phenotypic and fitness effects of genetic variation at allozyme loci in pink salmon (Altukhov 1990; Altukhov et al. 1987, 1989; Dubrova et al. 1995; Kartavtsev 1992). These papers argue that genotypes at allozyme loci have a significant effect on marine survival, growth rate, and several other important factors.

The clearest and perhaps most important effects have been demonstrated on marine survival and growth rates. Pink salmon that are more heterozygous at allozyme loci have greater viability and growth rates than more homozygous individuals (Altukhov et al. 1991; Zhivotovsky et al. 1987; Kartavtsev 1992). Table 1 shows the distribution of individual heterozygosities at four allozyme loci in fry before release into salt water and returning adult spawners in odd-year pink salmon from the Sakhalin Island (Altukhov et al. 1987). We would expect the heterozygosities in fry and adults to be similar if the genotypes at these loci are not associated with survival. The significantly higher heterozygosity in the returning adults (0.619) than in the fry (0.424) indicates that individuals that were more heterozygous at the four loci had greater marine survival.

Altukhov et al. (1991) found a significant positive regression ($r=0.14$; $P<0.01$) between individual heterozygosity at these same four allozyme loci and body length of fry

immediately preceding downstream migration from a hatchery on the Sakhalin Island. Kartavtsev (1992) reported a similar relationship in a different experiment with pink salmon from Sakhalin island ($r=0.23$; $P<0.001$). Previous studies with salmonids have found that size has an important effect on survival (Hunt 1969).

Table 1. Distribution of Heterozygosity at Four Allozyme Loci in Pink Salmon from Sakhalin Island

	Number of heterozygous loci*				
Age-class	0	1	2-4	Average Heterozygosity	
Fry	0.620 (559)	0.336 (302)	0.044 (40)	0.424 (901)	$\chi^2 = 37.3$ d.f. = 2 P<0.001
Adults	0.495 (300)	0.391 (237)	0.144 (69)	0.619 (606)	

* values are the frequencies (and number) of individuals with the indicated number of heterozygous loci.

Similar results have been reported in other salmonid species for many phenotypes of evolutionary importance (e.g., developmental rate, egg size, and disease resistance; reviewed by Ferguson 1992). Positive associations between heterozygosity at allozyme loci and important phenotypic characters, such as growth rate, survival, fertility, disease resistance, developmental rate, and developmental stability, have been described in many organisms (reviewed by Zouros and Foltz 1986; Allendorf and Leary 1986).

The mechanism underlying these associations remains unknown. The most likely explanations are (1) the associations are the consequence of heterozygosity at the loci examined, or (2) the loci examined may be in linkage disequilibrium with other loci that affect the traits being studied (associative overdominance; Leary et al. 1987).

It has been argued that these relationships between multiple locus heterozygosity and phenotypes have been found with allozymes because these loci are important in ATP production and protein catabolism (Koehn et al. 1988). We propose to distinguish between these hypotheses by using the linkage map to compare the effects of different markers on marine survival and other traits. If the enzyme loci themselves are responsible for this effect, then we would expect to find an association between enzyme genotypes and survival, but not between genotypes at DNA markers spread throughout the nuclear genome. However, if we find a similar association using DNA markers, this would suggest that the effect is due to chromosomal segments and not the enzyme loci themselves.

We believe that it is unlikely that the enzyme loci themselves are responsible for the observed relationships. Nevertheless, regardless of the underlying mechanisms of these

associations, even weak heterozygous advantage (or associative overdominance) would act to maintain similar allele frequencies in different populations in the absence of significant gene flow (Allendorf 1983). This could cause a large overestimation of the actual amount of gene flow among Prince William Sound pink salmon populations. For example, just a 10% selective advantage of heterozygotes will cause a 10-fold over estimation of the amount of migration in the case where local populations have an effective size of 100 and an average 0.5 migrants per generation (Allendorf 1983). Altukhov et al. (1987) have estimated an average selective advantage of approximately 25% at four allozyme loci in pink salmon.

We will ask a series of questions in this aspect of the research. The primary question is whether there are regions of the genome that have a significant effect on survival during the marine phase of the life cycle. Secondarily, we will ask if allozyme markers tend to occur in those regions that affect survival. We will also determine if selection favors heterozygotes.

Marine Survival and Fitness Experiment: 1998 cohort

In August 1998, 150 (75 male and 75 female) mature pink salmon were collected from Likes Creek, Resurrection Bay, and transported to the ASLC for controlled matings. We made 75 families of full-sibs by crossing one male and one female. One hundred progeny from each family were collected to test marker inheritance for parentage analysis. We then selected 50 of these families on the basis of egg number and survival during incubation for the release experiment. These families were pooled together into a single tank in March shortly after hatching. In May 1999, approximately 1,500 progeny from each of these 50 single-pair mating families were marked and released from the ASLC facility.

Progeny from this experiment returned in August 2000. We had anticipated a return rate of 2%, for a total of 1,000-2,000 individuals expected to be recovered for genetic and morphological analyses (approximately 30 fish per family). However, no fish returned to the ASLC fish pass, and we captured a total of 36 fish throughout Resurrection Bay. These 36 fish were placed into 30 familes on the basis of 10 microsatellite loci. This sample size was too small to answer the questions that we are addressing.

Marine Survival and Fitness Experiment: 1999 cohort

We repeated this experiment with odd-year pink salmon in August 1999. We collected 68 adults (34 females and 34 males) from Likes Creek, and released their marked progeny from the ASLC in May 2000. This cohort returned in the summer of 2001. We used a different experimental mating scheme with these fish to allow a more powerful genetic analysis of the progeny. Each male and each female was crossed with two individuals in a series of 2 x 2 diallel crosses (Figure 1).

[FIGURE 1 in WORD file (fig-1.doc)]

We collected 259 sexually mature adults from this cohort that returned to Resurrection Bay in summer 2001 (Figure 2). We have identified the parents of these fish based upon genotypes at nine microsatellite loci and a growth hormone locus. The distribution of

returning progeny (i.e., reproductive success) of the 34 males and females is close to expected with random reproductive success (Table 2; Figure 3). The only apparent exception is that there are 2 males that each produced an exceptionally large number of returning progeny (18).

[TABLE 2 in WORD file (table-2.doc)]

[FIGURE 2 in WORD file (fig-2.doc)]

[FIGURE 3 in WORD file (fig-3.doc)]

We have begun analysis of the heritability of several morphological traits on the basis of parent-offspring regression from these fish. Heritability estimates of body length at sexual maturity (length) are surprisingly high. We did these separately for the sexes because males tend to be longer than females. The heritability of length in males is 0.45 (Figure 4, $P<0.005$); the heritability of length in females is 0.34 (Figure 4, $P<0.005$).

[FIGURE 4 in WORD file (fig-4.doc)]

We also analyzed the heritability of several components of female reproductive success: mean egg size, total egg number, and total egg weight. As expected, these traits that are closely related to fitness had low heritabilies in comparison as morphological trait such as body length. The heritability of mean egg weight was 0.32 ($P<0.10$; Fig. 5). The heritabilies of total egg number and total egg weight were zero (Figure 6).

[FIGURE 5 in WORD file (fig-5.doc)]

[FIGURE 6 in WORD file (fig-5.doc)]

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The ADFG Genetics Lab is no longer funded to assist us in the work at the ASLC. Therefore, we are currently doing all of the allozyme analysis at the University of Montana.

SCHEDULE

A. Measurable Project Tasks for FY 03 (1 October 2002 - 30 September 2003)

1 Oct - 31 Jan: Complete genetic analyses of returning adults from 1999 cohort.

1 Dec - 30 Sep: Perform data analysis to test for correlations between markers from the linkage map and traits associated with marine survival and fitness in the returns of the 1999 cohort.

1 Jan - 30 Sep: Prepare manuscripts for publication describing results of marine survival and fitness experiment.

B. Project Milestones and Endpoints

Objective 1: This objective has been completed.

Objective 2: This objective has been completed.

Objective 3: This objective will not be pursued.

Objective 4: This objective will not be pursued.

Objective 5: This objective will be completed by the end of year 8.

Objective 6: This objective will be completed by the end of year 8.

C. Completion Date

We initially proposed to continue this work for five years. However, our release experiments were delayed until the ASLC facilities were available. The 1998 cohort fish released in the spring of 1999 returned at the end of year five, and the 1999 cohort fish will returned at the end of year six. Genetic analysis will be completed by in the first three months of year eight, and data analysis and will be completed by the end of year eight.

PUBLICATIONS AND REPORTS

Allendorf, F. W., P. Spruell, K. L. Knudsen, K. R. Lindner and K. L. Pilgrim. 1997. Construction of a Linkage Map for the Pink Salmon Genome, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 97190), University of Montana, Missoula, Montana.

Allendorf, F. W., P. Spruell, K. L. Knudsen, K. R. Lindner, D.J. Reedy, and K. L. Pilgrim.1998. Construction of a Linkage Map for the Pink Salmon Genome, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 98190), University of Montana, Missoula, Montana.

Allendorf, F. W., P. Spruell, K. L. Knudsen, and K. R. Lindner. 1999. Construction of a Linkage Map for the Pink Salmon Genome, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 99190), University of Montana, Missoula, Montana.

Spruell, P., B.A. Greene, C. Habicht, K.L. Knudsen, K.R. Lindner, J.B. Olsen, K.L. Pilgrim, G.K. Sage, J.E. Seeb, and F.W. Allendorf. 1999. Inheritance of nuclear DNA markers in gynogenetic haploid pink salmon (*Oncorhynchus gorbuscha*). Journal of Heredity 90:289-296.

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Lindner, K.R., J. E. Seeb, C. Habicht, K.L. Knudsen, E. Kretschmer, D. J. Reedy, P. Spruell, and F. W. Allendorf. 2000. Gene-centromere mapping of 312 loci in pink salmon by half-tetrad analysis. Genome 43:538-549.

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Steinberg, E.K., K.R. Lindner, J. Gallea, J. Meng, A.Maxwell, and F.W. Allendorf. 2002. Rates and patterns of microsatellite mutations in pink salmon. Molecular Biology and Evolution.

Lindner, K.R., P. Spruell, C. Habicht, J. E. Seeb, H. Zhao, and F. W. Allendorf. In preparation. Estimation of chiasma interference and construction of a linkage map for pink salmon. To be submitted to Genetics.

PROFESSIONAL CONFERENCES

We anticipate presenting our results at professional and scientific meetings.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This work has been done in collaboration with James E. Seeb, Principal Geneticist, ADFG. The inheritance experiments were performed in coordination with the project Oil-Related Embryo Mortalities (Restoration Study \191A). Dr. Seeb is no longer funded to collaborate with us in this Restoration Study.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The changes in this proposal reflect the discontinuation of Restoration Study \191A, and the decision not to fund our ADFG collaborators on this project. We made changes in our plans to capture fish returning to Resurrection Bay based upon the lack of any returns to the ASLC in summer 2000.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPLE INVESTIGATOR

FRED W. ALLENDORF: Principal Investigator

BIRTH: 29 April 1947; Philadelphia, Pennsylvania

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

EDUCATION: B.S., Zoology, Pennsylvania State University, 1971
M.S., Fisheries, University of Washington, 1973
Ph.D., Genetics and Fisheries, University of Washington, 1975

POSITIONS:

1975-1976 Lektor, Department of Genetics and Ecology, Aarhus University, Denmark
1976-1979 Assistant Professor of Zoology, University of Montana
1978-1979 NATO Fellow, Genetics Research Unit, University of Nottingham, England
1979-1984 Associate Professor of Zoology, University of Montana
1983-1984 Visiting Scientist, Department of Genetics, Univ. of California, Davis
1984-1989 Professor of Zoology, University of Montana
1989-1990 Program Director, Population Biology and Physiological Ecology, National Science Foundation (NSF)
1992-1993 Visiting Professor, University of Oregon
1990- Professor of Biology, University of Montana
2000-2001 Fulbright Senior Scholar, Victoria University of Wellington, New Zealand

HONORS: NATO/NSF Postdoctoral Fellowship, University of Nottingham, 1978-1979
European Molecular Biology Organisation (EMBO), Fellowship, University of Stockholm, 1979
Distinguished Scholar Award, University of Montana, June 1985
Burlington Northern Faculty Achievement Award for Research, University of Montana, June 1987
Elected Fellow, American Association for the Advancement of Science (AAAS), February 1987
Burlington Northern Faculty Achievement Award for Research, University of Montana, May 1991
Elected Member, AAAS Council (Biological Sciences Division), 1996-1998
President, American Genetic Association, 1997
Fulbright Senior Scholar Award, New Zealand, 2000

MAJOR GRANTS:
National Science Foundation Research Grant, EPSCR, 1980-1983, $70,000
National Science Foundation Research Grant, Population Biology, 1980-1982, $60,000
National Science Foundation Research Grant, 1983-1986, $121,000
National Science Foundation, Faculty Research Opportunity Award, 1986, $10,000

United States Department of Agriculture Grant, Aquaculture, 1983-1985, $43,000
National Science Foundation Research Grant, 1986-1989, $148,000
National Science Foundation, Dissertation Research Grant, 1988-1990, $9,850
National Science Foundation Research Grant, 1989-1993, $150,000
National Science Foundation Research Grant, Conservation and Restoration Biology, 1993-1998, $270,000
National Science Foundation Research Grant, Small Grant for Experimental Research, Population Biology, 2000-2001, $50,000

ASSOCIATE EDITORSHIPS: Evolution (1987-1990)
Journal of Heredity (1986-1989)
Progressive Fish Culturist (1986-1989)
Molecular Biology and Evolution (1994-1996)

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

PROFESSIONAL SERVICE:

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

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

BOOK CHAPTERS (since 1995):

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Table 2. Summary of adult progeny recovered from each family and parent, the number of alevins from each parent pooled prior to freshwater rearing, and the percentage of alevins from each parent recovered as adults. See Figure 1 for an explanation of parental cross schemes and family designations.

	Progeny per family									
Fam. No.	A	B	Dam	Progeny	%Survival	Alevins	Sire	Progeny	%Survival	Alevins
1	9	3	1	12	0.84	1424	101	18	1.44	1246
2	9	6	2	15	1.14	1321	102	9	0.60	1499
3	2	1	3	3	0.77	391	103	9	1.44	624
4	7	6	4	13	1.57	828	104	7	1.17	596
5	4	2	5	6	0.80	754	105	9	1.13	797
6	5	2	6	7	0.85	821	106	4	0.51	778
7	0	1	7	1	0.22	450	107	6	0.83	721
8	6	9	8	15	1.48	1017	108	10	1.34	746
9	4	2	9	6	1.61	374	109	7	2.40	291
10	3	6	10	9	1.97	456	110	8	1.48	539
11	0	1	11	1	0.17	597	111	8	1.14	702
12	8	3	12	11	1.21	911	112	4	0.50	805
13	2	11	13	13	2.07	628	113	6	1.22	490
14	4	7	14	11	0.96	1149	114	18	1.40	1287
15	2	4	15	6	0.57	1057	115	6	0.65	929
16	4	7	16	11	1.29	854	116	11	1.12	983
17	4	1	17	5	0.57	877	117	12	1.31	918
18	8	5	18	13	1.65	788	118	6	0.80	747
19	3	2	19	5	0.73	687	119	14	1.25	1124
20	11	5	20	16	1.77	905	120	7	1.50	468
21	3	5	21	8	0.76	1058	121	9	0.77	1171
22	6	0	22	6	0.41	1465	122	5	0.37	1351
23	4	2	23	6	0.55	1096	123	8	0.97	827
24	4	3	24	7	0.95	740	124	5	0.50	1010

Table 2. (continued)

	Progeny per family									
Fam. No.	A	B	Dam	Progeny	%Survival	Alevins	Sire	Progeny	%Survival	Alevins
25	6	3	25	9	0.97	925	125	9	0.97	927
26	3	5	26	8	0.89	904	126	8	0.89	901
27	2	2	27	4	0.43	941	127	6	0.58	1041
28	4	3	28	7	0.62	1125	128	5	0.49	1025
29	2	0	29	2	0.59	341	129	7	1.07	653
30	5	0	30	5	1.29	388	130	0	0.00	75
31	1	6	31	7	0.93	753	131	2	0.28	706
32	1	4	32	5	0.49	1017	132	10	0.94	1064
33	1	1	33	2	0.86	231	133	4	1.14	352
34	3	1	34	4	0.71	567	134	2	0.45	447
Total	259			259		27841		259		27841
Avg.	3.81			7.62	0.93	819		7.62	0.93	819

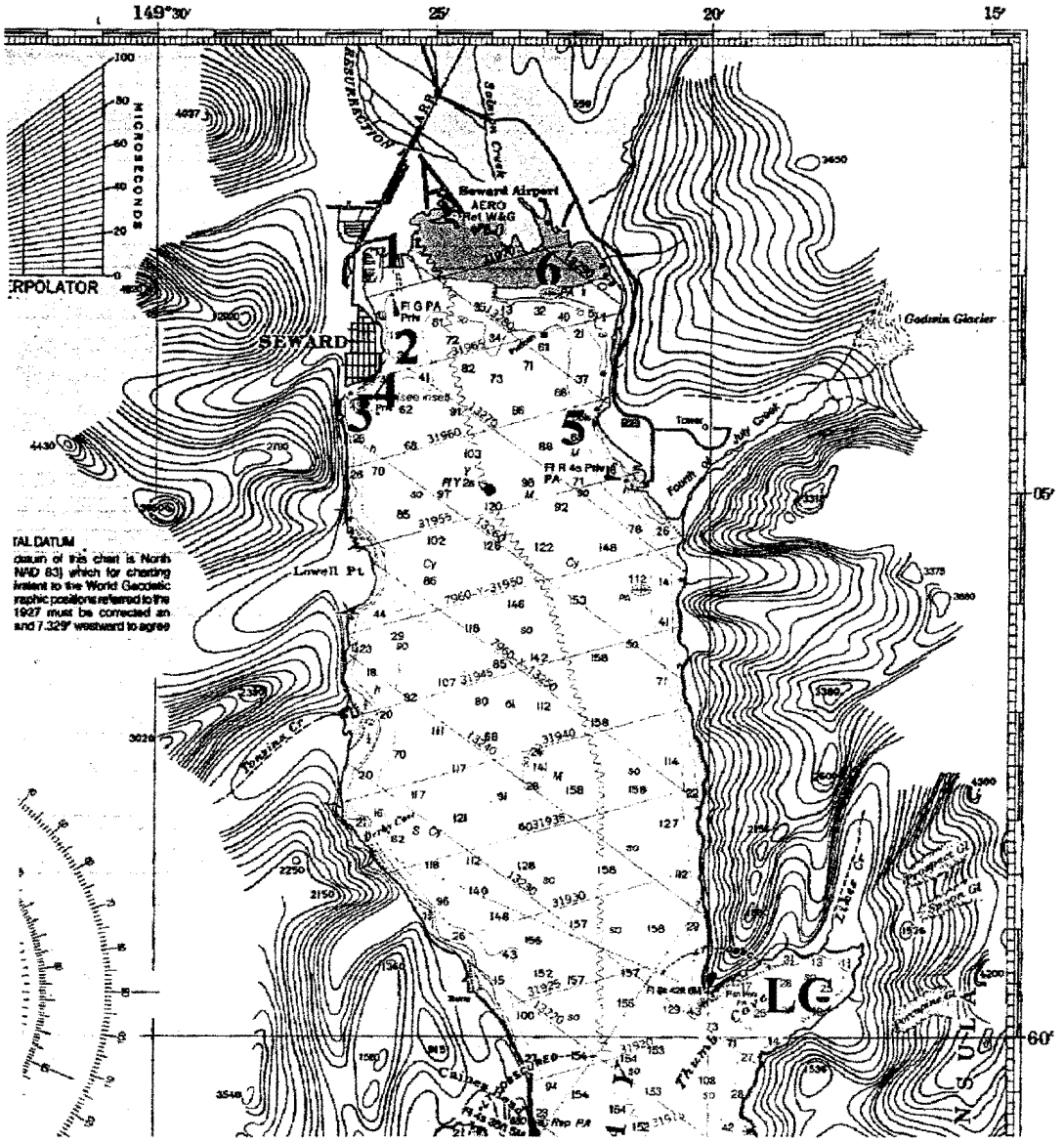
Figure 1. Diagram of our half-sib family experimental design. Numbers across the top represent females, numbers down the side represent males. The squares contain the family designation and the numbers of individuals used to make each family. The number of the dam is the family number in each half-sibling cross. The letter A or B for each family designates the sire. The parents of family 5A are dam 5 and sire 105, 5B are dam 5 and sire 106, 6A dam 6 and sire 105, and 6B are dam 6 and sire 106, and so forth.

FEMALES

MALES

	01	02	03	04	05	06	...	33	34
101	1A 01x101	2A 02x101							
102	1B 01x102	2B 02x102							
103			3A 03x103	4A 04x103					
104			3B 03x104	4B 04x104					
105					5A 05x105	6A 06x105			
106					5B 05x106	6B 06x106			
.							.		
.							.		
.							.		
133								33A 33x133	34A 34x133
134								33B 33x134	34B 34x134

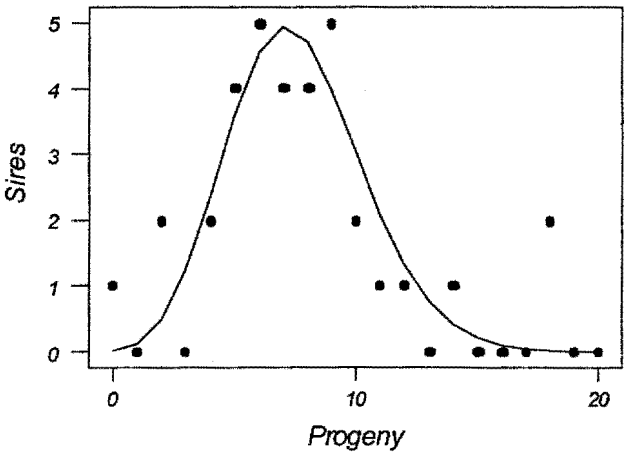
Figure 2. Map of Resurrection Bay. Numbers indicate the location where experimental fish were collected in 2001 as designated below. LC designates Likes Creek, the location where the parents were collected.



Map Number	Location	Number of fish collected
1	Boat Harbor	2
2	Culvert	31
3	Lowell Cr.	26
4	ASLC	182
5	Spring Cr.	4
6	Resurrection R.	10
	Unknown	4
	Total	259

Figure 3. Scatterplot of the number of progeny returning for sires (a) and dams (b). For example, there were two sires that produced 10 returning progeny. The line is the expected Poisson distribution.

(a)



(b)

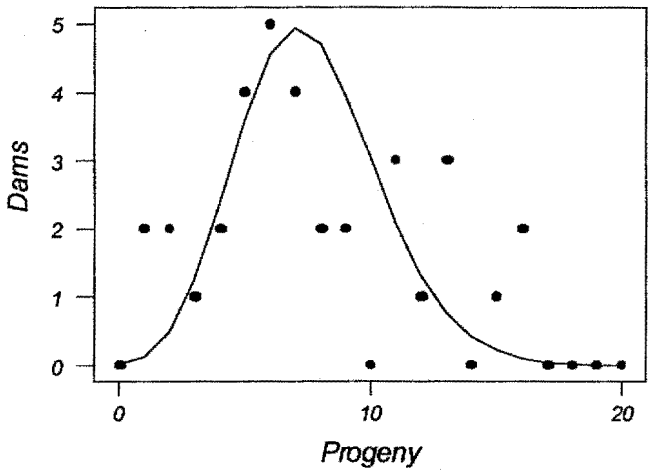
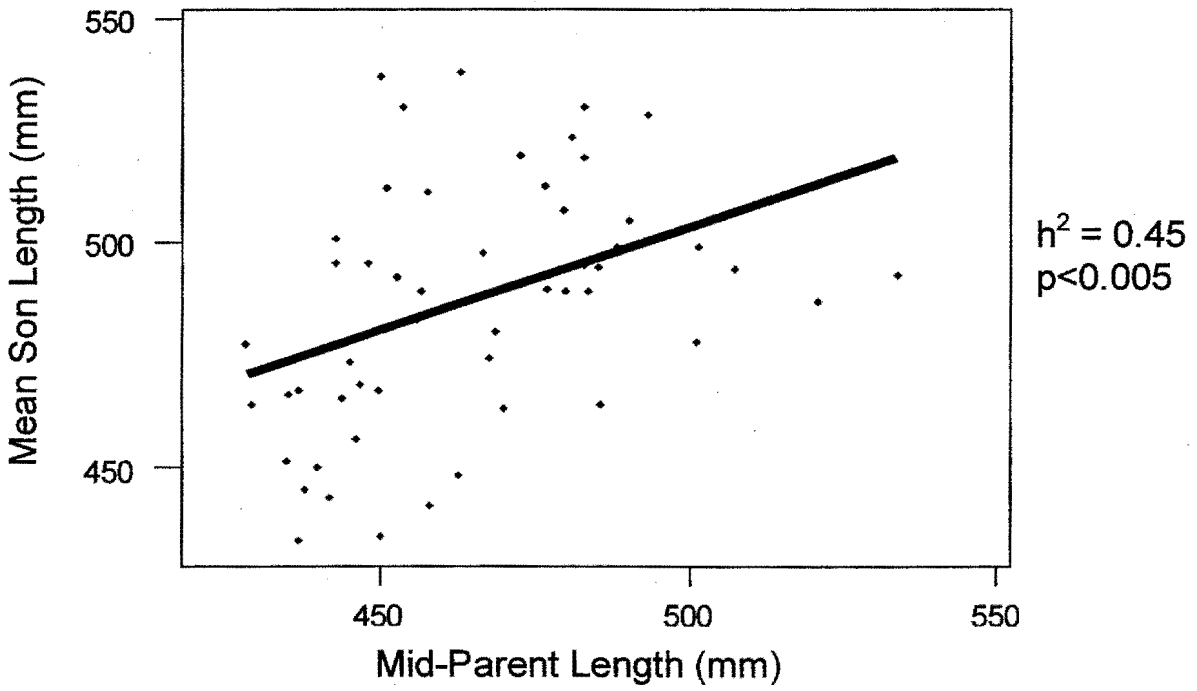


Figure 4. Regression of family means of male progeny length on mid-parent length (a), and female progeny length on mid-parent length (b).

(a)



(b)

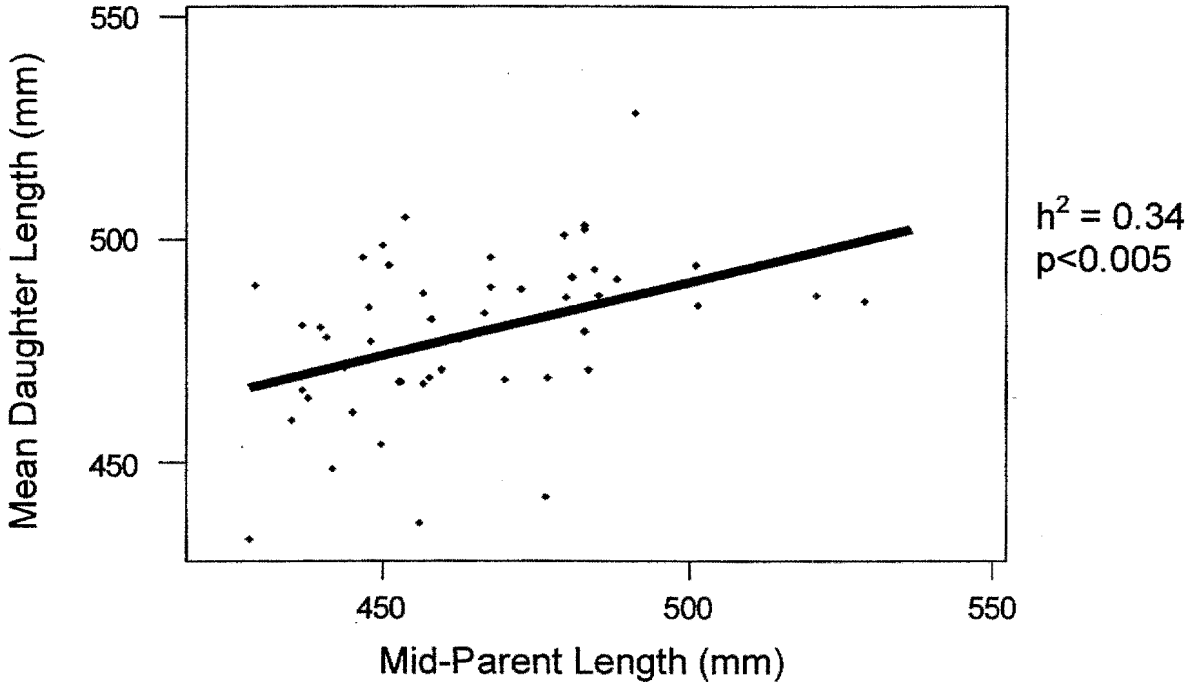


Figure 5. Regression of mean egg weight of progeny on maternal value.

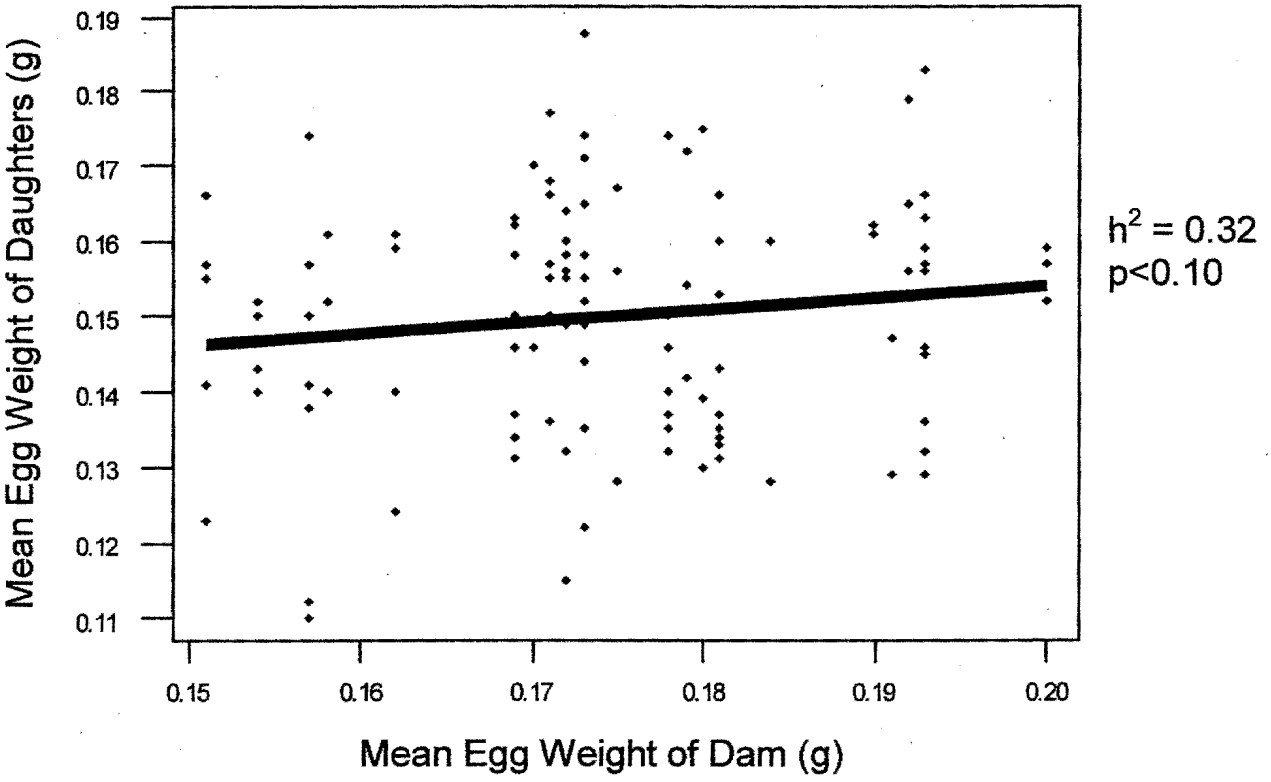
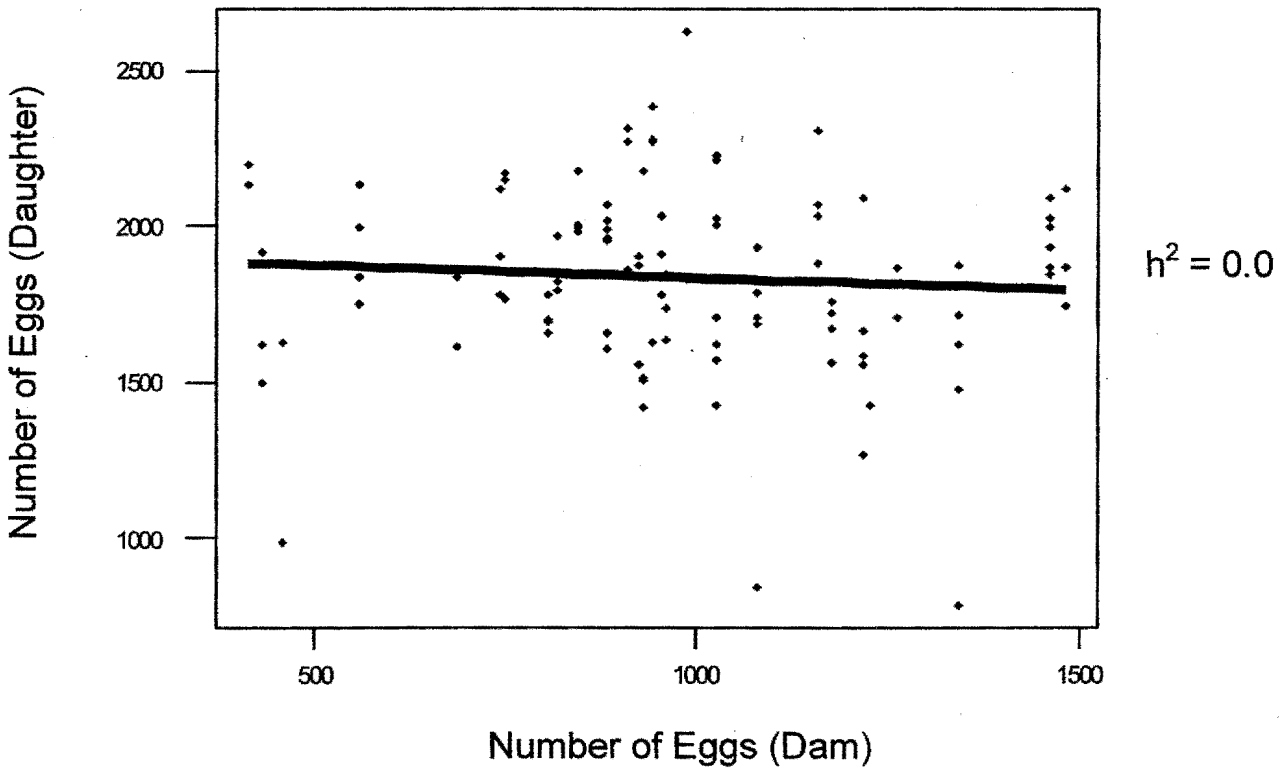


Figure 6. Regression of number of eggs in progeny on egg count in dams.



FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 02	Proposed FY 03
Personnel	$93.7	$51.6
Travel	$1.8	$1.8
Contractual	$0.0	$0.0
Commodities	$29.7	$5.3
Equipment	$0.0	$0.0
Subtotal	$125.2	$58.7
Indirect	$31.8	$16.3
Project Total	$157.0	$75.0
Full-time Equivalents (FTE)		1.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FY 04					
$0.0					

Dollar amounts are shown in thousands of dollars.

Comments:

Indirect costs are based on the University of Montana rate of 43.7% of salaries and wages.

Travel costs are included to attend the Trustee council Annual EVOS Workshop.

Travel costs are included to attend one scientific meeting.

Personnel time includes time for the final report and manuscript preparation.

FY03

Prepared: April, 2002

Project Number: 03190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4A
Non-Trustee
SUMMARY

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 03
F. Allendorf	Project Director		1.0	11.4		11.4
K. Knudsen	Research Specialist		3.0	4.4		13.2
J. Tyburczy	Research Specialist		10.0	2.7		27.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	14.0	18.5	0.0	
					Personnel Total	$51.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 03
					0.0
Missoula to Anchorage for the Annual EVOS Workshop	0.7	1	2	0.1	0.9
					0.0
Travel to a natonal or international meeting to present results	0.6	1	3	0.1	0.9
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.8

FY03

Project Number: 03190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4B
Personnel & Travel
DETAIL

Prepared: April, 2002

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Contractual Costs:	Proposed FY 03
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 03
Description	
Materials and supplies for genetic analysis	1.5
Equipment repair and maintenance	3.3
Communications	0.5
Commodities Total	$5.3

FY03

Prepared: April, 2002

Project Number: 03190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4B
Contractual & Commodities DETAIL

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 03
			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
Hitachi FMBIO 100 Fluorescent Imaging Scanner	1

FY03

Project Number: 03190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4B
Equipment
DETAIL

Prepared: April, 2002

Youth Area Watch

Project Number:	03210
Research Category:	General Restoration
Proposer:	Chugach School District
Lead Trustee Agency:	ADF&G
Cooperating Agency:	DNR
Alaska SeaLife Center:	Yes
Duration:	8th year, eight year project
Cost FY 03:	$90,500
Geographic Area:	Prince William Sound, Resurrection Bay and Lower Cook Inlet including: Cordova Harbor and Orca Inlet, Port San Juan and Evans Island, Tatitlek Narrows, Boulder Bay, Landlocked Bay
Injured Resource/Service:	Harbor seal, mussels, pink salmon, killer whales, subtidal and intertidal communities, subsistence, passive.

ABSTRACT

Youth Area Watch links students in the oil spill impacted area with research and monitoring projects funded through the Trustee Council. The project involves students in the restoration process and provides these individuals the skills to participate in oil spill restoration now and in the future. Youth conduct research identified and delegated by principal investigators who have indicated interest in working with students. Youth Area Watch fosters long-term commitment to the goals set out in the restoration plan and is a positive community investment in that process. Participating communities include: Cordova, Chenega Bay, Nanwalek, Port Graham, Seldovia, Seward, Tatitlek, Valdez, and Whittier.

INTRODUCTION

Since the inception of Youth Area Watch, coordination between research and restoration projects and the communities affected by the oil spill continues to increase. Resulting from many factors, community involvement in the restoration process continues to grow and strengthen; Youth Area Watch is an example of this coordinated effort through the connection that students, the communities and researchers maintain. This relationship creates an environment where youth are encouraged to interpret the data collected and apply the information to the ecosystem.

Students from the oil spill impacted communities are screened and selected for participation in Youth Area Watch at the beginning of each school year. Those showing an interest, academic ability and concern for the oil spill effects on local ecosystems are invited to represent their community as a student of the project. Students work with principal investigators of research projects and community facilitators, as well as independently to achieve the set project objectives.

There are two core research projects funded by the Trustee Council serve as the central link for all Youth Area Watch activities, harbor seal management and biological sampling (02244F) and comprehensive killer whale investigation in Prince William Sound (02012A). These projects continue to work with Youth Area Watch, providing specific research activities for students to conduct and protocol training for those duties. According to protocol, students collect samples and data for the cooperating research and monitoring projects. The samples and data are compiled by a Youth Area Watch project coordinator located in Anchorage and sent on to the principal investigator of the respective projects. Information on the data collected is maintained by the project coordinator for project analysis conducted by the students during group project sessions.

Yearly, students select a local restoration project to conduct. As in previous years, students will begin by completing a planning process during the winter months. Students work with local Community Involvement coordinators to integrate, where possible, their knowledge and expertise.

Students will post project information on their web site (http://www.chugachschools.com/youth_area_watch/index.html) for the public to view. This information will be updated throughout the project year.

NEED FOR THE PROJECT

A. Statement of Problem

Youth Area Watch, identified by the Trustee Council as a general restoration project, is committed to collecting the requisite samples and data for principal investigators of research projects to make informed decisions concerning the ecology of oil spill impacted areas. Research and restoration project PI s identify needed data collection within the oil

spill impacted communities that in many instances can best be facilitated through local involvement of community residents.

Given the finite resources available for project activities, cost containment is necessary. By working with local community youth, information can be collected at a minimal cost. In addition, a greater quantity of data collection from an increased number of sites throughout the year can be accomplished by Youth Area Watch project activities.

As a part of the Memorandum of Agreement and Consent Decree approved by the U.S. District Court, meaningful public participation in the injury and assessment and restoration process is recognized as an important component of the restoration process. While there are a variety of instituted mechanisms for this involvement, Youth Area Watch offers positive examples of meaningful public participation expressed by the oil spill impacted communities through the involvement of community facilitators (Community Involvement \052A) and other community-based projects. The project continues to receive strong support both within the communities that it is conducted as well as among the principal investigators involved with the youth.

B. Rationale/Link to Restoration

Community-based participation in ecosystem restoration is supported by recent research. Graduate field ecology work conducted through SUNY, Stony Brook applied co-management principles to revitalize the Oak Brush Plains Preserve of Long Island, New York (Block, p. 38). In this exercise, a local group familiar with the environment assisted in replanting and management efforts while the researcher actively participated in their experiential activities so that cooperative management strategies could best be achieved. This approach is supported by research techniques used in other ecological restoration projects such as fisheries (Pinkerton) and tropical rain forests (Allen). Furthermore, the link between Native cultures and environmental revitalization has gained significant support as a mechanism for sustaining ecological practices within communities (Rogers-Martinez). Given this research, appropriate extension is made to youth within the restoration region so that the issue of how people will inhabit, utilize and maintain the area in a manner that sustains its integrity can be addressed (Block, p. 38).

Youth Area Watch is based on the commitment by principal investigators of research and restoration projects to involve students in their work. Participating projects are funded by the Trustee Council and have met the guidelines under the settlement. It is through the cooperating projects that Youth Area Watch holds an interest in the immediate restoration activities.

As a long-term goal, project activities are expected to provide the foundation for long-term commitment to restoration of the impacted area to pre-spill levels. Involvement of youth in research and monitoring activities is essential in developing local commitment to the restoration plan adopted by the Trustee Council. Cooperating PI s request precise and detailed sampling/data collection from the youth. Students, in turn, have increased

their knowledge and participation through their connection to the projects. As a result, students are now stakeholders in the restoration process.

C. Location

While Youth Area Watch is administered through the Chugach School District s main office in Anchorage by project coordinators, project activities currently take place in the nine participating communities and in the oil spill impacted area. Local communities include Chenega Bay, Cordova, Port Graham, Nanwalek, Seldovia, Seward, Tatitlek, Valdez and Whittier.

The science teacher (site teacher) within each of the nine communities oversees the day-to-day activities pertaining to the project. Project coordinators travel to the local communities to facilitate in-class integration of project activities and off-shore research in specific locations of importance to the identified research projects. Local projects activities identified by each site occur at or near the community.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

One of the main goals of Youth Area Watch is to facilitate community involvement in the restoration process at a primary and secondary school age. It is through community interest and participation that the project has had a positive impact on students. Ultimately, long-term impacts, to include local ongoing restoration and ecosystem sustainability, are anticipated as youth conduct established research and apply this knowledge to community efforts to understand and preserve species affected by the oil spill. As a result, communities continue to request participation in Youth Area Watch.

Local oil spill impacted communities are involved and participate in Youth Area Watch. The local facilitators of Community Involvement (/052A) continue to work with students and the community Youth Area Watch activities to involve youth. Local facilitators and parents of participating youth assist with various aspects of project activities such as serving as chaperones, providing traditional ecological knowledge and coordinating opportunities for youth to work with local projects. Through this cooperative effort, information is exchanged between projects and across generations.

As a component of the project scope, students at each site are asked to identify a local project that they will conduct. Through these local projects, students gain a greater understanding of what the research and restoration process means at the community level, as well as an interest in meaningful project outcomes.

PROJECT DESIGN

A. Objectives

Selected students from the identified communities participate in research and restoration activities set out by Alaska Department of Fish and Game principal investigators, NOAA staff, University of Alaska, Fairbanks biologists and other project principal investigators working with Youth Area Watch. As part of an area watch project that works with existing research and restoration projects, students collect samples and data that is then provided to the respective projects.

Youth Area Watch objectives include:

1. Research project principal investigators interacting with students.
2. Identifying all research and data collection activities.
3. Updating memoranda of agreement with school districts.
4. Completing site teacher orientation.
5. Conducting school orientations for students on Youth Area Watch.
6. Selecting students to participate in Youth Area Watch.
7. Conducting site teacher training on project activity protocol.
8. Completing the student project orientation and training.
9. Conducting oceanographic data collection.
10. Assisting local hunters/technicians collecting harbor seal biological samples.
11. Conducting a local research/restoration projects.
12. Maintaining a Youth Area Watch web site.
13. Collecting blue mussels for pristane/mussel analysis.
14. Facilitating project follow-up training for site teachers.
15. Conducting killer whale monitoring

B. Methods

The Chugach School District currently works with the Kenai Peninsula Borough School District, Cordova School District and Valdez School District through memoranda of agreement so that the communities of Chenega Bay, Cordova, Nanwalek, Port Graham, Seldovia, Seward, Tatitlek, Valdez and Whittier may participate. School districts will operate under the existing agreements during the eighth project year.

Youth Area Watch project coordinators work with the principal investigators of the cooperating projects to solidify project expectations. Protocol is established for sample/data analysis. In addition, principal investigators commit to working with the students for a period of time during the training and/or data collection stage.

The Chugach School District developed an application and screening tool to select students for participation in the project. Up to 28 students will be selected from the communities to be a part of Youth Area Watch. While the distribution may vary according to the interest and ability of students that apply, it is expected that the

distribution will be as follows: two students from Chenega Bay, three students from Cordova, two students from Port Graham, two students from Nanwalek, two students from Seldovia, six students from Seward, three students from Tatitlek, four students from Valdez, three students from Whittier, and one remote site student.

Youth Area Watch relies on the participation of research projects, sites and program resources to successfully fulfill the project objectives. Throughout the project year, students travel to research vessels, specific project sites near their community and research labs in the process of project activity completion. In the past year, Youth Area Watch was able to coordinate with projects conducting research cruises and work cooperatively on task completion while sharing the costs of vessel hiring. In FY99, FY 00 and FY01, Youth Area Watch coordinators assisted with the coordination of Harbor seal protocol training. It is expected that this type of cooperative effort will continue in the present and coming years.

Students will participate in the core research projects as a group. This will consist of coming together as a group to work on collection protocol, as well as conducting activities for these projects in their community. In addition, students will participate in local projects that pertain to their geographic area. It is during the local project work that students receive a high degree of one-on-one interaction and involvement with principal investigators and their research. Youth Area Watch coordinators will continue to be open to working with other projects funded by the Trustee Council if students can have meaningful participation in these projects.

Ongoing Youth Area Watch research and restoration projects include:

1. Harbor seal management and biological sampling, Project Number 01244F. The project is conducted by Monica Reidel of the Alaska Native Harbor Seal Commission, in cooperation with Vicki Vanek from the Department of Fish and Game in Kodiak. After they have participated in traditional ecological knowledge and protocol training, students will pair up with local technicians/hunters and assist with bio-sampling activities. Students collect different parts of the seal, including the skin, blubber, teeth and stomach. Adherence to sampling protocol is ensured by working directly with the local hunters.

2. Comprehensive Killer Whale Investigation in Prince William Sound, Project Number 01012A. The principal investigator is Craig Matkin. The project tracks the killer whale population in Prince William Sound and Kenai Fjords. Whales are photographed and cataloged based on identifying markings and family relationships. Genetic studies on the whales are also conducted through the use of darting. Students will assist in locating and identifying the whales during day cruises in and around Resurrection Bay.

3. SALMON Project with University of Alaska, Fairbanks. The Principal investigator is Dave Musgrave. The project is preparing to gather oceanographic data for Prince

William Sound. Students will be ground truthing, interviewing elders and learning some basic oceanographic principals through interaction with the scientists.

In addition to the core projects in which Youth Area Watch students participate, each site is selecting a restoration project to work on in their local community. This restoration activity is something that the students select and not necessarily a project that is currently funded by the Trustee Council. However, local projects are closely linked to existing restoration activities.

Coordination between Youth Area Watch and participating research projects remains strong. Where possible, research vessel costs are shared to maximize resources for project activities. In other instances, time and resources are contributed by participating projects to Youth Area Watch.

At this point, the YAW project is in the midst of a metamorphosis. With the trustee council transitioning to the greatly reduced work level of the GEM program, YAW must transition also if it is to remain vital and current. There is a significant degree of uncertainty within the research community as to what exactly the GEM program will look like. In the current climate, we must remain flexible and agile so as to most advantageously position ourselves to participate in long term research and monitoring projects. While we maintain our working understanding with the two previously mentioned projects, (Harbor seal management and biological sampling, Project Number 01244F and Comprehensive Killer Whale Investigation in Prince William Sound, Project Number 01012A), we expect that changes in the working protocol will probably occur. We also fully expect to forge new, long-term partnerships as the GEM program settles into a more steady state.

During this time of funding reductions, student contributions to research projects will become more and more important. The past six years have allowed us to demonstrate that students can cost effectively and reliably collect scientific data for existing projects. As we move toward a program of low cost, high yield monitoring, it is time for our previous work to bear fruit. The many relationships we have built within the research community will serve us well in the next chapter of the Youth Area Watch program.

As funding for the Youth Area Watch project comes from increasingly non-trustee sources, and the pool of Trustee Council projects diminishes, the project will transition to include some non-Trustee Council funded projects. This shift will be necessary in order to meet the goals of the original project proposal and provide a long-term role for middle and high school students in research and restoration projects.

Objectives and Activities

Objective 1: Youth Area Watch students will interact with research project principal investigators, gaining a greater understanding of the affects of the oil spill on the ecosystem.

Activity 1: Principal investigators commit to working with students directly at least once during the project year.[1]

Activity 2: Students work beside principal investigators during field work.

Activity 3: Students independently conduct activities set out by the principal investigators.

Activity 4: Students draw conclusions from their independent work to be reported at the annual Science Review.

Activity 5: Students work with Community Involvement (/052) local facilitators and community members to increase awareness of restoration activities and the status of the ecosystem.

Objective 2: Project coordinators identify all research and data collection activities to be conducted by students at all sites participating in Youth Area Watch.

Activity 1: Project coordinators meet with the principal investigators or delegate project research personnel either by phone or in person to set student activity parameters.

Activity 2: Activity protocol forwarded by the principal investigator or delegate, including sample and data forwarding process, to project coordinators.

Activity 3: Project coordinators finalize project activities for site teacher and students.

Objective 3: Project coordinators update memoranda of agreement with the Valdez School District, Cordova School District, and Kenai Peninsula Borough School District for participation in Youth Area Watch.

Activity 1: Project coordinators contact each school district to evaluate the current agreement and make any necessary changes.

Activity 2: Site teachers are identified by each school district for the participating communities.

Objective 4: Site teachers receive Youth Area Watch project orientation.

[1] It is expected that additional contact occur throughout the project year, though not necessarily in person. Research project PIs receive updates and samples according to the protocol set out for students.

Activity 1: Project coordinators develop an orientation and training session plan in consultation with research project principal investigators.

Activity 2: Project coordinators set a date in the early part of October to conduct orientation. Site teachers are contacted to determine the most appropriate dates.

Activity 3: Project coordinators perform site teacher orientation and training.

Objective 5: Project coordinators conduct school orientations on Youth Area Watch.

Activity 1: Project coordinator travels to each participating school site prior to beginning the project year.

Activity 2: Project coordinators present Youth Area Watch to community science classes. Students that have participated in prior years will be asked to assist.

Activity 3: Students will be informed of the process to apply and participate in Youth Area Watch 03.

Objective 6: Students are selected to participate in Youth Area Watch.

Activity 1: Project coordinator distributes student applications to project sites. All village council/tribal offices (Chenega Bay, Seward, Tatitlek, Valdez, Seldovia, Port Graham, Nanwalek) will receive application forms, as well as the Valdez, Cordova and Kenai Peninsula Borough School Districts for their respective community sites.

Activity 2: Project coordinators convene a committee to review student applications for Youth Area Watch participation. The committee is comprised of Chugach School District staff and may be assisted by participating school district staff and community facilitators (/052).

Activity 3: The review committee examines applications and selects students based on science interests, academic achievement, maturity and site teacher recommendation.

Objective 7: Project coordinators conduct site teacher training on project activity protocol.

Activity 1: Project coordinators set a date in early October for site teacher protocol training and coordination

Activity 2: Project coordinators request the attendance of research project principal investigators at the site teacher orientation.

Activity 3: Project coordinators facilitate a protocol training session to ensure that correct information and research practices are followed by students during the project year.

Objective 8: Project coordinators complete the student project orientation and training. All participating students from the community sites collectively meet at the Seward SeaLife Center for the Youth Area Watch introduction and preliminary activity participation.

Activity 1: Project coordinators work with SeaLife Center staff to determine appropriate dates for orientation.

Activity 2: The project coordinators invite research project principal investigators to participate in the student orientation.

Activity 3: The Youth Area Watch principal investigator coordinates travel arrangements for student participation in the orientation.

Activity 4: In cooperation with the research project principal investigator(s), project coordinators conduct the student orientation to Youth Area Watch goals, responsibilities and activities. Students learn about the ecosystems, and identify ways in which project activities fit into the biotic cycle.

Objective 9: Students conduct oceanographic data collection in their local communities. Site teachers oversee these activities.

Activity 1: Students take twice monthly water temperature and salinity readings at their local site.

Activity 2: A weather station is installed at each site under the supervision of the site teacher. Students measure the wind speed and direction, air temperature and barometric pressure.

Activity 3: Data is collected at each site and transmitted to the project coordinator periodically.

Activity 4: Data is posted on the Youth Area Watch web page by the project coordinators

Objective 10: Students assist local hunters/technicians collecting harbor seal biological samples.

Activity 1: Project coordinators work with principal investigators to coordinate harbor seal biosampling trainings for students and local hunters.

Activity 2: Students analyze an available sample to become acquainted with what is taken and what to look for in a sample. Students collect various parts of the seal for analyzing, which include: skin, blubber, teeth, stomach, skull, liver, heart and kidney. Additionally, measurements and weight are taken for each animal.

Activity 3: Students at local sites participate in taking samples from harvested seals.

Activity 4: Students assist the hunter/technician in preparing the sample for shipment to the harbor seal management principal investigator.

Objective 11: Each community site conducts a local research/restoration project.

Activity 1: The site teachers and project coordinator work with participating students to identify a local research/restoration project.

Activity 2: During the winter months of November through January, students develop a plan for their local restoration project. This is completed with the appropriate assistance and coordination of community facilitators.

Activity 3: Site teachers work with project PIs where appropriate to develop protocol for student participation.

Activity 4: Students conduct local project activities according to protocol and timelines set out by site teachers.

Activity 5: Students provide data/samples to project PIs according to protocol.

Objective 12: Students maintain a Youth Area Watch web site.

Activity 1: Students become Internet proficient and learn to update their web site with current YAW information.[1]

[1] While many students will be familiar with the Internet, some communities recently linked will need training. Additionally, previous Youth Area Watch participants may be proficient at updating the web site, yet new students will need assistance.

Activity 2: Students analyze data collected from the research projects, both past and current.

Activity 3: Using the established reporting format, the data is posted on the web site.

Activity 4: Students update data on research activities as necessary.

Objective 13: Project coordinators facilitate project follow-up training for site teachers in the spring.

Activity 1: Project coordinators set a date convenient for site teachers to conduct a spring follow-up session.

Activity 2: Project coordinators invite principal investigators of participating projects to assist in the follow-up session.

Activity 3: Project coordinators facilitate a follow-up session for site teachers to share information and identify strategies for improving student activities.

Objective 14: Students participate in killer whale identification project.

Activity 1: Principal investigators train students in killer whale identification methods. Students are also informed of project scope and goals.

Activity 2: Students participate in a day cruise with principal investigators to track and identify killer whales in and around Resurrection Bay including: hydrophonic monitoring of whales, photographic recording of individual animals, and darting to obtain blubber and skin samples.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Chugach School District serves as the administrative agency for Youth Area Watch through their contract with the Department of Fish and Game. The school district has shown that it is an effective link to the students and communities impacted by the oil spill. As the administrative entity, the Chugach School District will maintain memoranda of agreement with the Valdez School District, Cordova School District and Kenai Peninsula Borough School District as the school districts that serve the identified communities.

The Chugach School District continues to work with the Chugachmiut and Chugach Regional Resources Commission to coordinate and exchange community information with

regard to regional restoration activities. As the coordinating agency for community involvement, Chugach Regional Resources Commission works with the youth through the local facilitators so that students may participate in research and restoration activities.

Since the inception of the project, significant contributions have been made and are identified in the budget. Contractors have provided discounted services, as in the case of vessel hiring. Expensive equipment used in project activities are offered by coordinating agencies. Cooperating agencies provide technical assistance, student supervision and support for project activities. The Chugach School District relies heavily on the commitment and participation of cooperating school districts involved in the project. Site teachers dedicate their time to the goals of Youth Area Watch, serving as an in-kind contribution.

In keeping with its commitment to secure additional support for Youth Area Watch activities, Chugach School District has sought and received additional funding from the SALMON Project. On a local level, Whittier wrote received additional funding from ASTF for their ongoing Kittiwake and Tatitlek has submitted a proposal to ADFG, Division of Wildlife Conservation, to put together a curriculum that is modeled after the *Alaska Wildlife Curriculum*. In addition, the district will continue to commit general funds to the project and will seek out alternative funding sources as the program transitions away from Trustee Council support. The success of the project activities motivates the Chugach School District to commit additional funding through diversified means so that the youth are equipped to continue their restoration and ecological management activities as an integral component of their education.

As Trustee Council responsibility for restoration activities decreases due to the decline of settlement funds, the project coordinators continue to pursue opportunities where Youth Area Watch project activities can transition to a more stable position. Toward this end, the school district maintains cooperative relationships with entities engaged in ecological management and restorative projects, independent of Trustee Council funding. Particularly with respect to local restoration projects where other agencies, organizations and private groups are involved, the Youth Area Watch project scope is expanding so that a smooth shift of focus can occur. By building and maintaining these cooperative working relationships, resource exchanges can be enhanced to augment other district resources.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001 - September 30, 2002)

July 1 - August 1, 2002:	Confirm research & data collection activities
August 15 - 31, 2002:	Site teacher orientation
September 1 - 18, 2002:	School site orientations
September 15 - 30, 2002:	Students selected for participation
October 1 - 31, 2002:	Site teacher training on protocol
October 1 - 31, 2002:	Student orientation and training
November 1 - 7, 2002:	Sites prepare weather stations
November 1 - July 30, 2003:	Students participate in research activities
November 1 - May 31, 2003:	Students maintain web site
March 1, 2003:	Project Coordinator sends data to PIs
May 1 - 15, 2003:	Site teacher follow-up training
June 1, 2003:	Project Coordinator sends data to PIs
June 1, 2003:	Students complete project reports for FY 01

Ongoing Activities:

October 02 - September 03:	Student weather station monitoring (daily)
October 02 - September 03:	Students collect harbor seal samples with local hunters
October 02 - September 03:	Students conduct local project activities
October 02 - September 03:	Students assist in documenting local TEK
October 02 - September 03:	PIs interact and exchange information with students

B. Project Milestones and Endpoints

October 17, 2002:	Students selected for participation
October 30, 2002:	Protocol training complete
November 1, 2002:	Students conduct project activities
March 1, 2003:	Data/samples to PIs
June 1, 2003:	Data/samples to PIs and reports complete

C. Completion Date

Objectives identified in the project design will continue to serve as guidelines for community involvement within the civil settlement throughout the life of the restoration effort. It is expected that the Youth Area Watch project will continue beyond the seven years of Trustee Council Funding.

PUBLICATIONS AND REPORTS

Youth Area Watch was featured in The Science Teacher, Living on Earth and Alaska Magazine. Copies of these articles have been forwarded to the Restoration Office. In addition, the project has been featured on NPR. The project will also be featured during state-wide broadcasts on the Alaska Rural Communication System during programs on standards in education.

The Youth Area Watch Web site http://www.chugachschools.com/youth_area_watch/index.html continues to be an important venue for students to both receive and distribute information. Each project that students work with has a student generated page of explanation and photographs. There is also space for students reports on their own local restoration projects as well as meteorological and oceanographic data. The site is utilized by students during training at the beginning of the year as they attempt to learn about each of the projects with which they will participate work over the course of the year. FY 02 will be the second year that all of the community schools involved in the project are online. This connectivity has been a strong benefit in allowing the project coordinator to communicate directly and regularly with students at each school. This increase in communication and coordination enables more flexible and responsive action by project coordinators and school site participants.

PROFESSIONAL CONFERENCES

Chugach School District received the 2001 Malcolm Baldrige National Quality Award for Excellence in Education and YAW was a showcased program. Due to receiving this honor, the project will be highlighted through several National and Regional Quality Conferences.

Youth Area Watch was also highlighted in a presentation by Phillip Marshall at the American Geophysical Union's Ocean Sciences Conference in Honolulu on Feb 11, 2002. Phil Marshall works with Dave Musgrave on the outreach portion of the SALMON Project at the University of Alaska, Fairbakns.

NORMAL AGENCY MANAGEMENT

This section is not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Youth Area Watch relies on the participation of Trustee Council funded projects to maintain coordination with restoration efforts. Through the commitment of principal investigators, youth conduct research activities with and for participating projects. Students work independently, as well as beside researchers during the project year. Costs

are shared between projects to allow for increased research vessel time and one-on-one interaction between students and the researchers.

Various people contribute the necessary technical assistance and resources. Local community facilitators from Community Involvement (/052) work with students and serve as chaperones for project activities. School districts provide teacher time and facility space for activities.

A variety of funding sources and project contributions ensure the success of the project. The school district commits over $164,385 in FY 02 to the project. School districts contribute $54,700 in teacher time and $24,050 in facility resources. Communities and school districts contribute $12,600 in lodging. Equipment in-kind contributions total $7,200. Participating principal investigators from research projects contribute $9,140 worth of their time.

PROPOSED PRINCIPAL INVESTIGATOR

Richard DeLorenzo
Chugach School District
9312 Vanguard Drive, Suite 100
Anchorage, AK 99507
Office: (907) 522-7400
Fax: (907) 522-3399

PRINCIPAL INVESTIGATOR

Richard DeLorenzo is the superintendent of the Chugach School District. He maintains administrative authority over all day-to-day functions of the district s activities. Mr. DeLorenzo has extensive experience administering grants, adhering to project objectives and managing budgets. Mr. DeLorenzo will be directly responsible for budget expenditures, negotiating contracts and working with the participating school districts to ensure effective project management.

OTHER KEY PERSONNEL

Project Coordinator: Billijo Mils is a certified K-8 teacher with several years of experience teaching science in Rural Alaska. Mrs. Mill s responsibilities include:

1. working with principal investigators of research projects to ensure proper protocol.
2. coordinating student selection process.
3. coordinating all orientation and training sessions with site teachers and staff.

4. ensuring that site teachers and students have proper supplies.
5. completing site visits.
6. monitoring project activity of students.
7. providing support to site teachers.
8. coordinating principal investigator-student interaction through research.
9. transmitting data to principal investigators.
10. completing necessary project reports and/or materials for publication.
11. continuing to seek additional funding sources for project activities beyond the life of the Trustee Council.

LITERATURE CITED

Allen, W.H. Biocultural Restoration of a Tropical Forest. Bioscience. 38(3): 156-161, 1988.

Block, Mindy. Pine Barrens - Upland Associations. Notes, 1997.

Pinkerton, E. Cooperative Management of Local Fisheries: New Directions for Improved Management and Community Development. Vancouver: University of British Columbia Press, 1989.

Rogers-Martinez. The Sinky One Intertribal Park Project. Restoration & Management Notes, 1992.

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2002	Proposed FY 2003
Personnel	$50.0	$50.4
Travel	$27.1	$20.1
Contractual	$5.0	$5.0
Commodities	$5.1	$3.0
Equipment	$0.0	$0.0
Subtotal	$87.2	$78.5
Indirect	$12.0	$12.0
Project Total	$99.2	$90.5
Full-time Equivalents (FTE)	1.0	1.0
Other Resources	$277.5	$248.0

LONG RANGE FUNDING REQUIREMENTS					
			Estimated FY 2003		
			$80.0		

Dollar amounts are shown in thousands of dollars.

Comments:

Personnel - The project coordinator is responsible for the duties of monitoring and facilitating the project activities at all sites.

Travel - Students travel by both charter (especially when conducting field work, such as mussel collection with the scientist). Student travel to Anchorage for the Science Review is a project contribution. Only transport expenses are requested through the budget.

Contractual - The hiring of boats at a rate of $1,000 per day (5 days) will occur in conjunction with research on surf scoters and kittiwakes.

Commodities - Each major classroom site is allocated $333 for project supplies. Supplies from previous years will be used as well.

Indirect - School district administrative costs are calculated at 15%. This accounts for the direct oversight of fiscal reporting and associated support at the administrative offices in Anchorage. In addition, these costs offset the expenses that sites incure including telephone, fax, postage and other general support.

Other resources - Teacher time ($52,100); participating PIs ($7,940); Youth Area Watch PI ($13,025); Facility space ($22,340); equipment ($6,200); travel, facilities, lodging and additional adminstrative support ($146,385).

FY03

Project Number: 03210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/02

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2001
	Project Coordinator	The coordinator facilitates training for both site teachers and participating students; coordinates youth interaction with research PIs; schedules project travel; works with local sites to develop community restoration projects; works with local facilitators and site teachers to ensure the exchange of information; monitors the completion of project activities; solicits additional funding for project enhancement.	12.0	4.20		50.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	12.0	4.2	0.0	
					Personnel Total	$50.4

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2001
	Charter and /or commerical trips for students to training/research.	0.5	28			14.0
	Project coordinator from Anchorage to Cordova.	0.3	2			0.6
	Project coordinator from Anchorage to Nanwalek.	0.2	2			0.4
	Project coordinator from Anchorage to Port Graham.	0.2	2			0.4
	Project coordinator from Anchorage to Seward.	0.1	3			0.3
	Project coordinator from Anchorage to Tatitlek.	1.0	2			2.0
	Project coordinator from Anchorage to Valdez.	0.2	2			0.4
	Research PI travel to training sites.	0.5	4			2.0
						0.0
						0.0
						0.0
					Travel Total	$20.1

FY03

Project Number: 03210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/02

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2001
The hiring of boats at a rate of $1,000 per day (5 days) will occur in conjunction with research on killer whales and kittiwakes.	5.0
Contractual Total	$5.0

Commodities Costs:	Proposed
Description	FY 2001
Supplies for each classroom site are necessary. This will replace consumable commodities used during the project year. Commodities include chemicals, sampling containers (beakers, plastic bags), water resistent note pads and office supplies associated with the project. Each major classroom site (8) will require $375 for supplies, totaling $3,000.	3.0
Commodities Total	$3.0

FY03

Prepared: 4/02

Project Number: 03210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4B
Contractual &
Commodities
DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

New Equipment Purchases:			
Description	Number of Units	Unit Price	Proposed FY 2001
			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	
Weather stations have been purchased in previous years. They will continue to be used in FY 02.	5	
Computers and peripherals are used at each site to synthesize and post information on the Youth Area Watch web site.	8	
Video equipment is used to document activities for future review and use.	1	
A GPS unit is used during various project activities.	1	

FY03

Project Number: 03210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4B
Equipment
DETAIL

Prepared: 4/02

The Exxon Valdez Trustee Hydrocarbon Database and Interpretation Service

Project Number:	03290
Restoration Category:	Service Project
Proposer:	Bonita D. Nelson and Jeffrey W. Short NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stan Rice
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
Duration:	Service Ongoing
Cost FY 03:	22,700
Cost FY 04:	22,700
Geographic Area:	Not Applicable
Injured Resource/Service:	Maintenance of the Trustee hydrocarbon database, archival of environmental samples, interpretative services

ABSTRACT

This project is an on-going service project providing data and sample archiving services for all samples collected for hydrocarbon analysis in support of *Exxon Valdez* Oil Spill Trustee Council projects. These data represent samples collected since the oil spill in 1989 to the present and include environmental and laboratory Response (National Resource Damage Assessment - NRDA) and Restoration data. Additionally, we provide interpretive services for the hydrocarbon analysis, provide public releases of the hydrocarbon and pristane databases and store and maintain the hydrocarbon sample archives.

INTRODUCTION

The Auke Bay Laboratory provides data and sample archiving services for all samples collected for hydrocarbon analysis in support of *Exxon Valdez* Trustee Council projects. These data represent samples collected since the oil spill in 1989 to the present and include environmental and laboratory Response and Restoration data . Additionally, we provide interpretive services for the hydrocarbon analyses. Currently, the database contains results of the hydrocarbon analysis of more than 16,000 samples and collection information from more than 51,000 sediments, tissues and water samples. The primary purpose of this project is to maintain the integrity of the database, incorporate new data and continue hydrocarbon data interpretive services. This year we are proposing to continue the this task. The second purpose is to make the results of the hydrocarbon analyses (including pristane analysis) available to principal investigators, resources managers and to the public, including FOIA requests. This service is expected to have activity as long as hydrocarbon data are collected. The third purpose of this project is to maintain the integrity of archived samples in freezers many of which have not yet been analyzed for hydrocarbons.

The Trustee hydrocarbon database not only contains sample collection and hydrocarbon analyses information, but also has data concerning sample shipping and location information as well as lists of other database identifiers (such as species and location codes). A public version of this database containing the sample collection and environmental hydrocarbon sample analyses was released in 1996 (*Exxon Valdez* Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995 -EVTHD) . Updating the database and the public release is an on-going program. Samples from pink salmon projects (01454, 01456) , coal/oil seep project (01599) , and SCAT (02543) will be added in FY2003.

The hydrocarbon interpretive service is designed specifically for investigators and managers. This includes: (1) identification of the probable sources of the hydrocarbons observed in the samples, (2) evaluation of new hydrocarbon data for evidence of systematic bias, (3) hydrocarbon data editing according to consistent criteria. Recently interpretation has grown to include identification of potential hydrocarbon sources (e.g. coal) for the background hydrocarbon signal in PWS. This is a continuation of project 01290 and previously funded under TS#1, 93090, 94290, 95290, 96290 , 97290, 98290, 99290 and 00290.

NEED FOR THE PROJECT

A. Statement of Problem

The Trustee hydrocarbon database is a dynamic structure which requires updating and maintenance. Currently, the database contains an inventory of the Trustee hydrocarbon sample collection and provides for retrieval of hydrocarbon analyses by principal investigators and managers. This project is designed to provide easy access to the Trustee hydrocarbon database and ensure the accuracy of the data. The volume of data contained in the database suggests that other users will benefit from access, particularly as more data is added and long term monitoring projects come on line via the GEM management plan.

B. Rationale/Link to Restoration

Archiving of the Trustee hydrocarbon sample data will ensure that these data are available to principal investigators, government agencies, and the interested public on a timely basis. The database allows direct comparison of restoration and NRDA data, and contains an inventory of hydrocarbon samples and information about their collection, storage and analysis. The continued use of the methods for hydrocarbon data evaluation and interpretation developed for the *Exxon Valdez* NRDA samples will insure direct comparability of future with previous samples. This will substantially increase the probability that temporal trends in these data will be detected when actually present. Principal investigators will be able to get assistance with chemical interpretation of hydrocarbon results from their project or other projects that relate to their project when needed. Since most investigators are not chemists, this type of assistance is usually required for proper interpretation of hydrocarbon results. Application of the petroleum weathering model developed under this project (Short and Heintz, 1997) has been used to compare coal samples and Katalla seep with Prince William Sound background samples, and has identified coal as the a biologically non-available source, in contrast to researchers sponsored by EXXON, who have identified the source as Katalla seep oil.

C. Location

While this project resides at the Auke Bay Laboratory, Juneau , Alaska, the service provided serves the entire spill area. The public release of the database is available on the internet.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement includes and extends beyond the spill area. Science centers, public schools, native corporations, universities, environmental organizations and other concerned groups will have access to the database with guidelines on how the data can be used.

PROJECT DESIGN

A. Objectives

1. Continue maintenance of the Trustee hydrocarbon database by updating the database with new information and continue the sample archiving procedures developed under NRDA.

2. Continue interpretation of hydrocarbon data, including new data produced for principal investigators and resources managers and for syntheses products as needed.

3. Maintain Pristane database for Trustee funded project.

4. Provide public release of the data via CD-Rom and on the internet.

5. Extend the use of the petroleum weathering model by using it as a tool for identifying potential sources of petroleum that contribute to the background signal identified in Constantine Harbor.

6. Implement a long-term archiving plan for the Trustee hydrocarbon database PWSOIL and provide information for FOIA requests.

B. Methods

Data associated with hydrocarbon samples are added to the existing Trustee hydrocarbon database. The samples and data currently reside at the Auke Bay Laboratory of NMFS. Incoming samples are inventoried and stored in laboratory freezers, and sample collection information is entered into the database. Samples are released for hydrocarbon analysis after ABL receives a written request from the responsible project leader. Hydrocarbon data, reported by the analytical laboratory, are matched to the sample collection information and all the data are checked for errors and electronic copies are sent to principal investigators or other requesters. An updated version of the public release of the database will be developed in Visual Basic software using *Exxon Valdez* Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995 (EVTHD) as a template and will include data collected from Trustee funded projects including sampling and analytical quality control procedures .The product is updated annually.

The petroleum weathering model developed under this project has been used to reject the hypothesis that the hydrocarbons comprising the background PAH source are derived from the Katalla oil seep. Analysis of sediment and mussel samples collected from locations near the Katalla oil seep as well as coal deposits east of PWS supports the conclusion that PAH derived from coal characterize the background hydrocarbon signal (Short et al., 1999). We will continue to use this information and analyses when necessary to demonstrate the generality of the weathering model with other oil sources and the absence of a similar weathering process in coal.

The Auke Bay Laboratory will continue to keep all environmental samples collected for hydrocarbon analysis under all phases of the oil spill process frozen in locked storage.

The pristane database will be maintained in ACCESS software. Information from samples collected under Trustee project 195 will be combined with data from the Trustee hydrocarbon database where applicable to provide a complete data set of pristane related information.

C. Contracts and Other Agency Assistance

No contracts are anticipated

SCHEDULE

A. Measurable Project Tasks for FY02

Samples will be stored and data analyzed throughout fiscal year. Release of the updated public version of the database software: Exxon Valdez Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995.

B. Project Milestones and Endpoints

April 15: Annual report in the form of updated release of hydrocarbon data software.

The primary objective of this project is to provide an ongoing service, consequently there are few set milestone dates or endpoints.

C. Completion Date

This is an ongoing service project to be completed when samples are no longer collected for hydrocarbon analysis and the Trustee Council terminates this service.

PUBLICATIONS AND REPORTS

The public release of the hydrocarbon database for projects funded in FY00 will be available on or about 15 April, 2002 in the form of the annual report .Data are submitted as soon as they are available from the chemistry laboratory.

PROFESSIONAL CONFERENCES

One meeting is required, an annual Quality Assurance Control meeting attended by ABL's Senior Analytical Chemist. The results of an international calibration exercise by participant is reviewed

for the integrity and credibility of chemical analyses. This meeting usually occurs in the Washington D.C. area, and is sponsored by National Institute of Standards and Technology (NIST).

NORMAL AGENCY MANAGEMENT

NOAA/NMFS has statutory stewardship for most living marine resources; however, if the oil spill had not occurred, NOAA would not be conducting this project. NOAA/NMFS proposes to make a significant contribution (as stated in the proposed budget) to the operation of this project, making it truly cooperative.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is a continuation of NRDA database and chemical interpretation work.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This ongoing service project has no significant project design or schedule differences from the project funded in FY02, it is a continuation of the same service. The project has been downsized, as the input volume has decreased somewhat, although interpretation services and the work load due to FOIA requests will probably increase.

PROPOSED PRINCIPAL INVESTIGATOR

Bonita D. Nelson
NMFS Auke Bay Laboratory
11305 Glacier Highway
Juneau, Alaska 99801
907-789-6071
907-789-6094
bonita.nelson@noaa.gov

PRINCIPAL INVESTIGATORS

Bonita D. Nelson

Education:
BS 1979, University of Illinois, Urbana (Ecology, Ethology , Evolution)
MS 1986, University of Alaska-Juneau (Fisheries)

Other Experience:
Database manager of the Trustee hydrocarbon data for 7 years. Responsibilities include: supervision of data entry of sample and analytical data; processing and dissemination of data after interpretation by chemist; database management including data retrieval for production of

the public versions of the database. Nelson has designed and managed databases as well as analyzed data for the radio telemetry program at the Auke Bay Laboratory for 15 years.

Jeffrey W. Short

Education:
BS, 1972 University of California, Riverside (Biochemisty & Philosophy)
MS, 1982, University of California, Santa Cruz (Physical Chemistry)

Other Experience:
1989 - Present: Established and managed the hydrocarbon analysis facility at ABL to analyze hydrocarbon samples generated by the *Exxon Valdez* NRDA effort (about 20% of these samples were analyzed at ABL).
1989 - 1992 : Principal Investigator, Exxon Valdez project Air/Water #3; Determination of petroleum hydrocarbons in seawater by direct chemical analysis and through the use of caged mussels deployed along the path of the oil spill.
1991 - 1992 : Principal Investigator, Exxon Valdez project Subtitle #8 ; Development of computer-based statistical methods for global examination of sediment and mussel hydrocarbon data produced for the Exxon Valdez NRDA effort for systematic bias, and for identification of probable sources of hydrocarbons. In addition, this project produced both hard-copy and computer display maps of all the sediment and mussel hydrocarbon data.

LITERATURE CITED

Short, J. W., K.A. Kvenvolden, P.R. Carlson, F. D. Hostettler, R. J. Rosenbauer, & B. A. Wright, 1999. Natural Hydrocarbon Background in Benthic Sediments of Prince Willaim Sound, Alaska: Oil vs Coal. Environ. Sci. Technol. 33:34-42.

Short, J. W., and R. A. Heintz. 1997. Identification of *Exxon Valdez* oil in sediments and tissues from Prince William Sound and the Northwestern Gulf of Alaska based on a PAH weathering model. Environ. Sci. Technol. 31:2375-2384.

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 02	Proposed FY 03
Personnel		$13.0
Travel		$2.3
Contractual		$2.0
Commodities		$3.0
Equipment		$0.0
Subtotal	$0.0	$20.3
General Administration		$2.1
Project Total	$0.0	$22.4
Full-time Equivalents (FTE)		0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 04					

Dollar amounts are shown in thousands of dollars.

Comments:
This project is ongoing to support the maintenance of the samples collected for hydrocarbon analyses sorting and archiving of samples and interpretation of chemical data as well as public releases of the data and FOIA requests.

NOAA Contribution: Research Chemist, Jeff Short .5 mo. @9.9 mo, Analytical Chemist, Marie Larsen .5 mo @7.0 /mo and Jacek Maselko .5 mo @ 2.5K forfor a total contribution of 11K.

FY03

Prepared: 4/4/02

Project Number: 03290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 03
Bonita Nelson	Fishery Research Biologist	Gs-11	2.0	6.5		13.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	6.5	0.0	
					Personnel Total	$13.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 03
Trip to Anchorage to Trustee Workshop	0.4	1	3	0.2	1.0
					0.0
Quality Control meeting for analytical chemist	1.0	1	3	0.2	1.6
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.6

FY03

Prepared:4/4/01

Project Number: 03290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Contractual Costs:	Proposed FY 03
Description	
Data error checking for periodic quality control	2.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.0

Commodities Costs:	Proposed FY 03
Description	
Conputer software upgrades and supplies	1.0
Disposal of samples	2.0
Commodities Total	$3.0

FY03

Prepared:4/4/02

Project Number: 03290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3B
Contractual & Commodities DETAIL

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 03
			0.0
			0.0
			0.0
			0.0
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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
Computer		
Freezers		

FY03

Prepared:4/2/02

Project Number: 03290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3B
Equipment
DETAIL

Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem

Project Number:	03340
Restoration Category:	Monitoring
Proposer:	University of Alaska Fairbanks
Lead Trustee Agency:	ADFG
Cooperating Agencies:	none
Alaska SeaLife Center:	no
Duration:	October 2002–August 2004
Cost FY 03:	$47,300
Cost FY 04:	$30,000
Geographic Area:	Resurrection Bay/Gulf of Alaska shelf
Injured Resource/Service:	All organisms and services

ABSTRACT

Interannual variations in temperature and salinity on the northern Gulf of Alaska (GOA) shelf reflect environmental changes that affect this marine ecosystem. Quantifying and understanding this variability requires long time series such as the 32-year record at hydrographic station GAK 1 near Seward. This project continues this time series, quantifies the synoptic, seasonal, and interannual variability and seeks to understand the reasons for this variability. It will also begin to examine interannual variations in near-surface stratification and the timing of the spring bloom on the inner GOA shelf. The data will be used to predict the baroclinic component of the mass and freshwater transport variability in the Alaska Coastal Current in the northern GOA.

INTRODUCTION

This proposal seeks support to continue monitoring temperature and salinity on the Gulf of Alaska shelf at the GAK 1 hydrographic station. Such measurements have been supported continuously by EVOS since November 1997. That support has maintained the roughly 32-year (1970 – present) time series of conductivity-temperature versus depth (CTD) data collected at GAK 1. With EVOS support we have continued to make monthly CTD measurements along with hourly measurements of temperature and conductivity at six depths using instruments on a mooring at GAK 1. GAK 1 is the only station in the northern North Pacific that routinely measures salinity and it is the only station that routinely collects temperature and salinity data throughout the water column. Weingartner (1999, 2000, and 2001) gives a more complete description and analysis of the data collected thus far. Our principal findings to date are:

1. The anomalous summer 1997 warming (amounting to 1–2°C above normal) was confined to the upper 40 m of the ocean. That warming was mainly a result of anomalously clear skies and low winds during the summer of 1997.
2. The abnormally large El Niño-related winter 1998 warming (~2°C) occurred throughout the entire 250 m depth of the shelf. Water temperatures returned to near normal during the following summer. This was also accompanied by anomalously large El Niño-related winter 1998 freshening (amounting to a vertically averaged salinity decrease of 0.15 psu) over the upper 200 m of the shelf. Freshening ceased in May and, below 200 m, was replaced with the saltiest waters ever observed at this location. These high salinity waters are enriched with nutrients and potentially available to phytoplankton in the surface layers the following winter.
3. Variations in freshwater forcing and the baroclinic transport of freshwater are large on seasonal, interannual, and interdecadal time scales. For example, freshwater transport within the Alaska Coastal Current increases fivefold between spring and fall and in spring 1998 (the 1997–98 El Niño) the freshwater transport was twice that of spring 1999 (the 1998–99 La Nina).
4. A first order description of seasonal variations in freshwater transport of the Alaska Coastal Current suggests that these variations are accounted for by the annual cycles of: 1) coastal discharge and 2) the Ekman onshore transport of relatively fresh surface waters. Their sum mimics the annual cycle in the baroclinic component of the freshwater transport within the Alaska Coastal Current. Most of the freshwater transport occurs within the upper 75 m of the water column and within 35 km of the coast.
5. Several factors appear responsible for the anomalously fresh shelf waters and large transport observed during the 1998 winter. First, the coastal Alaska discharge was above average in fall 1997 and winter 1998. Second, Pacific Northwest river discharge (as represented by the Fraser River in British Columbia and the Columbia River in Oregon) was above average during summer and fall 1997. Third, there was anomalously strong coastal downwelling around the coastal Northeast Pacific Ocean in fall 1997 and winter 1998. These factors cooperated to lower shelf salinities and enhance the transport. The high runoff diluted inner shelf waters and strengthened the cross-shelf density gradients. These gradients, in conjunction with the strong cyclonic wind stress, enhanced the alongshore extent and strength of the coastal current. The anomalously strong downwelling would also have enhanced trapping of freshwater against the coast and augmented coastal freshening by increasing the

onshore transport of low-salinity surface waters. Our results suggest that the simultaneous occurrence of all of these anomalies is unusual because 1997–98 was the only year since 1970 (the start of the GAK 1 record) in which all of these anomalies coincided with one another.

6. We have developed a predictive relationship between GAK 1 dynamic height (0/250 db) and the geostrophic baroclinic component of mass and freshwater transport computed from the cross-shore density field in the Alaska Coastal Current. This suggests that the GAK 1 data can be used as a low-cost proxy indicator for these variables. We are expanding this relationship using a number of atmospheric variables in an attempt to hindcast transport variations back to 1950 and possibly earlier.
7. Time series of coastal discharge estimates based on Royer's (1982) method and coastal salinity data all suggest a decrease in freshwater discharge into the northern Gulf of Alaska from the late 1950s through the mid-1970s. Discharge increased from the mid-70s through the early-80s, coincident with the regime shift of the 1970s and with the Pacific Decadal Oscillation (PDO) (Mantua, 1997; Overland et al., 1999). These findings add to other suggestions of a freshening across the North Pacific Ocean basin since the 1970s (Wong et al., 1999).
8. We find that the difference in sea level pressure between Seward and Ketchikan correlates well with Royer's freshwater discharge anomaly time series (after applying a 36-month low-pass filter to both data sets). This allows us to construct a proxy discharge time series back to 1899 using Trenberth's sea level pressure data set (Trenberth and Paolino, 1980).
9. Monthly anomalies in the PDO index are coherent with Royer's monthly discharge anomalies at periods of 2 – 4 years suggesting a possible relationship to El Niño events.
10. Monthly sea level anomalies at Seward Alaska are significantly correlated with monthly anomalies of the 0/250db dynamic height suggesting that sea level could serve as a proxy for shelf salinity variations here and perhaps elsewhere in the Gulf of Alaska. The Gulf of Alaska watershed and coastal ocean are severely undersampled with respect to precipitation, river discharge, and salinity. Long-term time series of these are lacking and future maintenance of existing discharge and weather stations is uncertain. There is a need to develop proxy variables that can be used to reliably estimate runoff and coastal salinity.
11. The mooring is also serving as a platform for other scientists, for example in 2001–02 we incorporated prototype halibut tags, under development by USGS-BRD scientists, onto the GAK 1 mooring.

Many of these results were obtained in conjunction with data collected under the auspices of the Northeast Pacific Coastal Gulf of Alaska Global ocean Ecosystems dynamics (GLOBEC) program. GLOBEC field sampling will continue through fall 2004 and provide additional data sets from the northern Gulf of Alaska that will be combined with the GAK 1 data for joint analyses.

NEED FOR THE PROJECT

A. Statement of Problem

The GAK 1 monthly time series illustrates some of the very large interannual and interdecadal variability of the high latitude North Pacific. From the greater sampling rate provided by the moored time series, shorter period variations are being detected and quantified and used to determine temporal aliasing problems associated with the monthly sampling. The results are enhancing interpretations of the historical data and place the magnitude of previous anomalies in a better statistical framework. Moreover, the GAK 1 time series appear to be a reliable proxy for the freshwater content, and the geostrophic, baroclinic component of the mass and freshwater transport in the Alaska Coastal Current along the Cape Fairfield Line (Figure 1). Variability in the marine environment, as reflected in ocean temperatures and salinities, and the shelf circulation, need to be quantified to understand the structure of, and changes in, the northern Gulf of Alaska marine ecosystem. The data have also supported efforts to assess the recovery of marine species and services affected by the oil spill. Indeed, several *Exxon Valdez* Oil Spill (EVOS)-supported investigators have underscored the need to understand natural climate variability and its influence on the recovery of species injured by the oil spill (Purcell et al., 1999; Piatt and Irons, 1999; Duffy, 1999; Anderson et al., 1999).

B. Rationale/Link to Restoration

This monitoring proposal provides a service to current and future investigators working in the Gulf of Alaska and adjacent waters needing information on environmental variability. The information will help assess recovery and restoration progress by allowing these issues to be analyzed within the context of the long-term variability of the physical environment. Our proposed measurements will continue this service by collecting time series at GAK 1 of:

1. Monthly temperature and salinity at every meter throughout the water column using a conductivity–temperature–depth (CTD) instrument.

2. Hourly temperature and salinity at several fixed depths distributed throughout the water column.

This information will assist in:

1. Understanding thermohaline variability on time scales ranging from the tidal to the interdecadal.

2. Interpreting historical data sets for use in retrospective studies.

3. Providing proxy information on freshwater content and the mass and freshwater transport in the Alaska Coastal Current.

4. Provide information on seasonal variations in upper ocean stratification and the onset of the spring bloom.

C. Location

The fieldwork will be conducted at Station GAK 1 at the mouth of Resurrection Bay (Figure 1). Both the CTD work and the mooring deployment and recovery operations will be conducted from the Seward Marine Center using the 25-foot vessel, *Little Dipper*. All data collected as part of this program will be available to those desiring it via files on the Internet. The monthly CTD data will be combined with the existing historical data that are on the Institute of Marine Science web page: http://www.ims.uaf.edu/GAK 1/. GAK 1 lies on the inner edge of the Alaska Coastal Current (Figure 1). This current is the most prominent feature of the Gulf of Alaska shelf circulation. It is a persistent circulation feature that flows cyclonically (westward in the northern Gulf) throughout the year (Figure 2). It originates on the British Columbian shelf (although in some months or years it might originate as far south as the Columbia River (*Royer*, 1998) and flows for ~2500 km to where it enters the Bering Sea through Unimak Pass in the western Gulf (*Schumacher et al.*, 1982). It represents an advective pathway by which climate signals can propagate into the Gulf and it responds to the integrated wind and freshwater forcing along its length.

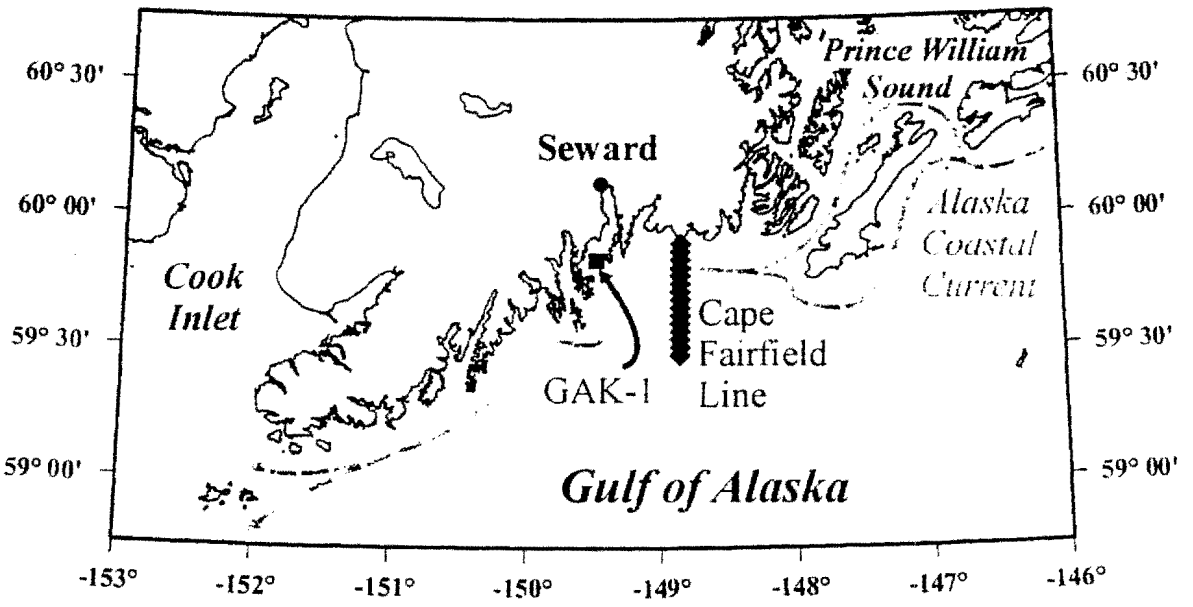

Figure 1. Map showing location of hydrographic station GAK 1 and the Cape Fairfield GLOBEC transect in relation to the Alaska Coastal Current, Prince William Sound, Cook Inlet and Seward.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

We do not see any overt connection to traditional ecological knowledge. However, data sharing with both the public and scientific communities is an important component of our program. The most efficient way to accomplish this objective is through the Internet. We have established a website (http://www.ims.uaf.edu/GAK 1/) that provides information on this project and allows rapid dissemination of the data. We continue to upgrade the website to make it more accessible

to the public. For example, we are preparing a glossary of the technical terms used on the website and are developing schematics that illustrate some of the basic physical processes occurring in the Gulf of Alaska. We have also made presentations on the Gulf of Alaska oceanography to high school science students in the Fairbanks area and will continue to do so in the future. The website allows ready access to the data for those working at the community level and with traditional ecological knowledge. Moreover, we are considering ways to transmit data in real-time cost-effectively from GAK 1 to a land station (possibly the Alaska SeaLife Center). If such a need exists and we can do so economically, then we will seek to upgrade the GAK 1 mooring in the future.

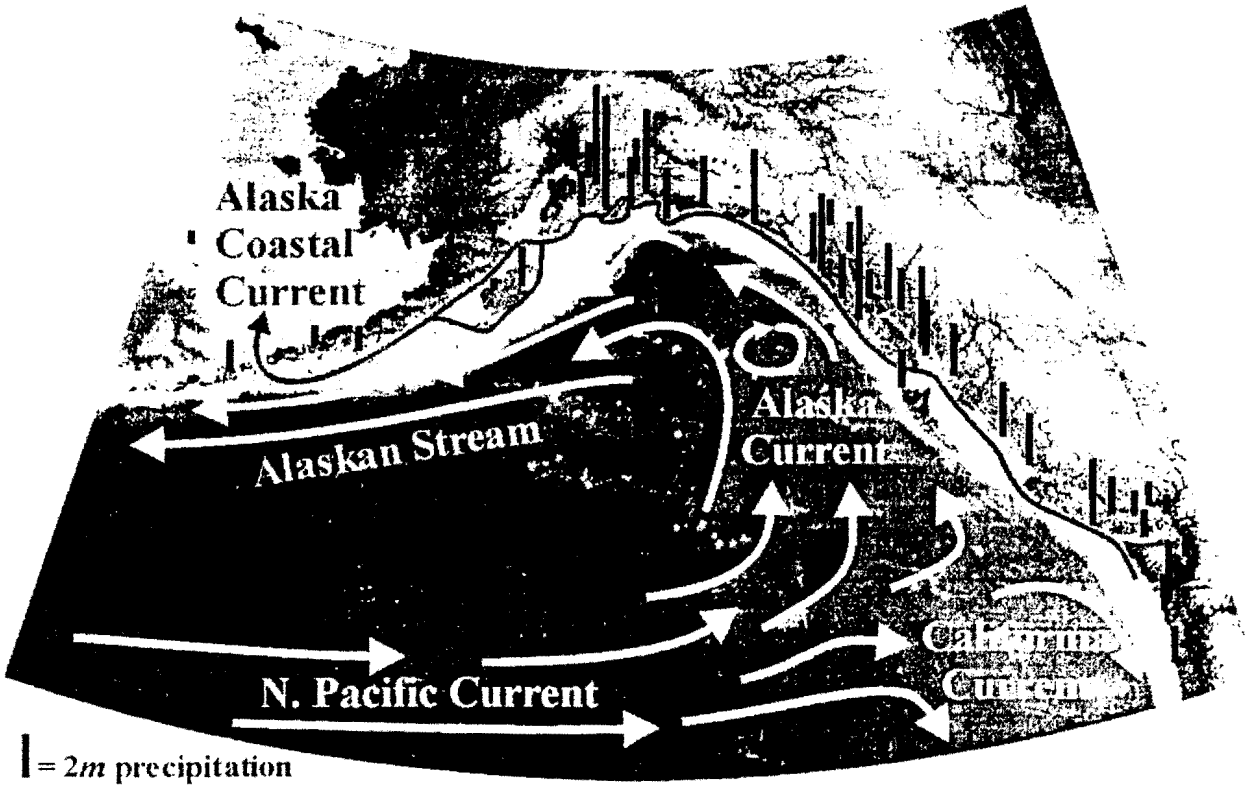

Figure 2. Schematic of the circulation of the Northeast Pacific and Gulf of Alaska. The vertical bars are the mean annual precipitation amounts at selected National Weather Service coastal sites and in the interior of the Gulf of Alaska. The latter is from Baumgartner and Reichel (1975).

PROJECT DESIGN

A. Objectives

The main objective of this program is to:

Continue the 32-year time series at station GAK 1 so that interannual and longer period variability can be quantified and understood.

This objective will be met through a combination of monthly CTD measurements and through year-long deployments of a mooring containing temperature and conductivity (T/C) recorders. The sampling schemes complement one another with one providing high vertical resolution at monthly time scales and the other providing high temporal but relatively low vertical resolution. We view the maintenance of this time series as essential to the broader goals of GEM. We believe that this effort is a cost-effective contribution to monitoring some of the key physical environmental variables on the Gulf of Alaska shelf, namely, temperature, salinity, freshwater content, and the baroclinic component of mass and freshwater transport in the Alaska Coastal Current.

Ecosystem monitoring is a long-term undertaking requiring multiple and multi-disciplinary efforts, with this proposed effort constituting an essential step. We envision the GAK 1 mooring eventually incorporating a diverse suite of biophysical sensors that will contribute toward ecosystem monitoring in the Alaska Coastal Current. We propose to upgrade the mooring by adding an additional T/C recorder coupled with a fluorometer and transmissometer. The instrument will be deployed in the euphotic zone at about 15 m depth. In the future, the sensor suite might be expanded to include automated chemical sensors capable of collecting time series of nitrate and acoustical and/or bio-optical sensors that can detect zooplankton and fish. Many of these techniques are being tested now or are under development. We plan to await the outcome of these tests before proposing to incorporate the instruments on the GAK 1 mooring. This mooring could also serve as a platform for passive acoustic recordings of marine mammals and/or ambient environmental noise. The latter could become a future issue in this region if recreational and commercial boat traffic increases. The mooring is also available for the deployment of instruments of interest to other users as a community service. For example, in 2001 we incorporated prototype halibut tags, under development by USGS-BRD scientists, onto the mooring. In 2002, Dr. R. Hopcroft (University of Alaska) will conduct year-round, bi-weekly sampling of the zooplankton community at GAK 1 and he will use the GAK 1 data set during the interpretive phase of his work. His sampling, funded under GLOBEC, will provide higher temporal resolution of the seasonal changes of the zooplankton community in the Alaska Coastal Current.

To guide our immediate efforts we formulated several project-specific objectives, several of which are continuing as discussed in our annual reports (Weingartner, 1999; 2000; 2001). These are:

1. Determine the rate of change of water mass properties (temperature and salinity) and the phasing of these changes at different depths. Some of these features, which are not resolved by monthly sampling, reflect important changes whose timing could be significant to the ecosystem. The data files will be made available on the time series homepage for downloading and as a graphical display. Key events will be highlighted and discussed as part of the graphical display.
2. Determine the basic statistical properties of the moored data and how variances in temperature, salinity, and dynamic height are distributed seasonally and over depth. Are there distinct vertical "modes" of variability that change with season? These results will also be

summarized in a file containing textual, tabulated, and graphical information and will be accessible via the time series homepage.

3. Determine the timing of the onset of stratification in the upper ocean in spring and its relation to the onset of the spring bloom.
4. According to NOAA forecasts, an El Niño is now developing over the equatorial Pacific. The physical effects of this phenomenon should be evident in the Gulf of Alaska in the winter of 2002–03 and our mooring should capture its evolution.

B. Methods

Funds are requested to monitor Gulf of Alaska temperature and salinity through FY 03 and part of FY04. We propose to collect data at GAK 1 in two ways: monthly CTD profiles throughout the water column and hourly measurements of temperature and salinity at selected depths. Seven times a year (March, April, May, July, August, October, and December) these measurements will be made from the R/V *Alpha Helix* while this vessel is supporting the GLOBEC program. In the remaining months we will use the Institute of Marine Science's 25-foot *Little Dipper* and collect CTD profiles with a Seabird SBE-25 internally-recording CTD deployed from the vessel's winch. The manufacturer calibrates the sensors on this CTD annually. The historical salinity data have an accuracy of ~0.01 or better using this instrument and these procedures. Temperatures are accurate to within 0.005°C.

The monthly sampling will be complemented by hourly measurements from temperature/conductivity recorders (Seabird MicroCats; SBE model 37-SM) incorporated in a taut-wire, subsurface mooring at GAK 1. The mooring can be deployed and recovered by the *Little Dipper* during the CTD cruises (or during one of the GLOBEC cruises time permitting). Throughout the first four years of this program we have deployed six instruments collecting at nominal depths of 30, 50, 100, 150, 200, and 250 meters. We propose to add a seventh instrument at about 15 m depth, to collect temperature, salinity, fluorescence, and transmissivity data in the near-surface layer throughout the year. (The instrument is a SeaCat, SBE-16 and is similar to a MicroCat except that it can mate with additional sensors, e.g., the optical sensors). There are several reasons for the proposed addition. First, in conjunction with the instrument at 30 m depth, the instrument at 15 m depth will allow us to assess the seasonal development of stratification in the upper ocean. Second, near-surface temperatures might be very useful in understanding salmon recruitment based upon the work of Willette et al. (1999) since the juvenile fish occupy the upper 15 m of the water column while on the shelf (Boldt and Haldorson, 2000). Third, the addition of the fluorometer and transmissometer will allow us to determine the timing of the spring bloom (based on fluorescence) and its relationship to the development of upper ocean stratification and seasonal changes in suspended sediment load (transmissivity). Bio-fouling of the optical sensors is likely to occur through time and this will degrade the accuracy of the optical data. This could be overcome by replacing these instruments more frequently throughout the year (albeit at an increase in cost). Although this might be desirable in the future, for the time being we will focus on the spring bloom. To minimize bio-fouling effects, we will deploy the mooring in March, prior to the spring bloom which typically occurs in April or May on the Gulf of Alaska shelf. With the proposed change the instrument

distribution covers the near-surface (15 – 30 m), the upper ocean (30 – 100 m), mid-depth (150 – 200 m) and bottom (200 – 250 m) of the water column. While prior results indicate that mooring motion can be ignored during analysis, we monitor this with a pressure sensor on the uppermost (15 m depth) SeaCat. Our prior experience with these and similar instruments (SeaCats) indicate that temperature and salinity drifts are generally <0.02°C and <0.03 psu/year, respectively.

The mooring design and fabrication consists of three steps prior to deployment. First, the manufacturer calibrates all of the instruments prior to deployment. (This step is usually completed 6 – 9 months prior to deployment). Second, we analyze the mooring response to the ambient current field using a mooring design program and typical ambient current speeds. This procedure optimizes the distribution of our flotation and minimizes current-induced mooring diving. Past experience indicates that the shallowest instrument should dive by no more than 1 – 2 m under the ambient currents. Third, all of our T/C recorders are run for about 5 days in a continuous flow-through seawater tank at the Seward Marine Center. This serves as a pre-deployment check on the instruments wherein we check that the clocks and sampling intervals are correct and that the temperature and conductivity sensors on each instrument differ from one other by no more than the manufacturer's stated accuracy. Prior to deployment, we mount the T/C recorders on gimbaled vanes and use in-line swivels so that the duct leading to the conductivity cell is always oriented into the current. This enhances flushing of the conductivity cell and leads to a better conductivity cell response and avoids the expense of a pump.

The analyses of the data sets are straightforward. Objective 1 is largely concerned with temporal aliasing issues associated with monthly sampling. Among the important processes that might be aliased are the summer onshelf influx of dense bottom water, changes in upper ocean stratification throughout the year as a consequence of winds and runoff, and the response of the thermohaline structure of the water column to synoptic scale forcing by the wind. Objective 2 will be achieved by harmonic analysis of the temperature and salinity time series. This analysis provides us with an understanding of the vertical and temporal variability in the temperature and salinity distribution. Objective 3 will be achieved by examining the fluorometer and transmissometer record in conjunction with the density differences determined using the instruments at 15 and 30 m depth. Our analysis will also use the weather data collected by the NOAA meteorological installation at Pilot Rocks, about 20 km south of GAK 1. This weather station is representative of local wind and air temperatures on the inner shelf and the data are available from the Internet. In the event that an El Niño develops, Objective 4 will be achieved by comparing data obtained in 2002 and 2003 with previous GAK 1 data. Such a comparison can only be achieved by having a sufficiently long time series so that the magnitude of any El Niño related change can be discussed and quantified in the context of previous variability. The statistical significance of the magnitude of a potential El Niño anomaly can be easily ascertained through standard statistical methods given the existing historical data set. We have constructed a multivariate linear regression model that uses a variety of independent variables to predict the dependent variables: freshwater content and the baroclinic components of the mass and freshwater content of the Alaska Coastal Current flowing along the Cape Fairfield Line (Weingartner, 2002). Under the GLOBEC program we will make seven additional transects of the Cape Fairfield Line (October and December 2002, March, April, May, July, and August 2003) upon which we can calculate the dependent variables. We will then apply our statistical model to predict these variables (actually the monthly anomalies of these variables) and assess the error in this prediction.

The regression is based on a large number of independent variables including, GAK 1 hydrography, Seward sea level, local winds, GOA upwelling indices, and sea level pressure and radiation fields, and larger-scale Pacific climate indices (SOI, NOI, and PDO). Monthly anomalies of each of these variables are formed, upon which we compute the principal components (PC) of the anomaly time series. These PCs are mutually orthogonal to one another and effectively reduce the number of independent variables used as predictors of the dependent variables. This procedure appears to be successful insofar as it explains more than 70% of the freshwater transport in the Alaska Coastal Current. We will use this model in the future to assess its predictive skill on the GLOBEC data sets. Because the new data will not be used to refine the model they will serve as an independent test of the model's skill.

SCHEDULE

A. Measurable Project Tasks for FY 03 and FY04 (October 1, 2002 – August 31, 2004)

Oct 2002 – Feb 2003:	Monthly CTD surveys scheduled at mid-month; update homepage as CTD data are processed and edited; prepare wind fields and acquire meteorological fields.
Mar 2003:	Recover and re-deploy mooring. Begin analysis of March 2002 – March 2003 GAK 1 mooring data.
Apr 2003 – Feb 2004	Continue monthly CTDs, complete post-calibration on mooring instruments, process mooring and CTD data.
Mar 2004	Recover mooring and begin analysis of March 2003 – March 2004 GAK 1 mooring data. Post-calibrate mooring (3 months required).
Aug 2004	Submit annual report.

B. Project Milestones and Endpoints

The data collected as part of this project will be available to a broad community of users. We anticipate that some will want "immediate" access to it. This desire often conflicts with the goal (and required time) of producing data of the highest possible quality. In the past, the final CTD data have generally been placed online about four months after collection. The final edited temperature and salinity data from the mooring should be ready within five months after instrument recovery. The delays arise because of post-calibration procedures (performed by the manufacturer) and data editing requirements (performed at the Institute of Marine Science). We intend to make much of the data, along with preliminary results, available for rapid dissemination. From a practical point of view this approach is prudent because for many users the differences between the raw and the final edited product are insignificant. We will attach appropriate warnings concerning data quality to both preliminary and final data products. Thus, we anticipate making most of the data available on the home page one month after recovery of the mooring. However, data will not be released if there are severe concerns regarding its quality unless and until such concerns are resolved. In addition to these general considerations, we anticipate the following project milestones:

1. The first objective is to examine rates of change of water mass properties (temperature and salinity) and the phasing of these changes at different depths. This work is largely descriptive

and will begin immediately after instrument recovery. Graphical data displays will be made available within four months of recovery. These will include textural information indicating features of interest. Displays will be updated periodically as new findings emerge. Eventually these results will be merged with those of the third objective.

2. The second objective pertains to basic statistical results pertaining to the system variance. The results will be made available on the web page and in the final report when completed.

3. The third objective is a new one and consists simply of documenting the onset of the spring bloom with respect to the development of stratification. As this component of the GAK 1 time series continues, we will be able to quantify the timing of the spring bloom and track its variability in relation to the physical parameters measured.

4. The fourth objective will quantify the magnitude of the El Niño signature of 2003 – 2004 in comparison to previous years and El Niño events observed in the northern Gulf of Alaska.

C. Completion Date

This project will be completed by August 2004.

PUBLICATIONS AND REPORTS

Data and results will be provided via Internet as indicated above and presented at the annual GEM workshop.

PROFESSIONAL CONFERENCES

We have presented some of our prior findings at national conferences in conjunction with our GLOBEC work. In the past year this has included annual EVOS workshop as well as the Ocean Sciences meeting (January 2000, San Antonio), the Eastern Pacific Ocean Conference (EPOC; September 2000, Sidney, British Columbia), and at the GLOBEC Principal Investigators' meeting (November 2001). In each case we have melded the GAK 1 results with GLOBEC results where appropriate and have acknowledged the support of EVOS as well as the National Science Foundation (NSF) and the National Oceanic and Atmospheric Administration (NOAA). I expect that this and other collaborative presentations of these data will continue in the future. I am not seeking funds from EVOS for travel and attendance at the national meetings, as GLOBEC funds will cover these costs. Funds are requested for attendance at the annual GEM workshop in Anchorage.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

We have discussed aspects of the GAK 1 historical data with several investigators supported by the Trustee Council. Many have expressed interest in these data and know how to access it. Other scientists are aware of these data through papers and meetings, (e.g., the American Geophysical

Union which serves primarily the U.S. oceanographic community and the North Pacific Marine Science Organization [PICES] composed of marine scientists from around the Pacific Rim). Though we have discussed in previous sections how we would make these data available, we welcome advice from the Trustee Council on additional ways to share these data with other investigators and/or the public.

Several scientists are co-investigators on a GLOBEC proposal whose results would complement this proposal. The UAF investigators (Coyle, Hopcroft, Haldorson, Whitledge, Weingartner) along with Royer (Old Dominion University) have funding from the NSF-NOAA GLOBEC program to examine the Gulf of Alaska shelf ecosystem for the period October 2000 – December 2004. This work includes seven R/V *Alpha Helix* cruises spaced throughout the year to examine the cross-shelf hydrography (including nutrients) and the distribution of phytoplankton, primary production, zooplankton, and fish (mainly juvenile salmon and forage fish) in relation to the physical environment. Costs for the GAK 1 data collection are shared with the GLOBEC program insofar as seven of the monthly cruises to GAK 1 will be undertaken by GLOBEC. Thus we are requesting support for only five *Little Dipper* cruises. Further, Hopcroft's GLOBEC work includes estimating zooplankton growth rates and production based on changes in zooplankton age-frequency composition at GAK 1. He will conduct several *Little Dipper* cruises during the year in addition to those described above. He will also collect CTD profiles as well during his cruises (following the same procedures as discussed above); thereby increasing the number of profiles available to this project. Other GLOBEC investigators (Strom, Western Washington; Dagg; Louisiana State; Napp, NOAA) will be investigating zooplankton dynamics in 2003 in the northern Gulf of Alaska and we anticipate that the GAK 1 data will be of use to them as well. Finally, NOAA-PMEL has deployed several moorings over the middle and outer shelf south of GAK 1 (along the Seward Line). Data from these in conjunction with the GAK 1 data set should provide a better understanding of synoptic and seasonal changes over this shelf.

We see these programs as highly complementary in several ways. First, the cross-shelf hydrography will provide a basis for comparison with variations observed at GAK 1. Second, a comprehensive nutrient data set will be made available for establishing the type of correlations alluded to in the introduction. If significant correlations exist then the GAK 1 data would be a proxy indicator of historical variations in nutrient concentrations (for some depths).

The effort described in this proposal takes a modest but important step toward achieving the goal of long-term, comprehensive ecosystem monitoring. There are compelling scientific and logistical reasons for believing that GAK 1 will be a long-term site and that the sampling will eventually expand to include other disciplines. Resurrection Bay and the adjacent ocean are paradigmatic for much of the Gulf of Alaska shelf, and this area is easily accessible by marine scientists at Seward. Although our understanding of chemical cycling and biological processes on this shelf is limited at the moment, programs such as SEA, APEX, and GLOBEC will provide substantial new information for these disciplines. Results from these programs and those anticipated from the work proposed herein will contribute to the design of a comprehensive long-term monitoring strategy. Additional impetus for expanding the monitoring activities at GAK 1 will occur as programs at the Alaska SeaLife Center evolve.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

We propose to add 1 SeaCat, SBE-16 to the mooring at a depth of 15 m. It will contain a fluorometer, transmissometer and pressure gauge to monitor diving. The reasons for the proposed addition are: 1) to begin to assess the interannual variation in the seasonal development of stratification and timing of the spring bloom over the inner shelf and 2) because near-surface temperatures might be useful in understanding juvenile salmon survival (Willette et al., 1999) since these fish inhabit the near-surface layers (upper 15 m of the water column) on the shelf (Boldt and Haldorson, 2000).

We also propose a change in the schedule of activities. In the past we have serviced the mooring in December of each year. In the future we want to service the mooring in March. The change is proposed to minimize biofouling of the optical instruments prior to the onset of the spring bloom. This typically occurs in April. By deploying in March 2003 biofouling of the optical instruments will be minimized. This means that the mooring will be replaced in March 2004 and that the annual report will be prepared by August 2004 after the instruments have been post-calibrated.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

Thomas J. Weingartner

EDUCATION

Ph.D. Physical Oceanography, 1990, North Carolina State University
M.S. Physical Oceanography, 1980, University of Alaska
B.S. Biology, 1974, Cornell University

MEMBERSHIPS

American Geophysical Union; American Meteorological Society

PUBLIC SERVICE

Member, Science Steering Committee, NSF - Arctic System Science-Ocean Atmosphere Ice Interaction (OAII) component
Member, Science Steering Committee, NSF - ARCSS-OAII Shelf-Basin Initiative
Member, Science Steering Committee, NSF - ARCSS-Human Dimensions of the Arctic component
Member, UNOLS - Fleet Improvement Committee

PROFESSIONAL EXPERIENCE

Assistant Professor; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 11/93 - present
Research Associate; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 9/91 – 10/93
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PROFESSIONAL INTERESTS

Physical oceanography of the Arctic and North Pacific Oceans and the adjacent shelves, biophysical linkages in oceanography.

PUBLICATIONS

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Weingartner, T. J., S. Danielson, and T. Royer . Freshwater transport and variability within the Alaska Coastal Current, Gulf of Alaska.

Weingartner, T. J., K. Aagaard, Y. Sasaki, and D. J. Cavalieri. Circulation on the Central Chukchi Sea shelf.

OTHER KEY PERSONNEL

Mr. Seth Danielson is a physical oceanographer who has worked in both the GLOBEC and EVOS-supported GAK 1 projects for several years. He has the responsibility for data processing, analyses, and maintenance of the project web page and will be intimately involved in preparing the final report and making presentations at the annual meeting. Mr. David Leech is the Seward based mooring and marine technician responsible for the design and deployment of the mooring and maintenance of the instruments. He will also conduct the monthly CTD sampling from the *Little Dipper*. Danielson and Leech are both employees of the Institute of Marine Science.

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FY 03 *EXXON VALDEZ* TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 200[illegible] September 30, 2003

Budget Category:		Authorized FY 02	Proposed FY 03	[redacted]					
				LONG RANGE FUNDING REQUIREMENTS					
Personnel			$15.3						
Travel			$0.8						
Contractual			$1.2						
Commodities			$3.5						
Equipment			$17.0						
Subtotal		$0.0	$37.8	Estimated FY 04					
Indirect	0.25		$9.5						
Project Total		$0.0	$47.3	$30.0					
Full-time Equivalents (FTE)			0.2	[redacted]					
		Dollar amounts are shown in thousands of dollars.							
Other Resources									

Comments:

FY03

Prepared: 4/10/02

Project Number: 03340
Project Title: Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

FY 03 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 20[illegible] September 30, 2003

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 03
	Weingartner, T.	PI,	0.5	7.0		3.5
	Danielson, S.	Physical oceanographer	0.8	5.8		4.6
	Leech, D.	Mooring and marine technician	1.0	5.5	1.7	7.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	2.3	18.3	1.7	[illegible]
					Personnel Total	$15.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 03
	Fairbanks-Anchorage	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
						0.0
					Travel Total	$0.8

FY03

Prepared: 4/10/02

Project Number: 03340
Project Title: Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 03
Little Dipper (2 half-days @ $208/half-day)	0.4
CTD calibration	0.6
Shipping (RT Seward-Seattle: CTD)	0.2
Contractual Total	$1.2

Commodities Costs:	Proposed
Description	FY 03
Batteries, O-rings, vane assembly parts	2.0
Shackles, sling links, thimbles	0.5
Standard seawater (5 @ $30/vial)	0.2
Mooring anchor and lashing chain	0.4
Swivels	0.4
Commodities Total	$3.5

FY03

Prepared: 4/10/02

Project Number: 03340
Project Title: Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 03
Description			
SeaCat with transmissometer, fluorometer, and strain pressure gauge	1	17.0	17.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$17.0

Existing Equipment Usage:	Number of Units	
Description		

FY03

Prepared: 4/10/02

Project Number: 03340
Project Title: Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Project Title: Patterns and Processes of Population Change in Selected Nearshore Vertebrate Predators

Project Number:	03423
Restoration Category:	Research and Monitoring
Proposers:	Jim Bodkin, Dan Esler, Brenda Ballachey
Lead Trustee Agency:	DOI--USGS
Cooperating Agencies:	
Alaska SeaLife Center:	No
Project Duration:	5th year, 5-year project
Cost FY 03:	$216,200
Cost FY 04:	$0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Sea Otter, Harlequin Duck

ABSTRACT

Sea otters and harlequin ducks have not fully recovered from the EVOS, based on population-level demographic differences between oiled and unoiled areas. Further, in oiled areas, both species show elevated cytochrome P4501A, almost certainly reflecting continued exposure to oil. This project was designed to explore links between oil exposure and the lack of population recovery, with the intent of understanding constraints to full recovery of these species and the nearshore environment generally. The results also serve to monitor the progress of recovery of the species and the system. To date, the work has consisted of field components for both species, and a captive component for harlequin ducks. Proposed activities for FY03 include (1) the third and final year of harlequin duck field studies quantifying oil exposure and survival of females during winter, and (2) closeout of all project components and preparation of the final report.

INTRODUCTION

The nearshore environment of Prince William Sound (PWS) received about 40% of the oil spilled after the *Exxon Valdez* ran aground (Galt et al. 1991). Concerns about nearshore recovery and restoration resulted in a suite of studies sponsored by the *Exxon Valdez* Oil Spill Trustee Council, including the Nearshore Vertebrate Predator project (NVP). Principal findings of NVP include an apparent lack of population recovery for sea otters (*Enhydra lutris*) and harlequin ducks (*Histrionicus histrionicus*), both invertebrate feeders in the nearshore ecosystem (Bodkin et al. 1999; Esler et al. in press, Dean et al. 2000, Bodkin et al. in press). Over a three year period, harlequin ducks residing in oiled areas had poorer survival than those in unoiled areas (Esler et al. 2000a). Sea otters also experienced poor post-spill survival through 1998, based on modeling of ages-at-death (Monson et al. 2000). Further indication of increased mortality (or higher rates of emigration) of sea otters in oiled areas compared to their counterparts in unoiled areas is provided by inferences based on capture data (Bodkin et al. 1999, Bodkin et al. in press). Additionally, both species show evidence of continuing exposure to hydrocarbons, based on elevations of the biomarker cytochrome P4501A (CYP1A), in oiled areas (Ballachey et al. 1999). Increases in CYP1A are not explained by background or natural hydrocarbon sources, as these were found to be negligible in intertidal areas of PWS (Short and Babcock 1996), nor by area differences in PCB contamination (Trust et al. 2000; USFWS unpub. data), leaving continued exposure to residual *Exxon Valdez* oil as the most plausible explanation. Residual oil is still stranded in intertidal areas of PWS (Babcock et al. 1996; Hayes and Michel 1999).

Conceptual links have been drawn describing mechanisms by which oil exposure could have population-level demographic impacts on sea otters and harlequin ducks. However, these links, and thus the processes that may limit full recovery, remain speculative. Therefore, we propose to build on the base of knowledge gained through previous research to (1) explore the relationships between oil exposure, individual health, and demographic attributes that could have population level effects, and (2) monitor the parameters identified in previous work that are effective and statistically powerful in describing population status and lend insight into the process of recovery of sea otters and harlequin ducks, and the nearshore environment generally.

Sea Otters

The NVP study provided several lines of evidence indicating that sea otters in the most heavily oiled portions of western Prince William Sound (WPWS), at northern Knight and Naked islands, have not recovered from oil-related injury (Bodkin et al. 1999, in press; Dean et al. 2000; Monson et al. 2000). The sea otter population at northern Knight has not increased between 1993-2001 (the period for which we have aerial survey data), with numbers remaining at about half the estimated pre-spill abundance. Sea otters in oiled areas show reduced survival, relative to prespill rates (Bodkin et al. 1999; Monson et al. 2000). Levels of CYP1A were higher in sea otters from Knight Island than from unoiled areas through 2001, suggesting continued exposure to residual oil may be constraining recovery. Additionally, increased proportions of larger-sized individuals of several sea otter prey species were identified at northern Knight, consistent with reduced predation and lack of recovery of the sea otter population in that area (Dean et al. 2000).

The sea otter component of this proposal was based on previous EVOS research (93045, 95025-99025) to develop a statistically sensitive and cost-effective program that has tracked the WPWS sea otter population and nearshore ecosystem recovery, and investigated the effects of chronic oil exposure on sea otters. We are addressing the following questions: (1) are sea otters increasing in abundance in the most heavily oiled areas, and in western PWS overall ? (2) has survival of sea otters returned to pre-spill rates? And (3) are biomarkers of oil exposure and indicators of sea otter health similar in oiled and unoiled areas?

Question 1 is being addressed by aerial surveys; question 2 by a modeling effort that uses ages at death from beach-cast carcasses (Monson et al. 2000), and question 3 by capture of sea otters in WPWS in summer 2001, with sampling of blood and liver tissues. In the final year of this project, we will complete modeling efforts and data analyses, and results will be compiled for presentation in the final report and for publication.

Harlequin Ducks

The most concerning result from NVP harlequin duck studies was the detection of significantly lower survival probabilities of adult females in oiled areas of PWS than in unoiled areas (Esler et al. 2000a). Analyses revealed that history of oil contamination was a more likely explanation for the survival difference than intrinsic differences between oiled and unoiled study areas. Further, projections of population trends using models incorporating these survival probabilities predicted declining populations on oiled areas and increasing populations on unoiled areas. This pattern was observed during Alaska Department of Fish and Game surveys (EVOSTC Project /427), suggesting that differences in survival were a likely mechanism for observed differences in population trends. Also, harlequin duck densities were lower on oiled Knight Island than on unoiled Montague Island, after accounting for intrinsic habitat differences; this is the pattern that would be predicted given high site fidelity and poorer survival on oiled areas. Finally, higher levels of CYP1A induction were detected on oiled areas.

Results from these studies led to speculation that continued exposure to oil could result in poorer survival of harlequin ducks, which in turn would result in differences in population trends and densities. There are reasonable explanations for how oil may be related to survival (see Statement of Problem below). Unfortunately, however, these links are drawn from a wide array of sources, with limited inference to wild harlequin ducks in PWS. Thus, with these 423 studies, we are exploring the relationship between oil exposure and survival using both field and captive bird approaches. These serve to examine mechanisms or processes that may continue to limit harlequin duck population recovery. These studies also monitor the most critical elements revealed in previous studies to gauge the progress of recovery.

The specific questions addressed by the harlequin duck components of this study are: (1) what is the relationship between levels of oil exposure and CYP1A induction, and what levels of oil exposure result in CYP1A values similar to those measured in PWS? (2) are there metabolic or behavioral consequences of oil exposure that could be a mechanism by which harlequin duck survival is compromised? (3) is oil exposure (as indicated by CYP1A induction) related to survival of harlequin ducks in the wild? and (4) is contaminant exposure declining over time and,

similarly, are survival rates on the oiled area improving through time? Questions 1 and 2 were addressed using captive birds at the Alaska SeaLife Center during winters 2000-01 and 2001-02. Questions 3 and 4 have been addressed by biosampling and radio telemetry work during winters 2000-01 and 2001-02, with the final required sampling proposed to occur in winter 2002-03. These studies are a continuation of work proposed and approved in Project 00423. This work will examine both the process of recovery (through understanding of the mechanisms constraining population demography) and will monitor the progress of recovery by sampling survival and CYP1A induction of wild birds starting 3 years subsequent to the last work done as part of NVP (winter 1997-98).

NEED FOR THE PROJECT

A. Statement of Problem

Sea otters and harlequin ducks occupy an invertebrate-consuming trophic level and are conspicuous components of the nearshore ecosystem. In 1995, the NVP Project was initiated to examine the status of recovery of nearshore vertebrates (including sea otters, harlequin ducks, river otters and pigeon guillemots), and to evaluate possible causes for the apparent lack of recovery. Results of the NVP project clearly suggest that complete recovery has not occurred for sea otters and harlequin ducks, and the lack of recovery may be related to continued exposure to oil. This proposed work follows up on the critical elements revealed by the NVP studies.

Sea Otters

The sea otter population in WPWS was injured as a result of the spill. Estimates of sea otter mortality due to the spill range from 750 to 2,650 individuals (Garshelis 1997, Garrott et al. 1993). A population model (Udevitz et al. 1996) predicted recovery of the WPWS sea otter population in 10 to 23 years, projecting maximum annual growth rates from 0.10-0.14. Surveys to date (1993-1998) have shown a significant increasing trend in the WPWS sea otter population, averaging about 4% per year since 1993 (power > 0.80 to detect a 1% annual change in 5 annual WPWS surveys). In contrast to the western Sound overall, at northern Knight Island sea otter numbers remain low with no sign of an increase through 2001 (Bodkin et al. 1999, Bodkin 2000; Dean et al. 2000, USGS unpublished data).

Sea otter carcasses have been recovered from beaches in WPWS since 1976, thus providing one of the few long-term baseline data sets for evaluating post-spill injury. Carcass surveys initially were not proposed as part of Project 99423. However, in 1999 we applied recently developed modeling techniques (Doak and Morris 1999) to estimation of sea otter survival rates, utilizing the distribution of otter ages-at-death as the basis for the model. The results provide compelling evidence of long-term injury from the EVOS (Monson et al. 2000). Briefly, the model involves a comparison of observed vs. predicted ages-at-death of sea otters prespill and postspill, using data from carcasses collected during 1976-98. Postspill survival of sea otters in the western Sound was poor relative to prespill rates, and by 1998, survival rates had not yet returned to prespill values. However, survival rates of younger age otters were increasing, suggesting that conditions

were normalizing. These results are consistent with other observations of sea otters in western PWS, which suggest that the population in the most heavily oiled areas has not yet recovered . Carcass collections and modeling efforts based on age-at-death data may provide one of the most efficient tools for monitoring recovery of sea otters. Additional age data are available (carcasses collected during 1999-2002) and will be incorporated into the model as part of FY03 work, providing new insight into survival rates of sea otters in WPWS.

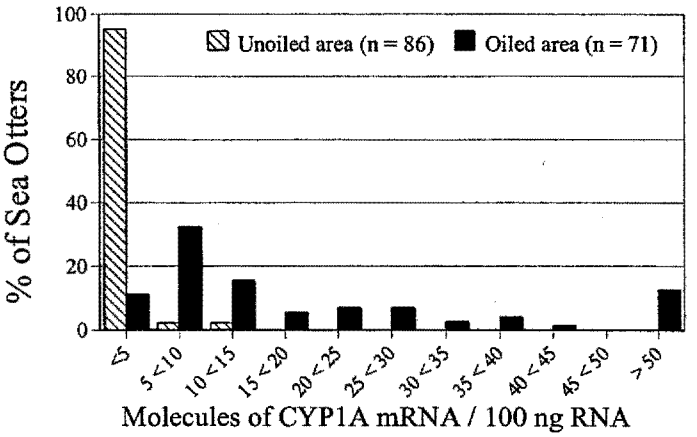

Figure 1. Measurement of cytochrome P4501A induction (RT-PCR technique) in sea otters in western Prince William Sound, 1996-98.

The NVP study identified elevated expression of CYP1A in 6 species that inhabit the nearshore areas of WPWS, indicating continued exposure to residual EVOS oil (Ballachey et al. 1999). Sea otters were sampled in 1996-98, and in all years, animals from Knight and Naked islands (oiled area) had elevated CYP1A, compared to those from Montague Island (unoiled area; Figure 1). Further, levels at Montague were similar to those measured in otters from a relatively clean area in southeast Alaska with no known exposure to oil or other contaminants (USGS unpub. data). In 1998, the mean value of CYP1A in the oiled study area was lower than means for 1996 or 1997, suggesting exposure to residual oil is diminishing over time. We resampled the wild sea otter population for CYP1A in summer 2001, and found that CYP1A levels in the oiled area continue to be elevated relative to the unoiled area. However, the trend to lower CYP1A levels over time continues.

These studies will be valuable in documenting extent of chronic injury and actual recovery time for the nearshore system including sea otters, and providing long-term population trend data which may be used in assessing initial damage and subsequent recovery of sea otter populations in the event of future oil spills.

Harlequin Ducks

Harlequin ducks were, and remain, particularly vulnerable to deleterious effects of the oil spill. Much of the oil from the *Exxon Valdez* was deposited in the nearshore intertidal and shallow subtidal zones (Galt et al. 1991), the coastal habitats where harlequin ducks occur. Also, Goudie and Ankney (1986) suggested that harlequins were near the lower limit of body size for sea ducks occurring in environments similar to Prince William Sound in winter. Because harlequin ducks exist close to an energetic threshold, any perturbation (e.g., an oil spill) that either affects health or condition directly (via toxic effects or increased metabolic costs) or indirectly (via food abundance) could have significant consequences for the population.

Also, among ducks, sea duck life histories are particularly K-selected (Eadie et al. 1988). Harlequin ducks typically defer reproduction for 3 years, have relatively low annual investment in reproduction, and are long-lived (Goudie et al. 1994). Species with these characteristics have relatively low potential rates of population change and, thus, following a perturbation such as an oil spill, require many years in the absence of continued adverse effects to recover to previous population levels. Further, population dynamics of animals with this life history strategy are particularly sensitive to variation in adult survival (Goudie et al. 1994, Schmutz et al. 1997).

Sea ducks have a general pattern of high philopatry throughout their annual cycle (e.g., Limpert 1980, Savard and Eadie 1989) and harlequin ducks follow this pattern, having high fidelity to molting and wintering sites (Robertson 1997; Esler, unpubl. data). High site fidelity could result in vulnerability to population effects because: (1) if residual oil spill damages exist, birds from oiled areas are vulnerable to spill effects as they return to those areas annually (i.e., these birds are affected disproportionately and are subject to cumulative effects), and (2) if dispersal and movements among areas are limited, recovery of groups of birds in oiled areas can occur only through demographic processes specific to that group (i.e., numbers are not enhanced through immigration from other areas). High site fidelity is an adaptive behavioral strategy in natural situations and predictable environments (Robertson 1997), but does not accommodate movement to undisturbed sites in the face of human-caused perturbations.

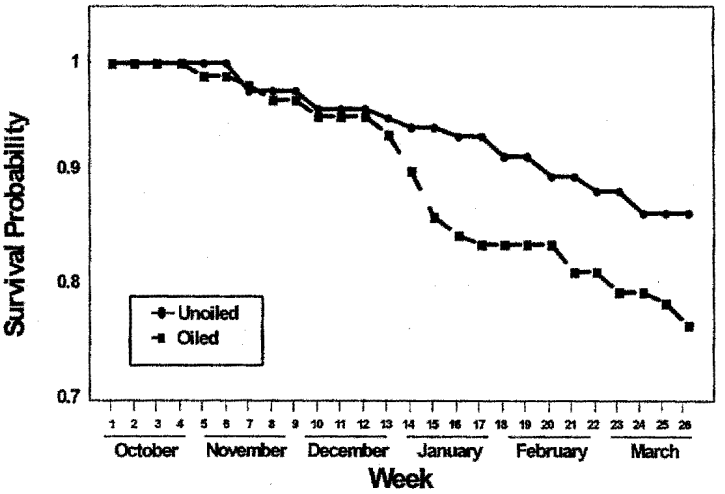

Figure 2. Survival probabilities of harlequin ducks.

Evidence from recent studies (NVP and /427) suggests that, as might be predicted from their vulnerability, harlequin duck populations have not fully recovered and, in fact, continue to suffer deleterious effects from the oil spill. Over the course of 3 winters, survival probabilities differed between oiled and unoiled areas (Figure 2). Survival probabilities were high, and similar between areas, in fall. However, survival diverged between areas during mid-winter, presumably the period during which conditions are most difficult for harlequin ducks. Also, differences in CYP1A induction were detected between populations from oiled and unoiled areas (Figure 3; Trust et al. 2000), although this was measured on different birds than those for which survival data were collected. Further, body mass during winter showed a slight, negative relationship with CYP1A level.

One can speculate on mechanisms by which continued exposure to oil could be related to differences in survival probabilities. Most lab studies have shown that mallards are tolerant of internal ingestion of oil, with toxic effects not evident until very high doses. These studies have been used to suggest that harlequin ducks should, similarly, be unaffected by residual Exxon

Valdez oil (Stubblefield et al. 1995, Boehm et al. 1996). However, other studies have found that, with addition of other stressors such as cold temperatures, oiled ducks in the lab suffered considerably higher mortality than unoiled (Holmes et al. 1978, 1979). This seems to be a much more appropriate analog for wild harlequin ducks. Particularly given their vulnerability to spill effects and hypothesized existence near an energetic threshold, harlequin ducks may not be able to handle additive effects of the oil spill, even if relatively small.

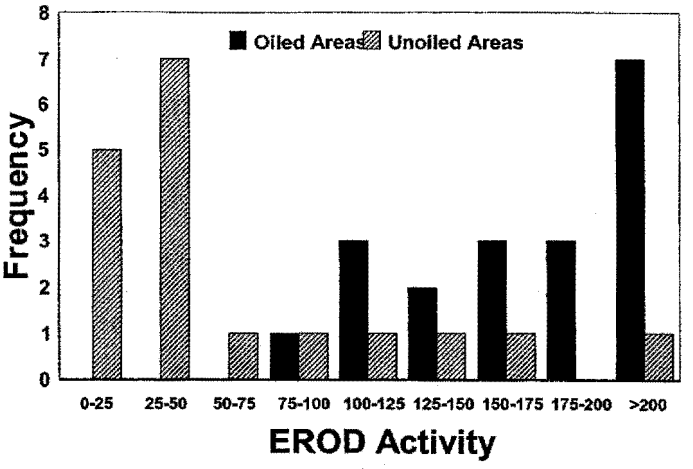

Figure 3. Comparison of CYP1A induction (hepatic EROD activity) in harlequin ducks from Prince William Sound.

To fully understand the process of harlequin duck population recovery from the oil spill, it is important to address these speculated links between oil exposure and survival probabilities, and subsequently population trends. The research proposed here was designed to explore these potential mechanisms constraining population recovery through field studies of winter survival and CYP1A induction and captive studies of metabolic, behavioral and CYP1A responses to controlled oil exposure. Further, because of their susceptibility to spill effects and high site fidelity, harlequin ducks are an ideal species for monitoring recovery of the nearshore environment.

B. Rationale/Link to Restoration

Sea otter and harlequin duck restoration requires assessments of population recovery status and definition of impediments to recovery. For harlequins and sea otters, the proposed work incorporates monitoring activities which, given the "baseline" data collected in NVP and other post-spill studies, will allow us to gauge recovery status. Additionally, the research components proposed herein represent a comprehensive approach to understanding the factors that affect population dynamics and definition of critical bottlenecks to recovery. Without an understanding of the underlying processes that dictate population change, we can not prescribe specific activities to enhance recovery. The project directly addresses the restoration objectives both by examining the processes affecting recovery and by monitoring the progress of recovery, including survival rates and contaminant exposure.

Sea Otters

Recovery of sea otters will be complete when population size returns to estimated pre-spill abundance, and there is no further evidence of continuing exposure to residual oil. Sea otter restoration requires an understanding of population status and the processes affecting changes in population status. Continued monitoring of sea otter distribution, abundance, survival rates and

prey populations in WPWS will provide insight into recovery and improve future recovery models, and potentially allow us to document the actual recovery time for the nearshore system, including sea otters. A further benefit of these project components is provision of long-term population trend data and monitoring tools which may be used in assessing initial damage and subsequent recovery of sea otter populations in the event of future oil spills.

Harlequin Ducks

Harlequin duck restoration will be complete when densities have recovered to prespill levels and birds no longer show evidence of oil contamination. Poor survival in oiled areas is the most plausible cause for lack of recovery to prespill densities; restoration requires an understanding of the factors that affect survival rates, in particular the effects of oil exposure. The restoration objectives for harlequin ducks are addressed both by examining the processes affecting recovery and by monitoring the progress of recovery, in particular contaminant exposure.

C. Location

Studies will be conducted in PWS. Specific study sites for the sea otter components were northern Knight Island and Port Chalmers/Stockdale at Montague Island, as used in the NVP project. Harlequin duck study sites also are those used in previous NVP work: unoiled Montague Island and oiled Green Island, Crafton Island, Main Bay and Foul Bay. Field components will be coordinated with recent findings from NOAA Auke Bay Lab describing oil persistence on beaches. Captive studies were done at the Alaska SeaLife Center in Seward. Communities affected by the project include Chenega, Whittier, Cordova and Seward.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The project will continue to inform and coordinate our community involvement activities, including the collection of indigenous knowledge with Dr. Henry Huntington, TEK specialist Chugach Regional Resources Commission and Hugh Short, Community Coordinator, EVOS Restoration Office. We will continue to solicit advice from the above parties and gather information on TEK through local community facilitators and residents. Efforts have and will continue to be made throughout the restoration process to participate in and provide public involvement in the design and implementation of this project. Information gathered from this project will be shared with local communities. Project staff has and will continue to present information to local communities or prepare articles or photographs for Trustee Council publications. Boat and air charter contracts, and other services will be contracted from local sources when possible.

PROJECT DESIGN

A. Objectives

Sea Otters

1. Summarize findings from this project and present as journal publications and a final EVOSTC report. At least two publications are anticipated: one on survival rates through 2002, and a second on CYP1A values and liver histopathologies.

Harlequin Ducks

1. Estimate winter survival rates of harlequin ducks in relation to area (history of oil contamination) and indices of oil exposure (CYP1A induction).

2. Monitor progress of harlequin duck population recovery via tracking of survival rates and CYP1A induction in oiled and unoiled areas.

3. Summarize findings from this project and present as journal publications and a final EVOSTC report.

B. Methods

Our 423 studies employed field studies on sea otters, and both field studies and experimental work with harlequin ducks. This combination of approaches addressed the need for controlled work to look explicitly at the effects of oil exposure on hypothesized mechanisms of mortality and field work to document the relevance of those mechanisms under wild conditions. The final data collection necessary for completion of the project is a third winter of survival and oil exposure data for harlequin ducks. Given the need for strong inference for understanding effects of oil exposure, this last year is critical for meeting project goals.

Sea Otters

All field activities under this project have been completed. Close-out efforts for FY03 will include modeling to assess survival rates, additional examination of liver samples for histopathological alterations, data analyses and compilation of results into reports and publications.

Harlequin Ducks

Field Studies

The key data for harlequin duck field studies are paired CYP1A and survival data, which will allow for explicit tests of the hypothesis that mortality and oil exposure are related in wild harlequin ducks. We intend to collect survival and exposure data from 50 birds in each of 3 years by capturing them during early winter, conducting surgeries to both implant transmitters and

biopsy livers, and monitoring subsequent winter survival. These types of data have been successfully collected during NVP studies.

This research requires capture of flighted harlequin ducks during early winter, after they have been on wintering sites long enough to be potentially exposed to residual oil, yet before the mid-winter period when survival probabilities diverged during NVP studies (Figure 3). The mid-winter period is presumably the time of greatest stress and thus the period when oil spill effects would be most likely to be expressed as differences in survival probabilities. The interval between capture and the critical mid-winter period must allow for at least a 2-week censor period to ensure that survival data are not biased by effects of capture, handling, or surgery (Esler et al. 2000b; Mulcahy and Esler 1999). Thus, we propose capturing birds during a 3-week period in November to generate both survival data and exposure data from the same individuals.

We will use floating mist nets (Kaiser et al. 1995) to catch flying birds in oiled (Knight Island, Green Island, Crafton Island, Main Bay, Foul Bay) and unoiled (Montague Island) study areas. Use of the same study areas as the NVP project allows for direct comparisons of results. The floating mist net capture technique was used successfully during NVP studies. However, this technique does not allow handling of as many birds as molt drives, so age cohorts used in survival estimation will not be as restricted as in NVP studies, which included only after-third-year females. We will radio females of all age classes; age parameters will be included in all analyses to account for any survival differences due to these effects. Captured birds will be banded with uniquely coded USFWS bands, aged by bursal probing (Mather and Esler 1999), and sexed by plumage characteristics.

To estimate survival probabilities of harlequin ducks, we will use implantable radio transmitters with external antennas (Korschgen et al. 1996). Implanted transmitters have been successfully used in waterfowl studies (e.g., Olsen et al. 1992, Haramis et al. 1993), and an increasing body of literature suggests that radio transmitters implanted into wild waterfowl are less disruptive than external methods of attachment, based on differences in survival or return rates (Ward and Flint 1995, Dzus and Clark 1996), behavior (Pietz et al. 1993), and reproductive rates (Pietz et al. 1993, Rotella et al. 1993, Ward and Flint 1995, Paquette et al. 1997), especially for diving ducks (Korschgen et al. 1984). NVP studies (Esler et al. 2000b) demonstrated that recapture probabilities of radio-marked harlequin ducks were not lower than unradioed individuals. Surgeries will be conducted by certified veterinarians experienced in avian implant surgeries, following procedures outlined in Alaska Biological Science Center, USGS Biological Resources Division standard protocol. Transmitters will weigh approximately 18g, which is < 3% of the body mass of the smallest wintering female harlequin ducks captured during NVP studies. Transmitters will be equipped with mortality sensors; the pulse rate will change from 45 to 90 beats per minute when a mortality is indicated. Mortality status will be confirmed by either carcass recovery or detection of signals from upland habitats, which are not used by harlequin ducks during nonbreeding periods.

We will conduct radio telemetry flights at approximately weekly intervals from the capture and marking period through the end of March. Survival data entry and general description will follow procedures outlined in Pollock et al. (1989a, 1989b), as modified by Bunck et al. (1995). We will

examine effects of area, season, and CYP 1A on survival by comparing AIC_c values (Burnham and Anderson 1998) among models with different combinations of these effects. The AIC_c indicates the most parsimonious model by balancing the goodness-of-fit of each model (from the maximum likelihood) with the number of parameters to be estimated. Under this approach, the model with the lowest AIC_c indicates the combination of parameters that are best supported by the data, which we will interpret as the factors related to variation in survival. Survival estimates and variances will be calculated by iterative solution of the likelihood using program MARK (White and Burnham 1999).

CYP1A induction will be measured by EROD activity. Small liver biopsies (approximately 0.1 g) will be surgically removed and immediately frozen in a liquid nitrogen shipper. EROD activity analyses will be conducted in a contracted lab following standard procedures (Trust et al. 2000). Plumage swabs and plucked feathers will be used to assess presence of external oil.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

USGS-BRD personnel will be responsible for directing and conducting sea otter and harlequin duck studies. A contract will be established with Dr. Dan Esler for the harlequin duck components.

SCHEDULE

A. Measurable Project Tasks for FY03

Sea Otters

October 02-Nov. 04: Data compilation, analysis, publication preparation, and final report.

Harlequin Ducks

November: Capture harlequin ducks for field studies of survival and CYP1A induction.

Nov-March: Monitor radioed birds for survival study.

October 02-Nov 04: Data compilation, analysis, publication preparation, and final report.

B. Project Milestones and Endpoints

This is a projected five-year research and monitoring program (initiated FY99, with completion of all objectives by FY03; see below) designed to assess the recovery of two injured species. Project objectives will be assessed annually. At the end of each year results will be compared with the restoration goals to assess whether recovery has occurred. The reporting schedule is described below, and is consistent with EVOS Trustee Council guidelines.

Sea Otters

FY03: Complete analysis, prepare final report and manuscript preparation

Harlequin Ducks

FY03: Conduct final winter of field studies, complete analysis, prepare final report and manuscript preparation.

C. Completion Date

All project objectives will be met by the end of FY03.

PUBLICATIONS AND REPORTS

A final report will be prepared at the end of the proposed work, with a delivery date of no later than 30 November 2003. Publications will be prepared for peer-review journals.

PROFESSIONAL CONFERENCES

D. Esler attendance at 2003 American Ornithologists Union meeting, date and location to be determined. B. Ballachey attendance at Carnivores 2002, a conference on carnivore biology and conservation (includes 2 sessions devoted to sea otter biology), Monterey, CA, November 2002.

NORMAL AGENCY MANAGEMENT

The work proposed here is not part of normal agency management and is related specifically to research addressing oil spill restoration concerns. No similar work has been conducted, is currently being conducted, or is planned using agency funds.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As described in the Introduction, this research relies on incorporation of data and results from other Trustee sponsored research, including projects /025, /427 and 02585. Equipment and commodities purchased under /025 will be used to conduct the proposed research and data collection and analysis will follow previously established protocols and standards. Additionally, in conjunction with NOAA Auke Bay Laboratory scientists, we (JLB, BEB) are submitting a new FY03 project proposal titled "Lingering Oil: Identifying Linkages Among Contaminated Habitat, Prey and Predators", which continues investigation of links between exposure to oil and lack of recovery in sea otters.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

In 1998, the EVOS Trustee Council first approved funding for Restoration Project 99423, "Patterns and Processes of Population Change in Sea Otters", an extension of the NVP project. The objectives of the project included sea otter aerial surveys of PWS, replicate surveys of sea otters at Knight and Montague Islands and sampling of sea urchin populations. In 1999, the Trustee Council approved the addition of harlequin duck studies to 00423 with the revised project title "Patterns and Processes of Change in Selected Nearshore Vertebrates". Those studies included relating harlequin survival to oil exposure and captive studies to assess responses to controlled oil exposure. In February 2000, the Trustee Council approved an amendment to 00423, to fund carcass recovery surveys in WPWS, to collect data on sea otter ages at death for estimation of survival rates. The work proposed for FY03 in this document follows directly from the work approved through the original proposals and amendments.

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PRINCIPAL INVESTIGATOR QUALIFICATIONS

Jim Bodkin is a Research Wildlife Biologist and team leader for coastal ecosystem studies in Alaska for the USGS Alaska Science Center. He has over 40 peer-reviewed scientific publications and directs an active coastal marine research program. He has studied and published on sea otter foraging ecology and community structuring since 1988 and has been principal investigator for sea otter survey methods development. He earned a M.S. from California State Polytechnic University in 1986.

Dan Esler is a University Research Associate with Simon Fraser University in British Columbia. He has conducted waterfowl research in arctic and subarctic regions of Alaska and Russia for the past 12 years. Since 1995 he has served as project leader for harlequin duck studies as part of the EVOSTC-sponsored Nearshore Vertebrate Predator project. He earned a M.S. from Texas A&M University in 1988 and a Ph.D. from Oregon State University in 2000. He has authored over 25 peer-reviewed journal publications and numerous reports and presentations addressing research and issues in waterbird conservation.

Brenda Ballachey is a Research Physiologist at the USGS Alaska Science Center in Anchorage. She was Project Leader for sea otter NRDA studies from 1990 through 1996, and has been involved in all aspects of post-spill research on sea otters, including the Nearshore Vertebrate Predator (NVP) project, with primary responsibilities for examining effects of residual oil on biomarkers and health of sea otters and other NVP study species. She has authored numerous peer-reviewed journal publications, reports and presentations. She received her M.S. in 1980 at Colorado State University, and Ph.D. in 1985 Oregon State University.

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2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 2002	Proposed FY 2003	PROPOSED FY 2003 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
							$216.2	
Personnel	$66.2	$38.6						
Travel	$3.9	$1.3						
Contractual	$223.5	$153.3						
Commodities	$10.5	$6.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$304.1	$199.7				Estimated		
General Administration	$25.6	$16.5				FY 2004		
Project Total	$329.7	$216.2				$0.0		
Full-time Equivalents (FTE)	1.0	0.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0			$0.0	$0.0		

Comments:

FY03

Prepared:4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Lead Agency: DOI--USGS

FORM 2A
MULTI-TRUSTEE AGENCY SUMMARY

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 2002	Proposed FY 2003	LONG RANGE FUNDING REQUIREMENTS					
					Estimated FY 2004			
Personnel	$55.7	$28.1						
Travel	$3.9	$1.3						
Contractual	$223.5	$153.3						
Commodities	$10.5	$6.5						
Equipment	$0.0	$0.0						
Subtotal	$293.6	$189.2						
General Administration	$24.0	$14.9						
Project Total	$317.6	$204.1			$0.0			
Full-time Equivalents (FTE)	0.9	0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI--USGS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2003
J. Bodkin (so)	Research Wildlife Biologist	GS 13-4	1.5	7.2		10.8
D. Monson (so)	Research Wildlife Biologist	GS 9-02	1.0	4.2		4.2
B. Ballachey (so)	Research Physiologist	GS 12-4	1.0	7.2		7.2
						0.0
						0.0
						0.0
D. Mulcahy (hd)	Veterinarian	GS 13	0.8	7.4		5.9
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		4.3	26.0	0.0	
					Personnel Total	$28.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2003
B. Ballachey Scientific Conference					1.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.3

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-USGS

FORM 3B
Personnel
& Travel
DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Contractual Costs:		Proposed
Description		FY 2003
4A Linkage	Simon Fraser University (hd)	136.3
Oregon State University - graduate student support (hd)		17.0
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$153.3

Commodities Costs:		Proposed
Description		FY 2003
Preparation and Page costs for 2 manuscripts (so)		2.0
Ballachey: P450 values in sea otters and relation to animal health		
Bodkin/Modson: mortality patterns of sea otters		
Vet supplies (hd)		4.5
	Commodities Total	$6.5

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI--USGS

FORM 3B
Contractual & Commodities DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2003
			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

FY03

Prepared: 4/8/02

Project Number: 02423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-USGS

FORM 3B
Equipment
DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 2002	Proposed FY 2003
Personnel	$10.5	$10.5
Travel	$0.0	$0.0
Contractual	$0.0	$0.0
Commodities	$0.0	$0.0
Equipment	$0.0	$0.0
Subtotal	$10.5	$10.5
General Administration	$1.6	$1.6
Project Total	$12.1	$12.1
Full-time Equivalents (FTE)	0.1	0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2004			
		$0.0			

Dollar amounts are shown in thousands of dollars.

Comments:

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI--FWS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2003
						0.0
K. Trust (hd)	Biologist	GS 12	1.5	7.0		10.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.5	7.0	0.0	
					Personnel Total	$10.5

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-FWS

FORM 3B
Personnel
& Travel
DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2002 - September 30, 2003

Contractual Costs:	Proposed FY 2003
Description	
	0.0
	0.0
	0.0
	0.0
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 2003
Description	
	0.0
	0.0
	0.0
	0.0
	0.0
Commodities Total	$0.0

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI--FWS

FORM 3B
Contractual & Commodities DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2003
			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

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-FWS

FORM 3B
Equipment
DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 2002	Proposed FY 2003	LONG RANGE FUNDING REQUIREMENTS					
					Estimated FY 2004			
Personnel	$69.0	$69.0						
Travel	$6.4	$5.1						
Contractual	$68.5	$58.7						
Commodities	$17.6	$3.5						
Equipment	$0.0	$0.0						
Subtotal	$161.5	$136.3						
Indirect	$0.0	$0.0						
Project Total	$161.5	$136.3						
Full-time Equivalents (FTE)	1.0	1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: SIMON FRASER UNIVERSITY

No overhead or fees are charged by the university on this contract.

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-USGS --Simon Fraser University Contract

FORM 4A
Non-Trustee
SUMMARY

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2002
	D. Esler	University Research Associate	9.0	6.8		61.2
		Biological Technician	3.0	2.6		7.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	12.0	9.4	0.0	
					Personnel Total	$69.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2002
	Esler - Seward (hd)	0.8	2	20	0.1	3.6
	Field crew/gear to Whittier (winter) (hd)	0.5	1			0.5
	Meeting (hd)					1.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$5.1

FY03

Prepared:4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-USGS--Simon Fraser University Contract

FORM 4B
Personnel
& Travel
DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Contractual Costs:	Proposed FY 2003
Description	
EROD activity - 50 @ $140 (hd)	7.0
Charter vessel (winter) - 21 days @ 1150 (hd)	24.2
Plumage swab analysis - 50 @ 100 (hd)	5.0
Air charter - survival monitoring - 90 hrs @ $250 (hd)	22.5
Contractual Total	$58.7

Commodities Costs:	Proposed FY 2003
Description	
Winter trap maintenance (hd)	0.5
Miscellaneous field/office supplies (hd)	3.0
Commodities Total	$3.5

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: DOI-USGS--Simon Fraser University Contract

FORM 4B
Contractual & Commodities DETAIL

2003 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2003
			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	

FY03

Prepared: 4/8/02

Project Number: 03423
Project Title: Pattern and Process of Population Change in Selected Nearshore Vertebrates
Agency: USGS--Simon Fraser University Contract

FORM 4B
Equipment
DETAIL